Facility: Date of Exam:

Tier	Group	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	RO Total	SRO A2	SRO G*	SRO Total
		RO K/A Category Points												SRO-Only Points		
1. Emergency & Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A		3	18	3	3	6
	2	1	2	2				1	2			1	9	2	2	4
	Tier Totals	4	5	5				4	5			4	27	5	5	10
2. Plant Systems	1	2	3	3	3	2	2	2	3	3	2	3	28	3	2	5
	2	1	1	1	1	1	1	1	1	0	1	1	10	- 1	2	3
	Tier Totals	3	4	4	4	3	3	3	4	3	3	4	38	4	4	8

	RO 1	RO 2	RO 3	RO 4	RO Total	SRO 1	SRO 2	SRO 3	SRO 4	SRO Total
3. Generic Knowledge and Abilities Categories	3	2	2	3	10	2	2	2	1	7

Note:
1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the “Tier Totals” in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A is replaced by a K/A from another Tier 3 Category).
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. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted with justification; operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.
4. Select topics from as many systems and evolutions as possible; sample every system or evolution in the group before selecting a second topic for any system or evolution.
5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics’ importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

ES-401							PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO)	Form ES-401-2	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A2	G*	K/A Topic(s)	IR	#
000007 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1	X						007EK1.05; Knowledge of the operational implications of the following concepts as they apply to the reactor trip: Decay power as a function of time	3.3	
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3			X				009EK3.11; Knowledge of the reasons for the following responses as they apply to the small break LOCA: Dangers associated with inadequate core cooling.	4.4	
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4						X X	015AG2.1.32; Ability to explain and apply system limits and precautions. 015AG2.4.45; Ability to prioritize and interpret the significance of each annunciator or alarm.	3.8 4.3	
000022 Loss of Rx Coolant Makeup / 2						X	022AG2.4.6; Knowledge of EOP mitigation strategies.	3.7	
000025 Loss of RHR System / 4						X	025EG2.4.35; Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects.	3.8	
000026 Loss of Component Cooling Water / 8					X		026AA2.02; Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: The cause of possible CCW loss.	2.9	
000027 Pressurizer Pressure Control System Malfunction / 3					X		027AA2.15; Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: Actions to be taken if PZR pressure instrument fails high.	4.0	
000029 ATWS / 1					X		029EA2.09; Ability to determine or interpret the following as they apply to an ATWS: Occurrence of a main turbine/reactor trip.	4.5	
000038 Steam Gen. Tube Rupture / 3						X	038EG2.2.22; Knowledge of limiting conditions for operations and safety limits.	4.7	
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4				X			040AA1.03; Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: Isolation of one steam line from header.	4.3	
000054 (CE/E06) Loss of Main Feedwater / 4			X				054AK3.01; Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Reactor and/or turbine trip, manual and automatic.	4.1	
000055 Station Blackout / 6	X						055EK1.02; Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : Natural circulation cooling	4.1	
000056 Loss of Off-site Power / 6									
000057 Loss of Vital AC Inst. Bus / 6				X			057AA1.05; Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: Backup instrument indications.	3.2	
000058 Loss of DC Power / 6					X	X	058AA2.03; Ability to determine and interpret the following as they apply to the Loss of DC Power: DC loads lost; impact on ability to operate and monitor plant system. 058AG2.1.27; Knowledge of system purpose and/or function.	3.5 4.0	

000062 Loss of Nuclear Svc Water / 4			X				062AK3.04; Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: Effect on the nuclear service water discharge flow header of a loss of CCW.	3.5	
000065 Loss of Instrument Air / 8				X			065AA1.04; Ability to operate and / or monitor the following as they apply to the Loss of Instrument Air: Emergency air compressor.	3.5	
W/E04 LOCA Outside Containment / 3	X						WE04EK1.1; Knowledge of the operational implications of the following concepts as they apply to the (LOCA Outside Containment): Components, capacity, and function of emergency systems.	3.5	
W/E11 Loss of Emergency Coolant Recirc. / 4		X			X		WE11EK2.2; Knowledge of the interrelations between the (Loss of Emergency Coolant Recirculation) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. WE11EA2.1; Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation): Facility conditions and selection of appropriate procedures during abnormal and emergency operations.	3.9 4.2	
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4		X					WE05EK2.1; Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.7	
000077 Generator Voltage and Electric Grid Disturbances / 6					X		077AA2.01; Knowledge of the interrelations between Generator Voltage and Electric Grid Disturbances and the following: Motors.	3.1	
K/A Category Totals:	3	3	3	3	3/3	3/3	Group Point Total:		18/6

ES-401							PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)		Form ES-401-2
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A2	G*	K/A Topic(s)	IR	#
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1		X					003AK2.05; Knowledge of the interrelations between the Dropped Control Rod and the following: Control rod drive power supplies and logic circuits.	2.5	
000005 Inoperable/Stuck Control Rod / 1					X		005AA2.04; Ability to determine and interpret the following as they apply to the Inoperable / Stuck Control Rod: Interpretation of computer in-core TC map for dropped rod location.	3.4	
000024 Emergency Boration / 1						X	024G2.1.7; Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	4.7	
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7	X						032AK1.01; Knowledge of the operational implications of the following concepts as they apply to Loss of Source Range Nuclear Instrumentation: Effects of voltage changes on performance.	2.5	
000033 Loss of Intermediate Range NI / 7									
000036 (BW/A08) Fuel Handling Accident / 8									
000037 Steam Generator Tube Leak / 3				X			037AA1.07: Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak: CVCS letdown flow indicator.	3.1	
000051 Loss of Condenser Vacuum / 4			X				051AK3.01; Knowledge of the reasons for the following responses as they apply to the Loss of Condenser Vacuum: Loss of steam dump capability upon loss of condenser vacuum.	2.8	
000059 Accidental Liquid Radwaste Rel. / 9					X		059AA2.05; Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: The occurrence of automatic safety actions as a result of a high PRM system signal.	3.6	
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5			X				069AK3.01; Knowledge of the reasons for the following responses as they apply to the Loss of Containment Integrity: Guidance contained in EOP for loss of containment integrity.	3.8	
000074 (W/E06&E07) Inad. Core Cooling / 4		X					074EK2.06; Knowledge of the interrelations between the and the following Inadequate Core Cooling: Turbine bypass and atmospheric dump valves.	3.5	
000076 High Reactor Coolant Activity / 9									
W/EO1 & E02 Rediagnosis & SI Termination / 3									
W/E13 Steam Generator Over-pressure / 4									

W/E15 Containment Flooding / 5					X		WE15EA2.2; Ability to determine and interpret the following as they apply to the (Containment Flooding): Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.	2.9	
W/E16 High Containment Radiation / 9					X		WE16EA2.2; Ability to determine and interpret the following as they apply to the (High Containment Radiation): Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.	3.3	
BW/E08; W/E03 LOCA Cooldown - Depress. / 4						X	WE03G2.1.31; Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup.	4.6	
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
CE/A11; W/E08 RCS Overcooling - PTS / 4						X	WE08EG2.1.7; Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	4.7	
K/A Category Point Totals:	1	2	2	1	2/2	1/2	Group Point Total:		9/4

ES-401 PWR Examination Outline Form ES-401-2
Plant Systems - Tier 2/Group 1 (RO / SRO)

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 Reactor Coolant Pump		X										003K2.02; Knowledge of bus power supplies to the following: CCW pumps.	2.5	
004 Chemical and Volume Control			X									004K3.06; Knowledge of the effect that a loss or malfunction of the CVCS will have on the following: RCS temperature and pressure.	3.4	
005 Residual Heat Removal		X										005K2.01; Knowledge of bus power supplies to the following: RHR pumps.	3.0	
							X					005A1.01; Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RHRS controls including: Heatup/cooldown rates.	3.5	
006 Emergency Core Cooling							X					006A1.15; Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: RWST Level and temperature.	3.3	
						X						006K6.05; Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: HPI/LPI cooling water.	3.0	
007 Pressurizer Relief/Quench Tank								X				007A2.05; Ability to (a) predict the impacts of the following malfunctions or operations on the P S; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Exceeding PRT high-pressure limits.	3.2	
008 Component Cooling Water				X								008K4.09; Knowledge of CCWS design feature(s) and/or interlock(s) which provide for the following: The "standby" feature for the CCW pumps.	2.7	
010 Pressurizer Pressure Control									X			010A3.02; Ability to monitor automatic operation of the PZR PCS, including: PZR pressure.	3.6	
						X						010K6.04; Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: PRT.	2.9	
012 Reactor Protection										X		012A4.06; Ability to manually operate and/or monitor in the control room: Reactor trip breakers.	4.3	
								X				012A2.01; Ability to (a) predict the impacts of the following malfunctions or operations on the RPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Faulty bistable operation.	3.6	

013 Engineered Safety Features Actuation	X											013K1.04: Knowledge of the physical connections and/or cause effect relationships between the ESFAS and the following systems: HVAC.	2.8	
								X				013A2.06; Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions: Inadvertent ESFAS actuation.	4.0	
022 Containment Cooling										X		022A4.01; Ability to manually operate and/or monitor in the control room: CCS fans.	3.6	
025 Ice Condenser					X							025K5.02; Knowledge of operational implications of the following concepts as they apply to the ice condenser system: Heat transfer.	2.6	
026 Containment Spray								X				026A2.07; Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit.	3.6	
		X										026K2.01; Knowledge of bus power supplies to the following: Containment spray pumps.	3.4	
039 Main and Reheat Steam											X	039G2.4.1; Knowledge of EOP entry conditions and immediate action steps.	4.6	
			X									039K3.03; Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: AFW pumps.	3.2	
059 Main Feedwater				X								059K4.08; Knowledge of MFW design feature(s) and/or interlock(s) which provide for the following: Feedwater regulatory valve operation (on basis of steam flow, feed flow mismatch).	2.5	
061 Auxiliary/Emergency Feedwater					X							061K5.03; Knowledge of the operational implications of the following concepts as they apply to the AFW: Pump head effects when control valve is shut.	2.6	
											X	061G2.4.31; Knowledge of annunciator alarms, indications, or response procedures.	4.1	
062 AC Electrical Distribution									X			062A3.01; Ability to monitor automatic operation of the ac distribution system, including: Vital ac bus amperage.	3.0	

063 DC Electrical Distribution				X					X			063K4.02; Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: Breaker interlocks, permissives, bypasses and cross-ties. 063A3.01; Ability to monitor automatic operation of the DC electrical system, including: Meters, annunciators, dials, recorders, and indicating lights.	2.9 2.7	
064 Emergency Diesel Generator								X				064A2.14; Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Effects (verification) of stopping ED/G under load on isolated bus.	2.7	
073 Process Radiation Monitoring											X	073G2.2.12; Knowledge of surveillance procedures.	3.7	
076 Service Water	X										X	076K1.19; Knowledge of the physical connections and/or cause- effect relationships between the SWS and the following systems: SWS emergency heat loads. 076G2.2.44; Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions.	3.6 4.4	
078 Instrument Air			X					X				078K3.03; Knowledge of the effect that a loss or malfunction of the IAS will have on the following: Cross-tied units. 078A2.01; Ability to (a) predict the impacts of the following malfunctions or operations on the IAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Air dryer and filter malfunctions.	3.0 2.9	
103 Containment											X	103G2.2.22; Knowledge of limiting conditions for operations and safety limits.	4.0	
K/A Category Point Totals:	2	3	3	3	2	2	2	3/3	3	2	3/2	Group Point Total:		28/5

ES-401 PWR Examination Outline Form ES-401-2
Plant Systems - Tier 2/Group 2 (RO / SRO)

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A2	A 3	A 4	G*	K/A Topic(s)	IR	#
001 Control Rod Drive										X		001A4.06; Ability to manually operate and/or monitor in the control room: Control rod drive disconnect/connect.	2.9	
002 Reactor Coolant						X						002K6.07; Knowledge of the effect or a loss or malfunction on the following RCS components: Pumps.	2.5	
011 Pressurizer Level Control			X									011K3.03; Knowledge of the effect that a loss or malfunction of the PZR LCS will have on the following: PZR PCS.	3.2	
014 Rod Position Indication											X	014G2.2.25; Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	4.2	
015 Nuclear Instrumentation								X				015A2.02; 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: Faulty or erratic operation of detectors or compensating components.	3.1	
016 Non-Nuclear Instrumentation								X			X	016G2.4.4; Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. 016A2.02; Ability to (a) predict the impacts of the following malfunctions or operations on the NNIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of power supply.	4.5 3.2	
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling	X											033K1.05; Knowledge of the physical connections and/or cause-effect relationships between the Spent Fuel Pool Cooling System and the following systems: RWST.	2.7	
034 Fuel Handling Equipment							X					034A1.02; Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: Water level in the refueling canal.	2.9	
035 Steam Generator														
041 Steam Dump/Turbine Bypass Control		X										041K2.01; Knowledge of bus power supplies to the following: ICS, normal and alternate power supply.	2.8	
045 Main Turbine Generator														
055 Condenser Air Removal														

056 Condensate														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring				X								072K4.01; Knowledge of ARM system design feature(s) and/or interlock(s) which provide for the following: Containment ventilation isolation.	3.3	
075 Circulating Water											X	075G2.1.25; Ability to interpret reference materials, such as graphs, curves, tables, etc.	4.2	
079 Station Air														
086 Fire Protection					X							086K5.04; Knowledge of the operational implication of the following concepts as they apply to the Fire Protection System: Hazards to personnel as a result of fire type and methods of protection.	2.9	
K/A Category Point Totals:	1	1	1	1	1	1	1	1/1	0	1	1/2	Group Point Total:		10/3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.2	Knowledge of operator responsibilities during all modes of plant operation.	4.1			
	2.1.36	Knowledge of procedures and limitations involved in core alterations.	3.0			
	2.1.45	Ability to identify and interpret diverse indications to validate the response of another indication.	4.3			
	2.1.35	Knowledge of the fuel-handling responsibilities of SROs.			3.9	
	2.1.40	Knowledge of refueling administrative requirements.			3.9	
	2.1.					
	Subtotal		3		2	
2. Equipment Control	2.2.18	Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.	2.6			
	2.2.38	Knowledge of conditions and limitations in the facility license.	3.6			
	2.2.6	Knowledge of the process for making changes to procedures.			3.6	
	2.2.21	Knowledge of pre- and post-maintenance operability requirements.			4.1	
	2.2.					
	2.2.					
	Subtotal		2		2	
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions.	3.2			
	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.	3.4			
	2.3.12	Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.			3.7	
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.			3.8	
	2.3.					
	2.3.					
	Subtotal		2		2	
4. Emergency Procedures / Plan	2.4.11	Knowledge of abnormal condition procedures.	4.0			
	2.4.25	Knowledge of fire protection procedures.	3.3			
	2.4.31	Knowledge of annunciator alarms, indications, or response procedures.	4.2			
	2.4.44	Knowledge of emergency plan protective action recommendations.			4.4	
	2.4.					
	2.4.					
	Subtotal		3		1	
Tier 3 Point Total			10	10	7	7

Facility: McGuire		Date of Examination:	4/2016
Examination Level:	RO	Operating Test Number:	N16-1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed	
Conduct of Operations	N, R	2.1.20 (4.6)	Ability to interpret and execute procedure steps.
		JPM:	Complete a Surveillance for Mode Change
Conduct of Operations	D, R	2.1.25 (3.9)	Ability to interpret reference materials, such as graphs, curves, tables, etc.
		JPM:	Calculate Boration Needed for a Specified Rod Change
Equipment Control	N, R	2.2.41 (3.5)	Ability to obtain and interpret station electrical and mechanical drawings.
		JPM:	Determine Leak Isolation Boundaries
Radiation Control	D, P, R	2.3.11 (3.8)	Ability to control radiation releases
		JPM:	Perform a Unit Vent Flow Calculation of a Containment Air Release

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when 5 are required.

*Type Codes & Criteria:
(C)ontrol room, **(0)** (S)imulator, **(0)** or Class(R)oom **(4)**
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) **(2)**
(N)ew or (M)odified from bank (≥ 1) **(2)**
(P)revious 2 exams (≤ 1; randomly selected) **(1)**

RO Admin JPM Summary

A1a This is a new JPM. The operator will be told that Unit 1 is in Mode 4 during a plant startup, that the current EFPD is 248, that NC System pressure has stabilized at 1600 psig, and that it has become necessary to perform Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items, in order to continue with the plant startup. The operator will be provided with the most recent chemistry sample results for the Cold Leg Accumulator Boron Concentrations, and directed to complete Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items. Additionally, the operator will be directed to identify any Flex Strategy Administrative Limits and/or Technical Specification LCO that are not being complied with. The operator will be expected to complete Enclosure 13.4 of PT/1/A/4600/003D in accordance with the attached KEY, determine that all Flex Strategy Administrative Limits are met, and determine that LCO 3.5.1 is not currently met.

A1b This is a Bank JPM. The operator will be given a set of initial conditions and told that it is desired to withdrawal the Bank D Control Rods about 45 steps. The operator will be given the Core Data Book and asked to manually determine the amount of Boric Acid that will be necessary to add, to complete the rod height adjustment. The operator will be expected to determine that a Boric Acid Addition of approximately 253.3 gallons is calculated within + 4 gallons per the attached KEY.

A2 This is a new JPM. The operator will be told that Unit 1 is operating at 100% power, that the crew suspects a leak in the Aux Building and has entered Case II of AP/1/A/5500/10, NC System Leakage Within the Capacity of Both NV Pumps, and that an AO has just reported that there is a large packing leak on 1NV-151A (NV Pumps Recirculation Valve). The operator will be directed to identify the closest leak isolation boundary valves for this leak, identify which, if any, of these valves need to be re-positioned from their current position, and to identify the Breaker location for any electrically operated leak isolation boundary valve that may need to be operated. The operator will be expected to review the Flow Diagram of Chemical and Volume Control System (NV) and determine the closest leak isolation boundary valves for this leak, review OP/1/A/6200/001E and determine the boundary valves that need to be re-positioned, and review OP/1/A/6200/001E and determine the Breaker location for 1NV-150A in accordance with the Attached KEY.

A3 This is a Bank JPM (Modified for current date and time). The operator will be told that GWR Package # 2016013 for Unit 1 Containment Air Release is currently in use to conduct a series of Containment air releases, and that during the first release, conducted using Enclosure 4.2 (Air Release Mode With VQ Flow Monitor Operable) of OP/1/A/6450/017 (Containment Air Addition and Release), the Unit 1 VQ Monitor became inoperable. The operator will be told that the crew stopped the release and continued the air release using Enclosure 4.3 (Air Release Mode with VQ Flow Monitor Inoperable) of OP/1/A/6450/017 (Containment Air Addition and Release), and that three previous releases have been made; including the one which was made with the Unit 1 VQ Flow Monitor in operation. Finally, the operator will be provided with the pertinent data for the current (4th) release, and then be directed to calculate the volume released for the current release and to determine the total volume released from the Containment during all releases. The operator will be expected to calculate the volume of air released from the Containment during the final release, and determine the total volume of air released in the series of four releases in accordance with the provided KEY. This JPM was randomly selected for use from the previous two NRC Exams.

Facility: McGuire		Date of Examination:	4/2016
Examination Level:	SRO	Operating Test Number:	N16-1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed	
Conduct of Operations	D, P, R	2.1.20 (4.6)	Ability to interpret and execute procedure steps
		JPM:	Review a Completed Procedure
Conduct of Operations	D, R	2.1.7 (4.7)	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.
		JPM:	Calculate QPTR
Equipment Control	D, R	2.2.40 (4.7)	Ability to apply Technical Specifications for a system.
		JPM:	Respond to a Fire Detection System Trouble Alarm
Radiation Control	D, R	2.3.4 (3.7)	Knowledge of radiation exposure under normal or emergency conditions.
		JPM:	Take On-Site Protective Actions During a General Emergency
Emergency Plan	M, R	2.4.41 (4.6)	Knowledge of emergency action level thresholds and classifications.
		JPM:	Classify an Emergency Event

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when 5 are required.

*Type Codes & Criteria:
(C)ontrol room, **(0)** (S)imulator, **(0)** or Class(R)oom **(5)**
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) **(4)**
(N)ew or (M)odified from bank (≥ 1) **(1)**
(P)revious 2 exams (≤ 1; randomly selected) **(1)**

SRO Admin JPM Summary

A1a This is a Bank JPM (Modified to accommodate changes within the procedure since last used). The operator will be told that Unit 1 is in Mode 4 during a plant startup, provided with the current EFPD and NC System pressure, told that PT/1/A/4600/003D, Monthly Surveillance Items, Enclosure 13.4, NC Boron Concentration Checklist, has been performed prior to entry into Mode 3, and that the completed Enclosure 13.4 is now ready for review. The operator will be directed to review the completed procedure and identify (1) whether Mode 1 can be entered, and (2) all administrative procedural/paperwork requirements. The operator will review completed Enclosure 13.4 of PT/1/A/4600/003D and identify that the Surveillance performer has entered an incorrect value for the minimum value of the Cold Leg Accumulator Boron Concentration; and correct this entry. Then when the correction is made, the operator will determine that the 1A through 1C CLA are within the allowable Boron concentration range, but that the 1D CLA is outside of the allowable range. The operator will identify that Mode 3 cannot be entered until 1D CLA boron concentration is raised, and complete Attachment 6 of AD-HU-ALL-0004 (Procedure and Work Instruction Use and Adherence) in accordance with a provided KEY. This JPM was randomly selected for use from the previous two NRC Exams.

A1b This is a Bank JPM. With the plant at 99% power, the operator will be told that the Unit 1 OAC failed and is not operating, and that the crew has implemented PT/1/A/4600/021A (Loss of Operator Aid Computer while in Mode 1). The operator will be directed to calculate QPTR in accordance with Enclosure 13.5, Part A of PT/1/A/4600/21A. The operator will be expected to calculate QPTR, and determine that Technical Specification 3.2.4 (Quadrant Power Tilt Ratio) has been exceeded, and identify any required Technical Specification ACTION.

A2 This is a Bank JPM. The operator will be told that Units 1 and 2 are operating at 100% power, that Annunciator 1AD-13, FIRE DET SYS ALERT, has alarmed, and that the crew has entered OP/0/A/6400/002F (Fireworks Fire Detection System), and is performing Enclosure 4.1 (Fire Detection System Alarm/Trouble). The operator will also be told that the Fireworks Computer is Out of Service and cannot be immediately restarted, that the Electronic Fire Impairment Log (eFIL) is unavailable, and that a check of Fire Alarm Control Panel (FACP) 1 shows that Zone 153A has a TROUBLE condition. The operator will be directed to complete Steps 3.4.1.2 through 3.4.1.5 of Enclosure 4.1 of OP/0/A/6400/002F; and to identify any Technical Specification LCO/SLC required actions and specific monitoring requirements that must be made in Autolog. The operator will identify that SLC 16.9.6 ACTION is required, that Remedial Action Condition C is met, that the required ACTION must be performed, and entries made in AUTOLOG in accordance with the attached KEY.

A3 This is a Bank JPM. The operator will be told that a General Emergency has been declared and that, as the OSM, they have initiated and completed the immediate actions of Enclosure 4.1 of RP/0/A/5700/004 (General Emergency). Additionally, the operator will be told that On-Site Protective Actions are being considered in accordance with RP/0/A/5700/004, and that there are reports of an injured non-ambulatory person on-site. The operator will be required to select two rescuers, from among seven potential rescuers, and dispatch them to the injured individual by completing Enclosure 4.4, (Request for Emergency Exposure),of RP/0/A/5700/004.

A4 This is a modified Bank JPM. The operator will be given a set of initial conditions involving a loss of main Control Room annunciators and a subsequent plant trip. The operator will be directed to classify the event in accordance with RP/0/A/5700/000 (Classification of Emergency). The operator will be expected to declare an ALERT based on 4.2.A.1, Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable; and complete the pre-printed ENF 4.2.A.1 in accordance with the attached KEY.

Facility:	McGuire	Date of Examination:	4/2016
Exam Level (circle one):	*RO (only)* / SRO(I) **/ SRO (U)**	Operating Test No.:	N16-1

Control Room Systems@ (8 for RO; 7 for SRO-I; 2 or 3 for SRO-U)

	System / JPM Title	Type Code*	Safety Function
A.	EPE 029 Anticipated Transient Without Scram (ATWS) [EPE 029 EA2.10 (3.1/3.4)] Emergency Borate the Reactor Coolant System Using the PD Pump	S, D, A	1
B.	**061 Auxiliary/Emergency Feedwater (AFW) System [061 A2.07 (3.4/3.5)]** **CA Suction Source Realignment**	**S, M, A, EN**	**4S**
C.	**004 Chemical Volume & Control System [004 A4.06 (3.6/3.1)]** **Establish Excess Letdown following a loss of Normal Letdown in Mode 4**	**S, N, A, L**	**2**
D.	**010 Pressurizer Pressure Control System [010A4.02(3.6/3.4)]** **Remove Pressurizer Heaters from Service**	**S, D, A**	**3**
E.	EPE E09 Natural Circulation Operations [EPE E09 EA1.1 (3.5/3.5)] Depressurize NCS During Natural Circulation Cooldown	S, D, A, L	4P
F.	027 Containment Iodine Removal System [027 A4.01 (3.3/3.3)] Perform the 1A Annulus Ventilation Operability Test	S, D, EN	5
G.	062 AC Electrical Distribution System [062 A2.05 (2.9/3.3)] Restore Power to 6900V Buses	S, D	6
H.	*075 Circulating Water System* [075 A2.02 (2.5/2.7)] *Isolate the Circulating Water System During Turbine Building Flooding*	*S, D*	*8*

In-Plant Systems@ (3 for RO; 3 for SRO-I; 3 or 2 for **SRO-U**)

I.	**EPE 055 Station Blackout [055 EA2.03 (3.9/4.7)]** **Transfer of 1EMXA4 To SSF During A Loss Of All AC on Unit 1**	**P, D, R, E**	**6**
J.	068 Control Room Evacuation [068 AAQ1.23 (4.3/4.4)] Locally Trip Unit 2 Main Turbine and Both Unit 2 FWPT's	D, E	8

K. APE 024 Emergency Boration [024AA1.04(3.6/3.7)] **Emergency Borate the NCS Locally Using 2NV-269**	**D, R, E**	**1**

@	All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 (5) /4-6 (5) / 2-3 (3)
(C)ontrol room	
(D)irect from bank	≤ 9 (9) /≤ 8 (8) / ≤ 4 (3)
(E)mergency or abnormal in-plant	≥ 1 (3) /≥ 1 (3) / ≥ 1 (2)
(EN)gineered Safety Feature	≥ 1 (2) /≥ 1 (2)/ ≥ 1 (1) (Control Room System)
(L)ow-Power / Shutdown	≥ 1 (2) /≥ 1 (2) / ≥ 1 (1)
(N)ew or (M)odified from bank including 1(A)	≥ 2 (2) / ≥ 2 (2) / ≥ 1 (2)
(P)revious 2 exams	≤ 3 (1) / ≤ 3 (1)/ ≤ 2 (1) (Randomly Selected)
(R)CA	≥ 1 (2)/≥ 1 (2) / ≥ 1 (2)
(S)imulator	

JPM Summary

JPM A This is a Bank JPM. The operator will be told that Unit 1 was at 100% power with “A” NV pump tagged for maintenance, when a failure of an automatic reactor trip occurred causing entry into EP/1/A/5000/FR-S.1, Response to Nuclear Power Generation/ATWS. The operator will be directed to emergency borate the NC System per Step 5 of EP/1/A/5000/FR-S.1. During the course of the procedure implementation the operator will discover that the “B” NV Pump has tripped **(Alternate Path)**. The operator will be expected to attempt to start the 1B NV Pump, and when it fails to start, start the PD Pump, and then commence emergency boration with the 1B Boric Acid Transfer Pumps running and 30 gpm or greater emergency boration flow indicated.

JPM B This is a modified Bank JPM. The operator will be told that Unit 1 has just tripped from 100% power, due to seismic activity, that the crew is now implementing EP/1/A/5000/ES-0.1 (Reactor Trip Response), and that the CAST has developed a leak, and level has lowered to 1.5 feet. The operator will be directed to perform EP/1/A/5000/G-1, Generic Enclosure 20 (CA Suction Source Realignment), while the crew continues with ES-0.1. The operator will be expected to realign the suction of the CA Pumps from the non-safety related to the safety-related source (RN). During the course of this action, the operator will recognize that RN Supply to the 1B MDCA Pump cannot be established **(Alternate Path)**, and stop the pump.

JPM C This is a new JPM. The operator will be told that Unit 1 is performing a plant shutdown and cooldown to Mode 5, that the plant is currently at 345°F and 600 psig, that the crew has entered AP/1/A/5500/12, Loss of Letdown, Charging or Seal Injection, due to a loss of Normal Letdown, and that it is not expected that the crew will be able to re-establish Normal Letdown without corrective maintenance. The operator will be directed to establish Excess Letdown per AP/1/A/5500/12 starting with Step 52, and maintain Pressurizer level between 85-96%. While establishing Excess Letdown the operator will discover that Excess Letdown cannot be placed in service due to a failure **(Alternate**

Path). The operator will be expected to attempt to place Excess Letdown in service in accordance with Step 52 of AP/1/A/55/12; and then after recognizing that Excess Letdown cannot be placed in service, establish letdown to the PRT using the Rx Head Vessel Vents in accordance with Step 53 of AP/1/A/5500/12 and maintain Pressurizer level between 85-96%.

JPM D This is a Bank JPM. The operator will be told that plant power has just been raised to 100% per OP/1/A/6100/003 (Controlling Procedure for Unit Operation). The operator will be directed to remove Pzr Heater Groups A, B and D from service per Enclosure 4.6 (Operation of Pzr Heaters) of OP/1/A/6100/003. The operator will be expected to remove the A, B and D Pzr Heater Groups from service in accordance with the Enclosure. After the Pzr Pressure Master has been placed in MANUAL and its output has been adjusted, the Pzr Variable Heaters (Group C) will fail **(Alternate Path)**. The operator will be required to respond to MCB Annunciator 1AD6/D6 (PZR HTR CONTROLLER TROUBLE), and manually control pressure using the other heater groups. The operator will be expected to place at least one Pzr Heater Group in service in accordance with Step 3.3.1 (or equivalent) of Enclosure 4.6.

JPM E This is a Bank JPM. The operator will be told that Unit 1 has tripped from 100% power due to a Loss of Off-Site Power, that the crew is currently implementing EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown), and is currently at Step 15, and that Normal Letdown is in service. The operator will be directed to perform Step 15 of ES-0.2, depressurizing the NC system to 1905 PSIG using aux spray per Generic Enclosures, Enclosure 3 (Establishing NV Aux Spray). The operator will be expected to place Auxiliary Spray in service and lower Pzr Pressure to 2030 psig; and after diagnosing a loss of Normal Letdown **(Alternate Path)** immediately remove Aux Spray from service.

JPM F This is a Bank JPM. The operator will be told that Unit 1 is operating at 100% power, that Unit 1 VE System is aligned for Engineered Safeguards Operation, and that PT/1/A/4450/003 A (Annulus Ventilation System Train 'A' Operability Test) is on the Operations schedule for today. The operator will be directed to perform PT/1/A/4450/003 A (Annulus Ventilation System Train 'A' Operability Test). The operator will be expected to place the 1A VE Fan in Recirculation Mode with the cross connect from B Train closed. The 1A VE Fan will be shut down after flow verification and returned to normal alignment.

JPM G This is a Bank JPM. The operator will be told that a total loss of Offsite Power has occurred to the Unit 1 Switchyard, that Unit 1 tripped from 100% power, and that the Electrical Grid has remained energized throughout the event. The operator will also be told that Unit 1 has implemented AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB), that power has been restored to the Unit 1 Switchyard, and that the crew is preparing to restore power to the 6900VAC Buses, and is complete through Step 43.n. The operator will be directed to restore power to the 6900V buses starting with Step 43.o of AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB) using the Normal Supply breakers. The operator will be expected to re-energize all four 6900V Buses per AP/1/A/5500/07 Steps 43.o-r.3.

JPM H This is a Bank JPM. The operator will be told that there is massive flooding in the Turbine Building and that the crew has implemented AP/0/A/5500/44 (Plant Flooding), Enclosure 1 (Unit 1 Turbine Bldg Flooding). The operator will be directed to isolate the RC System by continuing with Enclosure 1 of AP/0/A/5500/44, step 5.d, and completing all Step 5 sub-steps, while the crew continues with EP/1/A/5000/E-0 (Reactor Trip and/or Safety

Injection). The operator will be expected to take all pump and valve control switch manipulations to isolate the RC System. This task was chosen because Internal Flooding events are a large PRA contributor (15% CDF). This is a Time Critical JPM.

JPM I This is a Bank JPM. The operator will be told that a Station Blackout has occurred at Unit 1, that the crew is currently in EP/1/A/5000/ECA-0.0 (Loss of All AC Power), and that the CRS has dispatched an operator to the SSF to complete Enclosure 2 (Unit 1 SSF ECA-0.0 Actions). The operator will be directed to perform Enclosure 3 (Unit 1 ETA and ETB Rooms - ECA-0.0 Actions). The operator will be expected to transfer 1EXMA-4 to its alternate power supply within 3 minutes from dispatch (Start of the JPM), and identify that the 1ETA-2 Lockout Relay has tripped. This was previously used on the 2015 NRC Exam, randomly selected for use on the 2016 Exam.

JPM J This is a Bank JPM. The operator will be told that a loss of control room has occurred, that AP/2/A/5500/17 (Loss Of Control Room) has been implemented and is complete through step 10.b, that the operator has been dispatched to standby at the Unit 2 Main Turbine, and that communications have been established between them and the SRO at the Unit 2 Aux. Shutdown panel. The operator will be directed to perform the local actions of Step 10.c.1-3 of AP/2/A/550/17 Loss of Control Room) at the appropriate time. The operator will be expected to trip the Unit 2 Main Turbine locally, and trip any of the available "trip" mechanisms on both FWPT's such that 2SP-1 and 2SP-2 are closed.

JPM K This is a Bank JPM. The operator will be told that Unit 2 was at 100% power when a Boron dilution event occurred, that AP/2/A/5500/38 (Emergency Boration) was entered, and that while attempting to open 2NV-265B (Boric Acid To NV Pumps), the RO discovered that 2NV-265B was de-energized. The operator will be directed to emergency borate the NC System by performing Step 12.d RNO of AP/2/A/5500/38 (Emergency Boration and Response to Inadvertent Dilution). The operator will be expected to locate and open 2NV-269 within ten (10) minutes of dispatch. This is a Time Critical JPM.

ILT-16-1 MNS SRO NRC Examination **QUESTION 1** 1 **A**

SYS003 K2.02 - Reactor Coolant Pump System (RCPS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
CCW pumps ....

Given the following initial conditions on Unit 1:

- The unit is at 100% RTP
- Train "B" equipment is in service

Subsequently,

- An 86 Lockout occurs on 1ETB
- No operator actions have been taken

Based on the conditions above, ________ NC pumps currently have KC cooling.

Which ONE (1) of the following completes the statement above?

A. NO

B. ALL

C. ONLY A and D

D. ONLY B and C

General Discussion

Because a Lockout has occurred on the Emergency Bus which was supplying the running KC pumps, power has been lost to those pumps.

Since there is a loss of power to only one of the Emergency Busses, there is nothing which would have started the KC pumps on the "A" Train (i.e. a Blackout on 1ETA or a Safety Injection signal.

Therefore, KC cooling has been lost to ALL NC pumps.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant concludes that the opposite train KC pumps have automatically started. If that were true, ALL KC would have KC cooling.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the Reactor Building has two KC headers, one which supplies A and D NC pumps and one wihich supplies B and C NC pumps. The applicant could therefore conclude that flow has been lost to only one of the two headers.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the Reactor Building has two KC headers, one which supplies A and D NC pumps and one wihich supplies B and C NC pumps. The applicant could therefore conclude that flow has been lost to only one of the two headers.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the power supplies to the KC (CCW) pumps.

Basis for Hi Cog

This is a higher congitive level question because it requires the applicant to analyze the conditions given and determine the effect of the malfunction on the power supply to the KC pumps. It also requires the applicant to recall from memory the piping arrangement of the KC supply to the NC pumps.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-PSS-KC (Rev. 29B)

LEARNING OBJECTIVES:
OP-MC-PSS-KC Objective 6

Student References Provided

SYS003 K2.02 - Reactor Coolant Pump System (RCPS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
CCW pumps ....

401-9 Comments:

Remarks/Status

Q1 References

2.0 COMPONENT DESCRIPTION

2.1. Component Cooling Water Pumps (KC Pumps)

The KC Pumps are horizontal shaft, centrifugal pumps equipped with mechanical seals to minimize leakage. They are designed to provide the maximum cooling water requirements for the system. **They can be operated from the Control Room or ASP by two position START/STOP pushbuttons**. Normal operations parameters are as follows:

Pressure............95-105 psig

Flow ....2000-3000 gpm   Runout = 4000 gpm/pump

Objective #4 (also see section 3.2)

Minimum flow is maintained by an automatic recirc valve. Controls for these valves are located in the Control Room. Each valve will open when KC Pump discharge flow decreases to 1000 gpm and closes when flow increases to 1500 gpm. Flowpath is to the KC Surge Tank.

The pumps automatically start on a Safety Injection (S_s) or Blackout (BO) signal.

Objective #5

The KC Pumps are powered from the 4160 volt vital busses (ETA, ETB).

2.2. Component Cooling Heat Exchangers (KC Heat Exchanger)

Designed to provide the required heat transfer for all modes of operation. One heat exchanger is required for normal operation. One heat exchanger is adequate for Engineered Safeguards (ES) heat transfer requirements.

The KC Heat Exchanger is a horizontal, straight tube, single pass heat exchanger with RN on the tube side due to the tendency of fouling (Easier to clean), and KC on the shell side. The heat exchangers are located at the discharge of the KC Pumps to ensure KC pressure remains higher than RN pressure for the purpose of preventing in-leakage of RN water.

Design parameters are as follows:

Pressure ....150 psig

Temperature ....200 °F

Shell side flow (KC).........2,610,751 lbm/hr - ≈6200 gpm

Tube side flow (RN) ....4,976,600 lbm/hr - ≈10,000 gpm

Manual loader located in Control Room to adjust RN flow to KC Heat Exchanger.

SYS005 K2.01 - Residual Heat Removal System (RHRS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
RHR pumps ....

Given the following initial conditions on Unit 2:

- A LOCA has occurred
- The crew has entered E-1 (LOSS OF REACTOR OR SECONDARY COOLANT)
- Safety Injection has been reset

Subsequently,

- A Blackout occurs on the 2ETA Bus
- 2A D/G is supplying the 2ETA Bus

Which ONE (1) of the following identifies the restoration process for the Unit 2, Train A NV, NI and ND pumps?

A. 2A ND, NI and NV pumps will automatically restart

B. 2A ND, NI and NV pumps must be restarted by operator action

C. 2A ND and NI pumps will automatically restart
2A NV pump must be restarted by operator action

D. 2A NV pump will automatically restart
2A ND and NI pumps must be restarted by operator action

General Discussion

Both ND pumps will auto start on a Safety Injection Signal. If power is lost to the train related 4160V buss (Blackout), the ND pumps will receive a "start permissive" from the sequencer so they can be manually started if needed, but do NOT auto-start.
NI pumps are an SI load only, NV pumps are both an SI load and a blackout load.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible if applicant concludes that ND, NI and NV pumps are all blackout loads or does not understand that with SI reset, when the blackout occurs, only blackout loads will be loaded onto the bus.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible if applicant concludes that ND, NI and NV pumps are all safety injection loads, therefore when SI is reset and the blackout occurs, none of the pumps will be automatically loaded onto the bus.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible if applicant concludes that the ND and NI pumps are blackout loads and the NV pump is a safety injection load only.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the normal and emergency power supplies and whether or not the 2A ND pump is a safety injection load, blackout load, or both.

Basis for Hi Cog

This is a higher cognitive question because the applicant is required to analyze the conditions in the stem and determine which loads will be loaded on the bus by the sequencer (priority mode or secondary mode) and then recall from memory whether specific loads are SI only, BO only, or both.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2003 CNS NRC Q27 (Bank 4816)

Development References

REFERENCES:
OP-MC-DG-EQB Rev 21

LEARNING OBJECTIVES:
OP-MC-DG-EQB Objective 5

Student References Provided

SYS005 K2.01 - Residual Heat Removal System (RHRS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
RHR pumps ....

401-9 Comments:

Remarks/Status

Q2 References

Seq	Equipment/ Application	Load Per D/G	Req'd For SBO	Time After SBO Signal	Req'd For LOCA	Time After LOCA Signal	Voltage	Switchgear Grp/LC/MCC	REMARKS
1	Centrifugal Charging Pump	600 HP	500 HP	11 sec.	680 HP	11 sec.	4160V	1ETA, 1ETB, 2ETA, 2ETB	One Per Diesel
1	Motor Operated Valves	112 KW (1)	112 KW (1)	11 sec.	112 KW (1)	11 sec.	575V	1EMXA & B 2EMXA & B	Estimated
1	1500 KVA, 600 VAC Essential Aux Power System L.C.	(2)	(2)	11 sec.	(2)	11 sec.	575V	1ELXA & B 2ELXA & B	Additional Load Center In Seq. 2
1	600/120 V Power Panelboard	15 KVA	14.8 KVA	11 sec.	14.8 KVA	11 sec.	575V	1EMXH 2EMXH	Two Per Station
1	Vital AC-DC System Battery Chargers	100 KVA	60 KVA	11 sec.	60 KVA	11 sec.	575V	1EMXA & B 2EMXA & B	Two Per Diesel
1	VC/YC System Control Room Air Handling Unit Fans	50 HP	40 HP	11 sec.	40 HP	11 sec.	575V	1EMXH 2EMXH	Two Per Station
1	VC/YC System Pressure Filter Fan	10 HP	5 HP	11 sec.	5 HP	11 sec.	575V	1EMXH 2EMXH	Two Per Station
1	VC/YC System Pressure Filter Heater	10 KW	10 KW	11 sec.	10 KW	11 sec.	575V	1EMXH 2EMXH	Two Per Station
1	VC/YC System Switchgear Room Air Handling Unit Fans	15 HP	15 HP	11 sec.	15 HP	11 sec.	575V	1EMXA & B 2EMXA & B	Two 7.5 HP Fans Per Diesel
1	Diesel Jacket/ Intercooler Pump	20 HP	19 HP	11 sec.	19 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel Generator Battery Charger	5 KVA	5 KVA	11 sec.	5 KVA	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel Air Compressors	30 HP	30 HP	11 sec.	30 HP	11 sec.	575V	1EMXE & F 2EMXE & F	Two 15 HP Compressors Per Diesel
1	Diesel Lube Oil Before & After Pump	10 HP	9.5 HP	11 sec.	9.5 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel 600/120V Panelboard	5 KVA	3.75 KVA	11 sec.	3.75 KVA	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel Lube Oil Heater Pump	5 HP	5 HP	11 sec.	5 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel

Q2 References

Seq	Equipment/ Application	Load Per D/G	Req'd For SBO	Time After SBO Signal	Req'd For LOCA	Time After LOCA Signal	Voltage	Switchgear Grp/LC/MCC	REMARKS
1	Diesel Generator Building Ventilation Supply Fans	40 HP	25 HP	11 sec.	25 HP	11 sec.	575V	1EMXE & F 2EMXE & F	Two 20 HP Fans Per Diesel
1	Diesel Fuel Oil Transfer Pump	1 HP	1.5 HP	11 sec.	1.5 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel Crankcase Vacuum Blower	0.5 HP	0.5 HP	11 sec.	0.5 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Diesel Fuel Oil Drip Tank Pump	(15)	0.1 HP	11 sec.	0.1 HP	11 sec.	575V	1EMXE & F 2EMXE & F	One Per Diesel
1	Trace Heating Panelboard	30 KVA	10 KVA	11 sec.	---	---	575V	1EMXA & B 2EMXA & B	One Per Diesel
1	Tech Support Center MCC SMXE	130 KVA	130 KVA	11 sec.	---	---	575V	1EMXA 2EMXA	One Per Station Used During Blackout On Both Units
1	Radiation Monitoring	0.25 HP	0.25 HP	11 sec.	0.25 HP	11 sec.	575V	1EMXH	One Per Station
1	RHR & CS Sump Room Sump Pump	7.5 HP	4.5 HP	11 sec. (14)	4.5 HP	11 sec. (14)	575V	1EMXA & B 2EMXA & B	One Per Diesel
1	Diesel Generator Room Sump Pump	30 HP	26 HP	11 sec. (14)	26 HP	11 sec. (14)	575V	1EMXE & F 2EMXE & F	Two 15 HP Pumps Per Station
1	SSFARC Control Power	0.75 KVA	0.75 KVA	11 sec.	0.75 KVA	11 sec.	575V	1EMXA-4 1EMXH-1 2EMXA-4	Two Per Station
1	Hydrogen Analyzer	1.4 KVA	1.4 KVA	11 sec.	1.4 KVA	11 sec.	575V	1EMXA 1EMXB-3 2EMXA 2EMXB-3	One Per Diesel
1	Hydrogen Mitigation Panelboard	7.5 KVA (3)	---	---	6 KVA (3)	11 sec. (3)	575V	1EMXA & B 2EMXA & B	One Per Diesel
2	Safety Injection Pump	440 HP	---	---	440 HP	16 sec.	4160V	1ETA & B 2ETA & B	One Per Diesel
2	1500 KVA 600 VAC Essential Aux Power System Load Center	(5)	(5)	16 sec.	(5)	16 sec.	575V	1ELXC & D 2ELXC & D	
2	Emergency AC Lighting Panel	30 KVA	30 KVA	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	One Per Diesel

Q2 References

Seq	Equipment/ Application	Load Per D/G	Req'd For SBO	Time After SBO Signal	Req'd For LOCA	Time After LOCA Signal	Voltage	Switchgear Grp/LC/MCC	REMARKS
2	Annulus Ventilation System Fan	30 HP	---	---	24 HP	16 sec.	575V	1EMXC & D 2EMXC & D	One Per Diesel
2	Annulus Ventilation System Moisture Separator Heaters	43 KW	---	---	43 KW	16 sec.	575V	1EMXC & D 2EMXC & D	One Per Diesel
2	Radiation Monitoring	(6)	(6)	16 sec.	(6)	16 sec.	575V	1EMXC & D 2EMXC & D	(6)
2	Pipe Tunnel Booster Fans	15 HP	15.5 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	One Per Diesel
2	Control Rod Drive Ventilation Fans	100 HP	100 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	Two 50 HP Fans Per Diesel
2	Lower Containment Cooling Units	250 HP	261 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	Two 125 HP Fans Per Diesel
2	Upper Containment Air Handling Units	20 HP	12.8 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	Two 10 HP Fans Per Diesel
2	Upper Containment Return Air Fans	2 HP	2 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	Two 1 HP Fans Per Diesel
2	Incore Instrumentation Room Air Handling Unit	3 HP	1.7 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	One Per Diesel
2	Pressurizer Booster Fan	20 HP	8.6 HP	16 sec.	---	---	575V	1EMXC & D 2EMXC & D	One Per Diesel
3	Residual Heat Removal Pump	400 HP	---	---	455 HP	20 sec.	4160V	1ETA & B 2ETA & B	One Per Diesel
4	(Group 4 NS deleted see section 3.11 in lesson plan)								
5	Component Cooling Water Pumps	400 HP	380 HP	30 sec.	350 HP	30 sec.	4160V	1ETA & B 2ETA & B	Two 200 HP Pumps Per Diesel

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4816 CNS

C

Unit 2 is responding to a LOCA. Given the following sequence of events and conditions:

- A reactor trip and safety injection occurred
- ECCS was reset

Subsequently, the 2ETA bus momentarily lost power but was reenergized by the 2A D/G

Which one of the following statements describes the correct restoration process for the train A NV, NI and ND pumps?

A. 2A NV pump must be restarted by operator action
2A NI pump will automatically restart
2A ND pump will automatically restart

B. 2A NV pump will automatically restart
2A NI pump will automatically restart
2A ND pump will automatically restart

C. 2A NV pump will automatically restart
2A NI pump must be restarted by operator action
2A ND pump must be restarted by operator action

D. 2A NV pump must be restarted by operator action
2A NI pump must be restarted by operator action
2A ND pump must be restarted by operator action

Q2 Parent Question (2003 CNS NRC Exam Q27 (Bank 4816))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4816 CNS **C**

General Discussion

NV pumps are controlled by both the ECCS and blackout sequencers. NI and ND pumps are controlled by the ECCS sequencer only

Answer A Discussion

Incorrect: NI and ND pumps do not automatically restart, NV pump will auto restart.
Plausible: Directed for psychometric balance by NRC (?)

Answer B Discussion

Incorrect: NI pump does not auto restart
Plausible: NV pump will auto restart and ND pump must be manually restarted

Answer C Discussion

Correct answer

Answer D Discussion

Incorrect: NV pump will auto restart, the NI pump will NOT auto restart.
Plausible: ND pumps require manual restart.

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	2003 NRC Q27 (Bank 227)

Development References

Lesson Plan Objective: EQB Obj: 13
References:
1. OP-CN-EP-EQB page 25

Student References Provided

KA	KA_desc
SYS006 K2.01	Knowledge of bus power supplies to the following: (CFR: 41.7)ECCS pumps ....

SYS004 K3.06 - Chemical and Volume Control System

Knowledge of the effect that a loss or malfunction of the CVCS will have on the following: (CFR: 41.7/45/6)

RCS temperature and pressure ....

Given the following conditions on Unit 2:

- The unit is in solid operations while cooling down
- Both trains of ND are in service, 'A' NV pump is in service
- Letdown is through 2NV-121

Subsequently:

- The Letdown Heat Exchanger Outlet temperature sensor fails causing 2KC-132 to go full OPEN

Per OP/2/A/6100/SD-8 (WATER SOLID OPERATIONS), the operator action required is to throttle 2NV-241 ___(1)___ OR throttle 2NV-121 ___(2)___.

Which ONE (1) of the following completes the statement above?

COMPONENT LEGEND:

2NV-121 (ND LETDOWN CONTROL)
2KC-132 (U2 LD HX KC OUT TEMP CNTRL)
2NV-241 (SEAL INJECTION FLOW CONTROL)

A. 1. CLOSED
2. OPEN

B. 1. OPEN
2. OPEN

C. 1. CLOSED
2. CLOSED

D. 1. OPEN
2. CLOSED

General Discussion

When 2KC-132 fails open, full KC flow (cooling) is supplied to the Letdown Hx. With more cooling provided, NC system temperature will go down. While solid this causes NC system pressure to go down.

Increasing the mass input or decreasing the letdown flow will mitigate the pressure decrease.
Per SD-8, opening 2NV-241 will raise charging flow (and thus raise NC pressure) and reduce NC Pump seal flows.
Reducing letdown flow (closing 2NV-121) will cause NC System pressure increase.

Answer A Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is plausible if applicant concludes operation of 2NV-241 in the closed direction will raise charging flow and thus NC system pressure. 2NV-241 is a backpressure valve, when throttled closed this reduces charging flow and increases NC pump seal injection flow.

Second part is plausible because applicant may mis-diagnose the affect of the failure and determine operation of 2NV-121 in the open direction is needed to lower NC system pressure.

Answer B Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because applicant may mis-diagnose the affect of the failure and determine operation of 2NV-121 in the open direction is needed to lower NC system pressure.

Answer C Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is plausible if applicant concludes operation of 2NV-241 in the closed direction will raise charging flow and thus NC system pressure. 2NV-241 is a backpressure valve, when throttled closed this reduces charging flow and increases NC pump seal injection flow.

Second part is correct and therefore plausible.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched since the applicants are required to have knowledge of the effect on NC system temperature and pressure of a malfunction of KC cooling to the Letdown Hx during solid plant conditions.

Basis for Hi Cog

This question is higher cognitive because the applicants are required to analyze the malfunction of KC-132 and determine the effect it will have on the NV system Letdown Hx. Then determine the effect on NC system temperature and pressure and what NV system manipulations are required to mitigate the event.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2015 MNS NRC Q3 (Bank 3449)

Development References

REFERENCES:
OP/2/A/6100/SD-8 (Water Solid Operations) Encl. 4.2 pg 1 of 1 Rev. 28

OP-MC-PS-NV-DCS Rev 10

LEARNING OBJECTIVES:
NONE

Student References Provided

SYS004 K3.06 - Chemical and Volume Control System

Knowledge of the effect that a loss or malfunction of the CVCS will have on the following: (CFR: 41.7/45/6)

RCS temperature and pressure ....

401-9 Comments:	Remarks/Status

Q3 References

Enclosure 4.2
Solid Operations Parameter Review

1. Limits and Precautions

1.1 WHEN water solid, any changes to NC System pressure should be done slowly to prevent overpressurizing NC System.

2. Initial Conditions

None

3. Procedure

☐ 3.1 Use alternate indications to substantiate actions or verifications of other indicators.

3.2 Understand how each of the following can have an effect on water solid operations:

- ☐ ND Temperature can be affected by changes in KC flow and temperature
- ☐ RN flow and temperature changes will affect ND temperature
- ☐ RN flow changes on the opposite Unit can affect RN flows on the outage Unit
- ☐ Changes in letdown or charging may cause large NC System pressure changes
- ☐ Changes in ND temperature and flow may cause large NC System pressure changes
- ☐ NC / ND temperature increases may cause NC System pressure increase
- ☐ Raising letdown flow (opening 2NV-121) will cause NC System pressure decrease
- ☐ Reducing letdown flow will cause NC System pressure increase
- ☐ Raising charging flow (opening 2NV-238) will cause NC System pressure increase
- ☐ Reducing charging flow will cause NC System pressure decrease
- ☐ Closing 2NV-124 will cause letdown pressure to increase resulting in reduction in letdown flow and increase NC System pressure
- ☐ Opening 2NV-124 will cause letdown pressure to decrease resulting in raising letdown flow and decrease NC System pressure
- ☐ Opening 2NV-241 will raise charging flow and reduce NC Pump seal flows
- ☐ Closing 2NV-241 will reduce charging flow and raise NC Pump seal flows
- ☐ 2NC-32B and 2NC-34A open on NC System NR pressure between 378 - 382 psig

End of Enclosure

Unit 2

ILT-31 MNS SRO NRC Examination QUESTION 3 3 **A**

SYS004 A1.09 - Chemical and Volume Control System

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CVCS controls including: (CFR: 41.5 / 45.5)

RCS pressure and temperature ....

Given the following conditions on Unit 2:

- The unit is in solid operations while cooling down
- Both trains of ND are in service
- 'A' NV pump is in service
- Letdown is through 2NV-121

Subsequently:

- 2A1 KC pump trips

Per OP/2/A/6100/SD-8 (WATER SOLID OPERATIONS) which ONE (1) of the following describes operator actions necessary to respond to the failure?

COMPONENT LEGEND:

2NV-121 (ND LETDOWN CONTROL)
2NV-241 (SEAL INJECTION FLOW CONTROL)

A. Throttle CLOSED 2NV-241 OR Throttle OPEN 2NV-121

B. Throttle OPEN 2NV-241 OR Throttle OPEN 2NV-121

C. Throttle CLOSED 2NV-241 OR Throttle CLOSED 2NV-121

D. Throttle OPEN 2NV-241 OR Throttle CLOSED 2NV-121

Q3 Parent Question (2015 MNS NRC Q3 MODIFIED (Bank 3449)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 3 | 3 | **A**

General Discussion

When 2A1 KC trips, less KC flow (cooling) is supplied to the ND Hx. With less cooling provided, NC system temperature will go up. While solid this causes NC system pressure to go up.

Decreasing the mass input or increasing the letdown will reduce the pressure increase.
Per SD-8, opening 2NV-241 will raise charging flow and reduce NC Pump seal flows and closing 2NV-241 will reduce charging flow and raise NC Pump seal flows.
Raising letdown flow (opening 2NV-121) will cause NC System pressure decrease and Reducing letdown flow (closing 2NV-121) will cause NC System pressure increase.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is plausible if applicant concludes operation of 2NV-241 in the OPEN direction will reduce charging flow and thus NC system pressure.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible if applicant concludes operation of 2NV-121 in the CLOSED direction will lower NC system pressure.

Answer D Discussion

INCORRECT: See explanation above

PLAUSIBLE:
First part is plausible if applicant concludes operation of 2NV-241 in the OPEN direction will reduce charging flow and thus NC system pressure.

Second part is plausible if applicant concludes operation of 2NV-121 in the CLOSED direction will lower NC system pressure.

Basis for meeting the KA

The K/A is matched since the applicants are required to predict changes in NC system pressure, during solid plant conditions, when operating NV system valves 2NV-121 (Low Pressure Letdown Pressure Control) and 2NV-241(Seal Injection Flow Control).

Basis for Hi Cog

This question is higher cognitive because the applicants are required to analyze the malfunction of the 2A1 KC pump and determine the effect it will have on NC system temperature and pressure and then determine the correct NV system manipulations required to mitigate the event.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2007 MNS NRC SRO Retake Examination NRC Q29 (Bank 3449)

Development References

REFERENCES:
OP/2/A/6100/SD-8 (Water Solid Operations) Encl. 4.2 pg 1 of 1

LEARNING OBJECTIVES:
NONE

Student References Provided

SYS004 A1.09 - Chemical and Volume Control System
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CVCS controls

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 3 | 3 | **A**

including: (CFR: 41.5 / 45.5)
RCS pressure and temperature ....

401-9 Comments:	Remarks/Status
	401-9 Comments from Chief Examiner: ENHANCEMENT I believe the word :"throttle" should be added after the "OR" in each of the answer choices. An applicant could believe that each or the choices would have 2NV-121 either fully opened or fully closed. I do not believe that would be a correct answer in any situation. Need to work on the wording of the stem question. The OP does not directly require any of these valve manipulations in particular. It just has an enclosure that explains what each of these manipulations would do. Facility Response: The facility concurs with Chief Examiner's comments and the question has been revised per Chief Examiner's recommendation. SLM 03/26/15

SYS005 A1.01 - Residual Heat Removal System (RHRS)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RHRS controls including: (CFR: 41.5 / 45.5)

Heatup/cooldown rates ....

Given the following conditions on Unit 2:

- Both trains of Residual Heat Removal (ND) are in service
- ND Heat Exchanger outlet valves (2ND-14 & 2ND-29) are throttled to 2000 gpm each
- NC Cooldown rate is 25°F/Hr
- The instrument air line to Train "B" ND Heat Exchanger outlet valve (2ND-14) breaks off

Which ONE (1) of the following indicates the **INITIAL** ND System response to this event?

	Total ND System Flow	NC System Cooldown rate
A.	Goes UP	Goes UP
B.	Goes UP	Remains the Same
C.	Goes DOWN	Goes DOWN
D.	Goes DOWN	Remains the Same

General Discussion

ND HX outlet valves fail open on loss of air. Since the valve fails open, more flow will go through the ND Heat Exchanger and total ND system will go up because there is now less total resistance to flow in the system.

Cooldown rate will go up because a higher percentage of ND flow is going through the heat exchanger

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant concludes that 2ND-34 (ND Hx Bypass) automatically opens in response to the change in total system flow caused by 2ND-14 failing opening. This is additionally plausible since 2ND-14, 1ND-29, and 2ND-34 are typically adjusted in conjunction with each other to maintain a desired NC system temperature and cooldown rate and maintain required ND system total flow within limits.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concluded that 2ND-14 fails closed on a loss of air.

If the applicant concludes that 2ND-14 fails closed on a loss of air, they would also conclude that the NC system cooldown rate would go down as well (due to the total heat transfer area being reduced by 1/2).

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concluded that 2ND-14 fails closed on a loss of air.

If the applicant concludes that 2ND-14 fails closed on a loss of air, they could conclude (correctly so) that more flow would be forced through the 2A ND Hx. If they conclude that the increase in flow through the 2A ND Hx was exactly equal to the flow lost through the 2B ND Hx, they would logically conclude that the NC system cooldown rate would remain the same.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of how the NC system cooldown rate is affected by a malfunction in the RHR system (which is normally controlled manual by the board operator). Since the given malfunction results in an increase in the cooldown rate, the board operator must be aware of how the system responds so that they may take action if necessary to prevent exceeding cooldown rate limits.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory how the ND Hx Outlet Valves fail on a loss of air.

Then the applicant must analyze how total ND System Flow rate and NC system cooldown rate are affected by the valve in the failed position.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2007 MNS NRC SRO Examination NRC Q4 (Bank 3525)

Development References

REFERENCES:
Lesson Plan OP-MC-PS-ND (Residual Heat Removal System) Rev. 49

LEARNING OBJECTIVES:

Student References Provided

SYS005 A1.01 - Residual Heat Removal System (RHRS)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RHRS controls including: (CFR: 41.5 / 45.5)

Heatup/cooldown rates ....

401-9 Comments:	**Remarks/Status**

Q4 References

- NI-184B (RB Sump to Train B ND & NS) prevents FWST from being drained to the containment sump
- NS-1B (B NS Suct. From Cont Sump) prevents the NS System suction from being overpressurized.

ND-19A is interlocked so that it cannot be opened unless the following valves are closed:

- NS-43A (A ND to NS Cont. Outside Isol.) prevents NCS coolant from being pumped to the containment spray ring.
- ND-58A (Train A ND to NV & NI Pumps) prevents NV System suction overpressurization
- NI -185A (RB Sump to Train A ND & NS) prevents FWST from being drained to the containment sump
- NS-18A (A NS Pump From Cont Sump) prevent NS System suction overpressurization

ND-4B and ND-19A are normally open when the ND System is aligned to the FWST, NC loop "C" hot leg or in standby readiness. They are closed when aligned for ECCS recirculation phases.

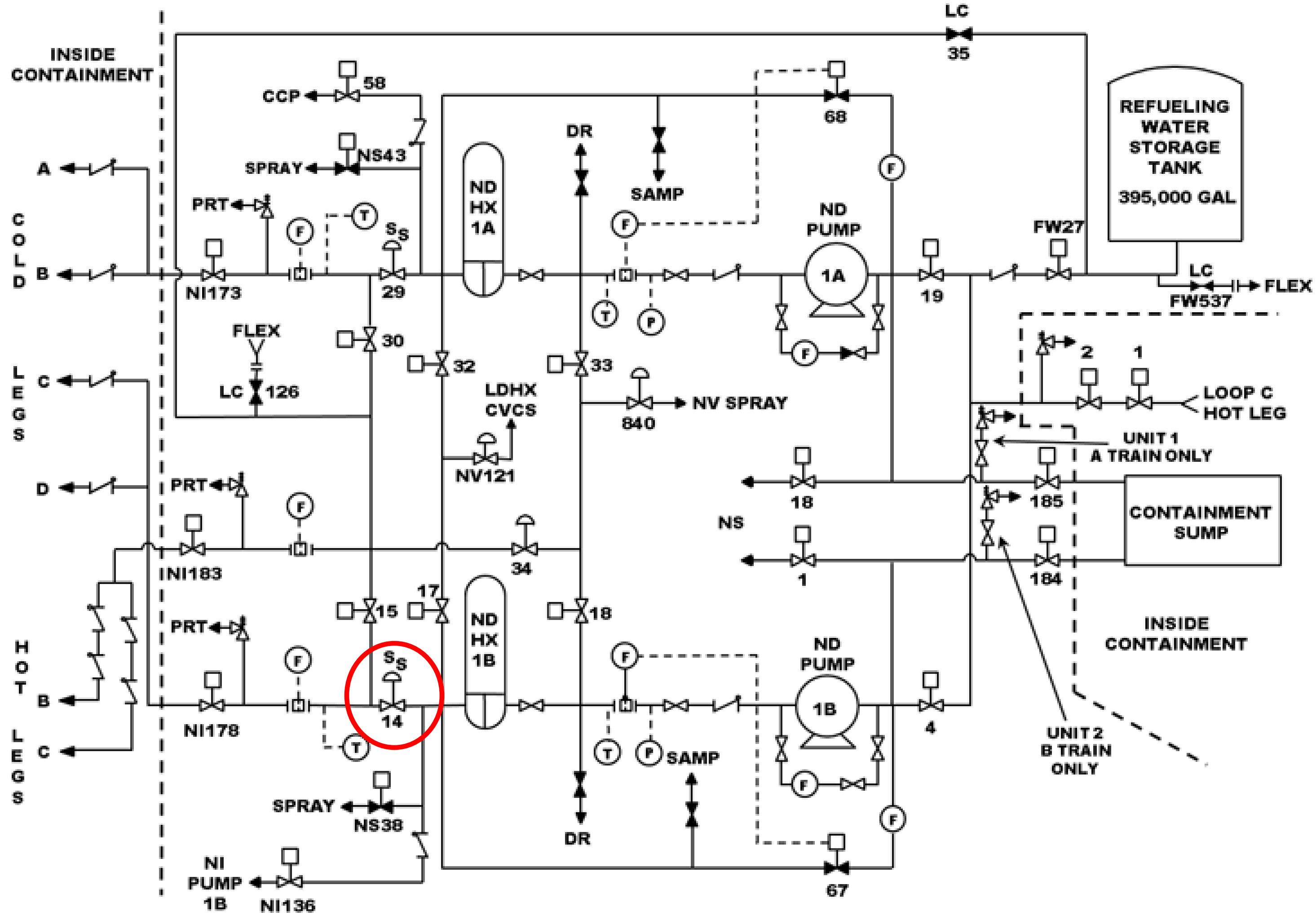
2.3.3 ND-14 (B ND HX Outlet), ND-29 (A ND HX Outlet)

These are air operated valves and are controlled by non-safety manual loaders on MC11 or the ASP by transferring control with the "C/R, LOCAL" selector switch. The valve manual loaders are used to control the pump discharge flow. These valves are failed to the full open position on a Ss to ensure the required ECCS flow is provided by the ND Pumps. On a loss of power to the solenoid valve in the control air line (NDSV0140 or NDSV0290), control will transfer from the ASP to the control room. These valves are designed to fail open on a loss of instrument air, however, since the control system utilizes non-safety grade controllers, solenoid valves and instrumentation, the valves may not assume their safe position when required. **They have reverse acting controllers and depending on where the failure occurs these valves could go closed.** To alleviate this, a safety grade solenoid is in the control air line to vent the valve and insure it achieves its safe position. This safety solenoid is NDSV0141 for ND-14 and NDSV0291 for ND-29. The solenoid is deenergized by the safety injection signal (Ss), which is latched in through the operation of a latching relay. To regain control of ND-14 and ND-29 following a Safety Injection, the "Safety Injection Reset Train A (B) and the Sequencer Train A(B) " must be reset followed by resetting the "Train A (B) Modulating Valves Reset" (located on the RN portion of MC11). Each of these reset pushbuttons have an amber "Reset" light which is illuminated when its respective signal is reset.

Valve status for both valves is provided to the OAC and the Monitor Light Panel. An annunciator on AD11 actuates in the control room when either valve control is transferred to the ASP.

Q4 References

7.1 ND System Composite (09/01/14)



Q4 Parent Question (2007 MNS NRC Exam Q4 (Bank 3525))

Examination Outline Cross-reference:	Level	RO	SRO
	Tier #	2	
	Group #	1	
	K/A #	005 A1.01	
	Importance Rating	3.5	

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RHRS controls including: Heatup/cooldown rates

Proposed Question: Common 4

Given the following conditions:

- Both trains of residual heat removal (ND) are in service.
- ND heat exchanger outlet valves are throttled to 2000 gpm each.
- NC Cooldown rate is 25 degrees F per hour.
- The instrument air line to Train "B" ND heat exchanger outlet valve breaks off.

Which ONE (1) of the following would represent the **INITIAL** ND System response to this event?

	Total ND System Flow	NC System Cooldown rate
A.	Goes UP	Goes UP
B.	Goes UP	Remains the Same
C.	Goes DOWN	Goes DOWN
D.	Goes DOWN	Remains the Same

Proposed Answer: A

Explanation (Optional):
A. Correct: ND HX outlet valves fail open on loss of air. Since the valve fails open, more flow will go through the ND Heat Exchanger. Cooldown rate will go up because a higher percentage of ND flow is going through the heat exchanger
B. Incorrect: Credible because flow does increase, but cooldown rate does go up. Credible if applicant misunderstands failure mode and location of valve
C. Incorrect: Credible because applicant can misunderstand the failure mode of the valve. If valve did fail closed, cooldown rate would go down.
D. Incorrect: Flow would go down if the valve failed closed, and if applicant misunderstands location of valve, could assume that cooldown rate remains the same.

Q4 Parent Question (2007 MNS NRC Exam Q4 (Bank 3525))

Technical Reference(s): PS-ND (Attach if not previously provided)

Proposed references to be provided to applicants during examination: None

Learning Objective: PS-ND-5 (As available)

Question Source:			
	Bank #	X	
	Modified Bank #		(Note changes or attach parent)
	New		

Question History: Last NRC Exam Catawba 2005

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

10 CFR Part 55 Content:		
	55.41	3
	55.43	

Comments:

SYS006 A1.15 - Emergency Core Cooling System (ECCS)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: (CFR: 41.5 / 45.5)

RWST Level and temperature ....

Given the following conditions on Unit 2:

- Unit is at 75% RTP
- ONE bank of FWST heaters have failed "ON"
- Current FWST temperature is 91°F
- FWST temperature is increasing at a rate of 0.5°F/min

Based on the conditions above, FWST temperature will reach the T.S. 3.5.4 (REFUELING WATER STORAGE TANK) limit in ___(1)___ minutes.

Normally, Group 1 FWST heaters cycle automatically to maintain FWST temperature greater than a MINIMUM of ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. 14
   2. 72°F

B. 1. 14
   2. 75°F

C. 1. 18
   2. 72°F

D. 1. 18
   2. 75°F

General Discussion

The following parameters are associated with the FWST:

- Minimum Temperature - 75°F
- Maximum Temperature - 100°F

Heater Group '1' (A1, B1, C1, & D1) can be controlled both automatically and manually. In automatic, the heater group is set to energize at 75°F when two out of the three temperature loops detect 75°F. The heater group will cycle on and off around this setpoint.

Heater Groups '2' (A2, B2, C2, & D2) and '3' (A3, B3, C3, & D3) are controlled in manual only. Heater Group '2' should be manually energized at 73°F decreasing.

Heater Group '3' should be manually energized at 72°F decreasing. Additionally, a high temperature heater cutoff will trip the heaters off at 80°F if two out of the three temperature loops detect 80°F.

T.S 3.5.4 limit is less than or equal to 100°F. Therefore (100 - 91) / 0.5 = 18 minutes.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since it is the time to reach the OAC hi temperature alarm (98°F) on the FWST.

Second part is plausible since this is the setpoint where the operator would be directed to manually place the third bank of heaters in service per the annunciator response.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since it is the time to reach the OAC hi temperature alarm (98°F) on the FWST.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since this is the setpoint where the operator would be directed to manually place the third bank of heaters in service per the annunciator response.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to predict when the FWST temperature will exceed the T.S 3.5.4 (FWST) limit based on current temperature and the current trend of that temperature.

Basis for Hi Cog

This question is high cog because the applicant must first recall the FWST maximum temperature limit of T.S 3.5.4 and then calculate, based on the given trend, the time required to exceed that limit.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References
REFERENCES: Lesson Plan OP-MC-FH-FW (Refueling Water System) Rev 45 T.S 3.5.4 (Refueling Water Storage Tank) LEARNING OBJECTIVES: OP-MC-FH-FW Objective 5

Student References Provided

SYS006 A1.15 - Emergency Core Cooling System (ECCS)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: (CFR: 41.5 / 45.5)

RWST Level and temperature ....

401-9 Comments:	Remarks/Status

Q5 References

- A sufficient volume of borated water to insure that the radiation dose at the surface of the refueling cavity is limited to 2.5 millirem per hour during the period when a fuel assembly is transferred over the reactor vessel flange.

The FWST is surrounded by a seismic wall. The basis of the seismic wall is that in the event a Tornado induced missile ruptures the FWST, the wall is high enough to retain a sufficient volume of FWST water to provide NPSH to the Centrifugal Charging Pumps and the Safety Injection Pumps. The Missile induced rupture assumes that there is a Main Steamline Break in conjunction with an FWST rupture. There is no concern for the ND Pumps because it is assumed that the Steam Break Outside Containment Event will not cause primary pressure to be reduced below the Shut-off Head of the pumps. The FWST overflows to the Spent Fuel Pool and to the FWST trench. The following parameters are associated with the FWST:

- Minimum Volume modes 1-4 — 383,146 gallons
- Minimum Volume modes 5-6 — Cycle Dependent (See COLR)
- Minimum Boron Concentration — Cycle Dependent (See COLR)
- Minimum Temperature — 70°F
- Maximum Temperature — 100°F

The limits on minimum volume and boron concentration ensure that a sufficient volume of water is available within containment to permit Recirculation flow to the core. The reactor will remain subcritical in the cold condition following mixing of the FWST and NC water volumes with all control rods inserted except the most reactive control assembly.

The minimum and maximum temperatures are assumed in the safety analysis.

2.7 Refueling Water Pump, and Pump Strainer

Objective 3, 8

The refueling water pump is designed to transfer one refueling cavity and transfer canal volume through the KF purification loop to the FWST. The time lapse is 24 hours. This pump can handle all cleanup problems normally encountered.

The refueling water pump is controlled remotely from the Control Room. There are no automatic actions associated with the refueling water pump.

The refueling water pump has a number of uses:

- It may be used to fill and drain the spent fuel pool.
- It may be used to fill, drain and purify the FWST and the Refueling Cavity.

During normal operations the following parameters are monitored locally:

- FW pump suction pressure which should be ≥ 7 psig on the 0 - 160 psig suction pressure gauge.
- FW pump discharge pressure which should be between 95 - 125 psig on the 0 - 300 psig pressure gauge.

Q5 References

There is also a trench located outside of the FWST wall. Refueling water trench sump pump B is used to remove rain water collected in that trench. If there is an RMWST overflow condition, a signal is sent to the "B" sump pump to automatically stop. The signal to stop the pump is from a flow switch on the RMWST overflow line. When overflow conditions clear and water is verified clear, the FWST sump pump B reset pushbutton located at the FWST must be depressed to allow the pump to operate. The discharge lines for the trench sump pumps are stainless steel. They are routed to the turbine building sump

(NSM 12479, 22479). Heat tracing has been added to these lines.

2.10 Heat Tracing and Thermal Insulation

Objective 3

The FWST vents are heat traced.

The portion of the refueling water Recirculation pump discharge piping located in the yard is heat traced

Heat tracing is provided for all safety related level instrumentation in both FWSTs. A source of reliable, permanent power for heat tracing is in place (PIP 2-M96-0406).

The FWST Heat Trace System has been redesigned such that the FWST level instrument line heat tracing is controlled by ambient temperature. Two ambient thermocouples (Normal and Emergency) are mounted above the heat trace instrument lines. Heat trace will be turned on when the outside ambient temperature drops to 40 degrees and turned off when the outside ambient temperature rises to 50 degrees. The heat trace on the FWST instrument lines will still be controlled by thermocouples: one to a normal controller and one to an emergency controller.

There is an OAC alarm circuit for the FWST level transmitter enclosure temperature for both units. The OAC will alarm if outside air temperature is 40°F decreasing. This will allow Operations time to notify IAE SPOC to fix the enclosure heaters before the transmitter lines are in a situation where they could freeze. Freezing of the transmitter lines could render the ND autoswitchover capability inoperable. (LER 370/96-01) (PIP 2-M96-0332). Also, if any one of the four enclosures has a temperature > 130°F, an OAC alarm will actuate. This high temperature is wired in parallel with the existing low temperature enclosure alarm such that the same OAC point will alarm whenever any one of the four enclosure temperatures is high or low. (MM-8884 and MM-8885).

2.11 The Refueling Water Storage Tank Heaters

Objective 3, 7

The FWST heaters are rated at 575 VAC, 3 phase, 60 cycles. The heater elements are stainless steel with high limit thermocouples. There are four banks of heater elements distributed around the periphery of the FWST. Each bank contains three elements, one 10 KW heater element associated with each of the three groups. This arrangement allows for even heating of the FWST water from each heater group.

Q5 References

Heater Group "1" (A1, B1, C1, & D1) can be controlled both automatically and manually. In automatic, the heater group is set to energize at 75°F when two out of the three temperature loops detect 75°F. The heater group will cycle on and off around this setpoint. Heater Groups "2" (A2, B2, C2, & D2) and "3" (A3, B3, C3, & D3) are controlled in manual only. Heater Group "2" should be manually energized at 73°F decreasing and heater Group "3" should be manually energized at 72°F decreasing. Additionally, a high temperature heater cutoff will trip the heaters off at 80°F if two out of the three temperature loops detect 80°F.

The following will cause all heater groups to trip:

- Heater element overtemperature. (200°F) (1/4) (Relay must be reset using RESET pushbutton located on refueling water heater control panel).
- Excessive water temperature in tank. (80°F) (2/3)
- Low water level in tank. (47 inches) (2/3)

The following FWST Temperatures have receiver gauges in the Control Room:

- FWST Temperature MC-9

The FWST heater groups have ON/OFF indicating lights and a pushbutton operator for each heater.

The FWST heater control panel has an indicating light which energizes when a heater overheats. Each heater group has a local indicating temperature gauge to indicate element temperature. A RESET pushbutton is used to reset overtemperature conditions.

The following Annunciator Alarms are associated with FWST Temperature:

- Refueling Water Emergency Low Temperature 1AD12, F-5
- Refueling Water Low-Low Temperature 1AD12, E-5
- Refueling Water Low Temperature 1AD12, D-5
- FWST Yard Line Contents Low Temperature 1AD13, B-1

The following Computer inputs are associated with FWST Temperature:

- FWST Yard Line Contents Temperature
- FWST Heater Overtemperature
- FWST Temperature High
- FWST Temperature Low
- FWST Temperature Low-Low
- FWST Temperature Emergency Low

Main header water temperature is measured just inside the Auxiliary Building. An alarm sounds when water temperature decreases below 75°F. A test connection is used to verify water temperature. Three redundant instruments are used to measure water temperature. Temperature is be maintained above setpoint by controlling the

Q5 References

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.4 Refueling Water Storage Tank (RWST)

LCO 3.5.4 The RWST shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RWST boron concentration not within limits. OR RWST borated water temperature not within limits.	A.1 Restore RWST to OPERABLE status.	8 hours
B. RWST inoperable for reasons other than Condition A.	B.1 Restore RWST to OPERABLE status.	1 hour
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

Q5 References

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify RWST borated water temperature is ≥ 70°F and ≤ 100°F.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.2	Verify RWST borated water volume is ≥ 383,146 gallons.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.3	Verify RWST boron concentration is within the limits specified in the COLR.	In accordance with the Surveillance Frequency Control Program

SYS006 K6.05 - Emergency Core Cooling System (ECCS)

Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: (CFR: 41.7 / 45.7)

HPI/LPI cooling water ....

Given the following initial plant conditions:

- Both units are at 100% RTP
- "A" Train components are in service on both units

Subsequently,

- A loss of offsite power occurs on Unit 1
- Both U1 D/Gs start and load 1ETA and 1ETB
- 10 minutes after the Blackout, the 1A RN pump trips

Which ONE (1) of the following components loses cooling water as a direct result of the 1A RN pump trip?

A. U1 Reactor Building RV loads

B. U1 PD Pump motor cooler

C. U1 Auxiliary Building RV loads

D. 1A NV pump motor cooler

General Discussion

Based on the conditions given, since a loss of offsite power has occurred on Unit 1, a Blackout has occurred on both Unit 1 Emergency Busses. Therefore, when the sequencer loaded the BO loads on the respective D/Gs, both RN pumps were automatically started.

Subsequently, the 1A RN pump trips which would effect the U1 Train A RN Essential Header and the Reactor Building Non-Essential Header.

Loss of the 1A RN pump could also potentially effect the Unit 1 Auxiliary Building Non-Essential Header, Unit 1 Auxiliary Building RV Loads, and the Unit 1 Reactor Building RV Loads.

Because the 1B RN pump is running (as a result of the Blackout signal), the Unit 1 Train B Essential Header has a cooling water supply.

The RV header loses it's supply from Unit 1. However, RV is still being supplied by the 2A RN pump.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the U1 Reactor Building RV loads are supplied via the U1 Auxiliary Building Non-Essential header. Since the 1A RN pump has tripped and the 1B Train supply is isolated fron the Non-Essential Header (as a result of the Blackout signal), the applicant could logically conclude that the U1 Reactor Building RV loads have no cooling water supply. However because the running RN pump on Unit 2 is the 2A RN pump, the U1 Reactor Building RV loads are still supplied cooling by the 2A RN pump via the RV supply header. If the 2B RN pump had been running the only way the U1 Reactor Building RV loads would have had cooling water (on the U1 Blackout the U2 'B' Train is also isolated from the Non-Essential Header) would be if the 'C' RV pump had been in AUTO prior to the event (as 'A' and 'B' RV pump are powered from Unit 1 and have no power).

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the U1 PD pump is supplied by the U1 Auxiliary Building Non-Essential header and the Auxiliary Building Non-Essential header return is normally isolated (due to fouling concerns in the PD pump heat exchanger). Since the PD pump heat exchanger does not normally have a cooling water supply, the applicant could conclude that the loss of the 1A RN pump has affected the cooling water supply. However, since the PD pump does not normally have cooling water aligned, the effect of 1A RN pump has no effect on the PD pump. Additionally, a cooling water supply to the PD pump is still available if needed.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the U1 Auxiliary Building RV loads are supplied via the U1 Auxiliary Building Non-Essential header. Since the 1A RN pump has tripped and the 1B Train supply is isolated fron the Non-Essential Header (as a result of the Blackout signal), the applicant could logically conclude that the U1 Auxiliary Building RV loads have no cooling water supply. However because the running RN pump on Unit 2 is the 2A RN pump, the U1 Auxiliary Building RV loads are still supplied cooling by the 2A RN pump via the RV supply header. If the 2B RN pump had been running the only way the U1 Auxiliary Building RV loads would have had cooling water (on the U1 Blackout the U2 'B' Train is also isolated from the Non-Essential Header) would be if the 'C' RV pump had been in AUTO prior to the event (as 'A' and 'B' RV pump are powered from Unit 1 and have no power).

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because the NV pump is a HPI ECCS pump and the question tests the applicants knowledge of the cooling water supply to that pump.

Basis for Hi Cog

This question is higher cognitive because the applicants are required to perform multiple mental steps to arrive at the correct answer. The applicants must know that the RN pumps are blackout loads and will be re-energized by their respective D/G's, that 1B RN pump is running and supplying cooling water to its loads, that the RN system will make automatic valve alignments due to the blackout signal (train separation) and then be able to determine the effect of losing the 1A RN pump while in this configuration.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References
REFERENCES: Lesson Plan OP-MC-PSS-RN (Rev. 51) Lesson Plan OP-MC-CNT-RV (Rev. 21) LEARNING OBJECTIVES: OP-MC-PSS-RN Objective 8

Student References Provided

SYS006 K6.05 - Emergency Core Cooling System (ECCS)

Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: (CFR: 41.7 / 45.7)

HPI/LPI cooling water ....

401-9 Comments:	Remarks/Status

Q6 References

The following alarms on 1AD12 provided indication of SNSWP level:

- **SNSWP LO LEVEL**

  Setpoint : 739.75 mean sea level elevation

  Origin: SNSWP level transmitter

- **SNSWP LO-LO LEVEL**

  Setpoint : 739.50 mean sea level elevation

  Origin: SNSWP level transmitter

The SNSWP has level (738' 11" to 741' elevation) and temperature (30^0F to 100^0F) meters located on 1MC9.

2.2 RN Pumps, Strainers and Mini-flow

Objective # 3

RN Pumps

The station has four RN pumps, two for each unit. Each pump is powered from its unit related 4160v buss, ETA for the "A" train pump and ETB for the "B" train pump. Each RN pump can be operated from MC11 using start/stop pushbuttons. If the Control Room has to be evacuated, then each pump can be controlled from the Auxiliary Shutdown Panel (ASP) after control has been transferred. (Transfer of control to the ASP will be covered in lesson plan OP-MC-CP-ASP). Normally only one pump per unit is operating, however the number of pumps running will correspond to unit requirements. The RN pump motor cooler receives cooling water from its corresponding RN pump discharge.

Each pump meets or exceeds design flow requirements. Indication of RN pump A(B) Discharge pressure (0 to 150 psig) and RN pump A(B) Flow (0 to 20,000 gpm) is provided on MC9.

Objective # 4

The RN pumps will **automatically start** if:

- Train related Safety injection signal is actuated
- Train related Blackout signal is actuated
- Train related CA pump is started.

Q6 References

2.3 Suction Paths

Objective # 8,9

The RN System has three **suction sources**:

- Low Level Intake (LLI) through 1RN-1
- SNSWP
- RC crossover.

The **LLI** is the normal source of water to the RN pumps. This source comes from a line from the dam and is isolated by and/or supplied to both units by 1RN-1 (LLI Supply to RN) **(refer to Drawings 7.2 and 7.3)**. This source provides cooler water for heat sink purposes and helps minimize the buildup of Asiatic clams in the RN System piping since they do not live in water with a low oxygen concentration.

The **SNSWP** is a backup supply in the event of a loss of Lake Norman. It is automatically aligned to train "B" on a Blackout or Safety Injection signal. If the SNSWP is being used as a suction source, the discharge must also be back to the SNSWP to prevent draining the pond. Under certain postulated conditions, NPSH from the SNSWP may be less than required, specifically a seismic event (loss of Lake Norman supply) that requires shutdown of both units with a loss of VI. See PIP M-09-2341 in section 5 for additional information.

The **RC crossover supply** can supply each train but must be manually aligned by the operator. This source may be used if LLI is unavailable or if all four RN pumps are to be operated.

2.4 Supply Headers

Objective # 8, 10

The RN system provides flow to the following **headers**:

- "A" and "B" essential headers
- Reactor building Non-essential headers
- Auxiliary Building Non- essential headers

There is one redundant **essential header** for each train. These headers contain the equipment and component essential for safe shutdown of the plant. (**Refer to Drawing 7.4 and 7.6)**. The following loads are supplied by the essential header. Included in this listing is whether these components are supplied on Ss , BO or Sp:

Q6 References

LOADS	Ss	BO
1) Pump motor coolers/AHU		
• Component Cooling Pump motor (KC)	X	X
• Centrifugal Charging Pump motor (NV)	X	X
• Safety Injection Pump motor (NI)	X	
• Residual Heat Removal Pump motor (ND)	X	
• Containment Spray Pump motor (NS)	X	
• Fuel Pool Cooling Pump motor (KF)	X	X
• Nuclear Service Water Pump motor (RN)	X	X
• Auxiliary Feedwater Pump (CA)	X	X
2) Heat exchangers:		
• Containment Spray (NS) *		

* **Note:** NS is manually placed in service per Emergency Procedure implementation

• Component Cooling (KC)	X	X
• Diesel Generator Engine Cooling (KD)	X	X
• D/G Starting Air Compressor After Cooler	X	X
• Control, Cable and Equip Room A/C Cond (YC)	X	X
3) Oil coolers :		
• Centrifugal Charging Pump Bearing (NV)	X	X
• Centrifugal Charging Pump Gear (NV)	X	X
• Safety Injection Pump Bearing (NI)	X	

4) Supplies assured makeup for the following systems:

- Auxiliary Feedwater (CA)
- Component Cooling (KC)
- Spent Fuel Pool Cooling (KF)
- Diesel Generator Cooling (KD)

The RN return from the NS heat exchangers is monitored for radioactivity by EMF-45A & B to detect tube leakage. The NS heat exchangers have a wet lay-up loop associated with the shellside (RN) of the heat exchanger **(Refer to Drawing 7.7)**.

Q6 References

This wet lay-up loop was added to help reduce corrosion buildup on the shellside of the HX. The 2B NS heat exchanger wet lay up loop is on the tube (RN) side of the heat exchanger. This system is non-safety related and in case of a break in the system there are flow limiting orifices on the suction and discharge sides. This system is primarily the responsibility of the Chemistry Dept. with the exception of the isolation valves directly off the RN piping which will be Operations. The wet lay up system will normally be in service with the isolation valves open and the heat exchanger water solid. The recirc pump will be run for sampling purposes and chemical additions as necessary.

The RN **Reactor Building non-essential header** is not redundant and is isolated on an S_P (Phase B) signal, when it is being supplied from the 'A' RN header. If 'B' train is supplying the header, flow will be lost to the NCP coolers on a BO or SS. This header contains the NCP motor coolers **(Refer to Drawing 7.6)**. Loss of RN to the NCP motor cooler(s) requires the operator to trip the effected NCP(s).

Objective # 11

The RN **Auxiliary Building non-essential header** is not redundant and is isolated on an S_S signal. The components supplied by this header are: **(refer to Drawing 7.6)**

- Reciprocating Charging Pump Bearing oil cooler
- Reciprocating Charging Pump Fluid Drive oil cooler

Note: The Steam Generator Blowdown Heat Exchanger has been flanged out and "abandoned in place" for Unit #1 (NSM 12430) and Unit #2 (NSM 22430).

Due to both units alignment to the RL Header, a cross-tie is created between the units through a 6 inch line. **(Refer to drawing 7.4)**

The reason that the Auxiliary Building non-essential header supply isolation valve (RN42) is **NOT** closed during a Blackout is to allow "A" RN pump supply the Reactor Building ventilation units **(refer to Drawing 7.11)**. The "A" RN pump will have a greater NPSH since it will be supplied by the LLI. Also it is likely under Blackout conditions the RV pumps will not have power.

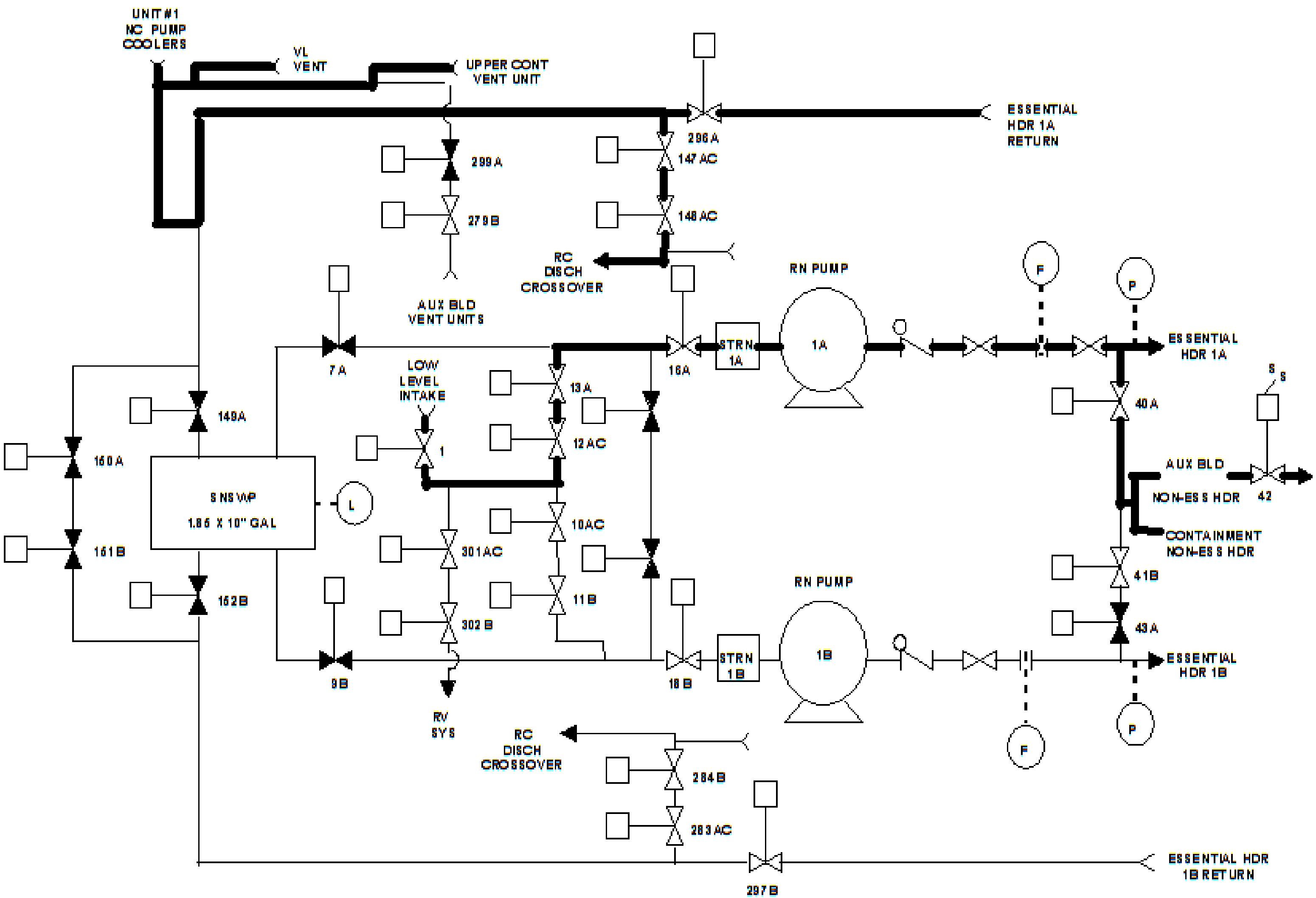
Due to fouling problems and repeated maintenance on the PD pump heat exchanger a decision was made to isolate the Aux. Bldg. non-essential header. As a result the normal position of 1RN-64 will be closed. When it is necessary to start/stop the PD pump 1RN -64 will be opened/closed per the NV procedure.

Auxiliary Building RV loads:

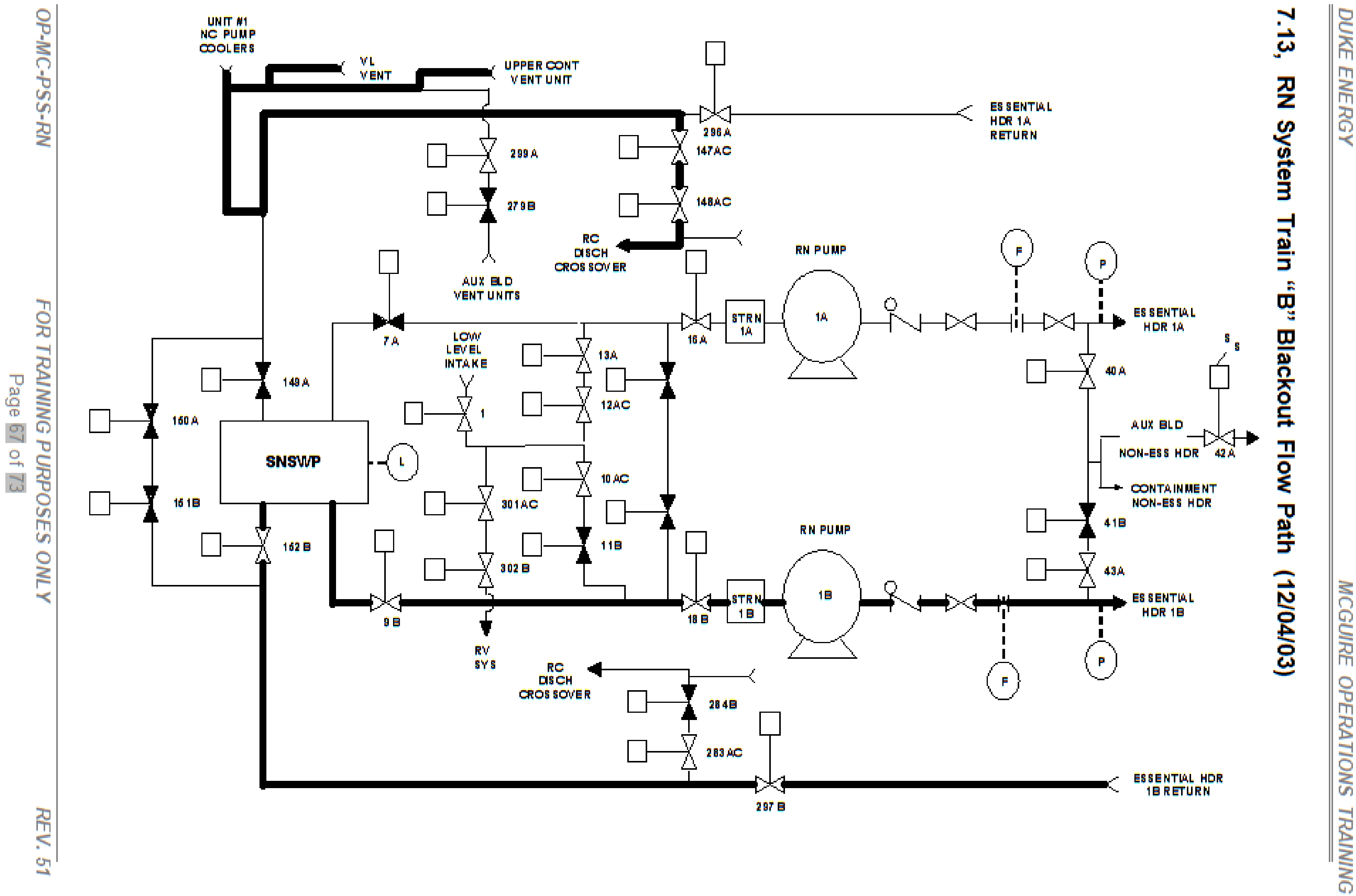
Auxiliary Building Ventilation Units

Q6 References

7.12, RN System Train "A" Blackout Flow Path (12/04/03)



<u>**Q6 References**</u>



Q6 References

2.8 Power Supplies

600 VAC	Load Center - Compartment
RV Pump A	1SLXA-5A
RV Pump B	1SLXD-5A
RV Pump C	2SLXA-5A
125 VDC Solenoid Valves	Power Panel, Breaker Number
1RVSV0790 (2RVSV0790)	1EVDA, 14 (2EDVA, 7)
1RVSV0800 (2RVSV0800)	1EVDD, 13 (2EDVD, 20)
1RVSV1010 (2RVSV1010)	1EVDA, 14 (2EDVA, 20)
1RVSV1020 (2RVSV1020)	1EVDD, 12 (2EDVD, 10)
Motor Operated Valves	Motor Control Center - Compartment
1RV0032A (2RV0032A)	1EMXA1-1E (2EMXA1-5C)
1RV0033B (2RV0033B)	1EMXB5-1B (2EMXB5-1B)
1RV0076A (2RV0076A)	1EMXA3-2C (2EMXA3-1A)
1RV0077B (2RV0077B)	1EMXB3-F1D (2EMXB3-F1D)

3.0 SYSTEM OPERATION

3.1 Normal Operation

Objective # 10

The preferred RV Pump configuration is one pump in "AUTO" and the remaining pumps in "MANUAL" (and off). One pump should always be in "AUTO" unless all three pumps are in service.

The RV system is designed for normal operation with supply coming from the RN Non-Essential Aux. Building Supply Header. The standby RV pump will start automatically on low header pressure (50 psig) when required. Other RV pumps may be Manually placed in service if required to maintain VL cooling water flow rates above 600 gpm or if additional VL cooling is desired.

RV Pump suction pressure is verified to be above negative 6 inches Hg (per local gage RVPG5171) twice daily per Service Building Rounds Sheet.

SYS007 A2.05 - Pressurizer Relief Tank/Quench Tank System (PRTS)

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

Exceeding PRT high-pressure limits ....

Given the following initial conditions on Unit 2:

- A reactor trip has occurred
- The crew is performing E-0 (REACTOR TRIP OR SAFETY INJECTION)
- Containment pressure is 0.1 PSIG and stable

Subsequently,

- ONE (1) PZR PORV fails partially open
- PRT pressure rises to approximately 115 PSIG, and then suddenly drops and stabilizes at 2 PSIG
- Containment pressure starts to rise at 0.1 PSIG per minute

Based on the conditions above,

1) the PRT rupture discs ________ operate as designed.

2) assuming the rate of pressure increase remains constant, Containment pressure will reach the Tech Spec 3.6.4 (CONTAINMENT PRESSURE) limit in ________ minutes.

Which ONE (1) of the following completes the statements above?

A. 1. did
   2. 2

B. 1. did
   2. 3

C. 1. did NOT
   2. 2

D. 1. did NOT
   2. 3

General Discussion

According to Lesson Plan OP-MC-PS-NC, the PRT Rupture Discs will lift at 100 PSIG to protect the PRT.

According to Technical Specification LCO 3.6.4, the upper Technical Specification Containment Pressure limit is 0.3 PSIG. Since initial pressure was 0.1 PSIG, and Containment pressure is rising at .1 PSIG per minute, the limit will be reached in 2 minutes.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part plausible if the applicant confuses PSIA and PSIG. If so, they would conclude that the rupture discs had operated at 100# as designed.

The 2nd part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part plausible if the applicant confuses PSIA and PSIG. If so, they would conclude that the rupture discs had operated at 100# as designed.

The 2nd part is plausible if the applicant neglects to calculate the time to reach the TS limit including the starting pressure of 0.1 PSIG. If so, they would calculate the time starting at 0 PSIG in Containment and would calculate that it would take 3 minutes to reach the TS limit for Containment pressure (+0.3 PSIG).

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part is correct.

The 2nd part is plausible if the applicant neglects to calculate the time to reach the TS limit including the starting pressure of 0.1 PSIG. If so, they would calculate the time starting at 0 PSIG in Containment and would calculate that it would take 3 minutes to reach the TS limit for Containment pressure (+0.3 PSIG).

Basis for meeting the K

The KA is matched because the operator predicts the impact of exceeding the PRT high pressure limit (i.e. Containment pressure increase) and uses procedures (Tech Specs) to correct, control, mitigate by having knowledge of the Tech Spec limit on Containment pressure.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory the setpoint at which the PRT rupture discs relieve to protect the PRT. The applicant must then compare that recalled knowledge to determine if the PRT rupture discs have operated as designed.

Next the applicant must recall from memory, the TS limits on Containment pressure (-0.3 PSIG to +0.3 PSIG). The applicant must then perform a calculation using the data given to determine how long it will take for Containment pressure to reach the upper TS limit.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2014 MNS NRC Exam Q70 (BANK # 5980)

Development References

REFERENCES:
Lesson Plan OP-MC-CNT-VQ (Containment Air Release and Addition) Rev 19
Lesson Plan OP-MC-PS-NC (Reactor Coolant System) Rev 38

Student References Provided

Tech Spec 3.6.4 (Containment Pressure) Rev 261/241

LEARNING OBJECTIVES:

SYS007 A2.05 - Pressurizer Relief Tank/Quench Tank System (PRTS)

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

Exceeding PRT high-pressure limits ....

401-9 Comments:

Remarks/Status

Q7 References

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

Operator Fundamental Focus; Control

While discussing the Containment Air Release and Addition System (VQ) ***emphasize*** *the fundamental Control principle of "maintain systems and parameters within established limits to ensure that systems are not operated outside of the intended design and that operating margins are not eroded".*

Explain *that the* Containment Air Release and Addition System (VQ) *is one of the systems that helps prevent the release of fission products to the environment to protect the health and safety of the public. Protecting this system and ensuring that it is operated within its design basis will help to ensure that operating margins are maintained.*

The Containment Air Release and Addition System (VQ) is utilized to maintain the containment pressure between the Tech. Specs. limits of ± 0.3 psig. The system is capable of maintaining the correct pressure during all operating modes including startup and shutdown.

1.2 General Description

The Containment Pressure must be maintained between the limits of ± 0.3 psig to ensure that prior to an accident, containment pressure will be within its analyzed range. The VQ System is not safety related however, the VQ containment isolation valves VQ-1A (Cont Air Rel Inside Isol), 2B (Cont Air Rel Outside Isol), 5B (Cont. Air Add Outside Isol), 6A (Cont. Air Add Inside Isol) are SAFETY RELATED.

Objective # 2

Drawing 7.1 provides a simplified flow path for the VQ System. The operator will be required to sketch and/or describe the flowpath shown on this drawing from memory. On a release, air is taken from lower containment through VQ-1A and 2B through the PAC filter through VQ-4 to the unit vent. On an addition, air flows from the auxiliary building ventilation through VQ-3 through the PAC filter through VQ-5B and 6A to upper containment.

Q7 References

2.9 Pressurizer Relief Tank (PRT)

Objective # 19

The purpose of the pressurizer relief tank is to condense and cool discharge water from the PORVs and safeties. The tank normally contains water and a N_2 cover gas. The N_2 gas overpressure is used to prevent the O_2 from entering the tank and forming an explosive mixture with the H_2 gas present. The N_2 gas is supplied from bulk N_2 (GN system) or from Shutdown Tank B. When the relief valves lift, the steam is discharged into the PRT through a sparger pipe (under water). The PRT design is based on the requirement to:

- be able absorb the pressurizer discharge during a step load decrease of 10% (equivalent to 110% continuous discharge from the pressurizer).
- the spray rate is designed to cool the tank from 200^0 F to 120^0 F in approximately one hour following the design discharge.
- the volume of the N_2 gas in the PRT is selected to limit the maximum pressure following a design discharge to 50 psig.

The PRT is not designed for relief valve continuous discharge, therefore, it has two rupture discs designed to prevent it from exceeding its design pressure of 100 psig. The rupture disc setting is also 100 psig which is twice the calculated pressure resulting from the maximum design safety valve discharge. The tank and rupture discs are also designed for full vacuum to prevent tank collapse if the contents cool following a discharge without nitrogen being added.

The PRT can be vented to containment atmosphere through a manual vent valve at the tank (NC51). Due to ALARA concerns this is not normally performed with the Unit at power. This line has a capped connection designed to accept a filter assembly to reduce radioactivity released from the tank to containment. The PRT can also be aligned to the waste gas system for venting. The PRT has pressure indication on 1(2)MC10 and alarms on **1(2)AD6 "PRT Hi Press" (setpoint 8 psig).**

The PRT is equipped with internal spray and drain system to cool the tank. The PRT is cooled by recirculating its contents with the Reactor Coolant Drain Tank (NCDT) Pump through the NCDT heat exchanger. If the NCDT pumps are unavailable, the PRT can be cooled by increasing PRT N_2 pressure, initiating PRT spray flow from the RMWST while cycling NC107 to maintain level. The PRT has a temperature indication on 1(2)MC10 and an alarm on **1(2)AD6 "PRT Hi Temp" (setpoint 114° F)** to inform the operator that the tank needs cooling. PRT level can be lowered by opening NC-107A (PRT Drain to NCDT system) or by opening NC-109 (PRT #1 Sample) to the containment floor and equipment sump. PRT level can be raised by opening NC-58A (PRT Spray Supply Block) and either using gravity fill from the RMWST or starting an RMWST pump in the recirculation mode. The PRT has level indication on 1(2)MC10 and alarms on **1(2)AD6 "PRT Abnormal Level" (setpoints hi 88% and low 64%).**

Refer to OP/1(2)/A/6150/004 Pressurizer Relief Tank, for PRT operations.

Q7 References

3.6 CONTAINMENT SYSTEMS

3.6.4 Containment Pressure

LCO 3.6.4 Containment pressure shall be ≥ -0.3 psig and ≤ +0.3 psig.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment pressure not within limits.	A.1 Restore containment pressure to within limits.	1 hour
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.4.1 Verify containment pressure is within limits.	In accordance with the Surveillance Frequency Control Program

Q7 Parent Question (2014 MNS NRC Q70 (Bank 5980)

D

ILT-30 MNS SRO NRC Examination QUESTION 70 | 70

GEN2.2 2.2.38 - GENERIC - Equipment Control
Equipment Control
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

Given the following initial conditions on Unit 2:

- A reactor trip has occurred
- The crew is performing E-0 (REACTOR TRIP OR SAFETY INJECTION)
- Containment pressure is 0.1 PSIG and stable

Subsequently:

- ONE (1) PZR PORV fails partially open
- PRT pressure rises to approximately 115 PSIG, and then suddenly drops and stabilizes at 2 PSIG
- Containment pressure starts to rise at 0.1 PSIG per minute

Based on the conditions above,:

1) the PRT rupture discs operated ________.

2) assuming the rate of pressure increase remains constant, Containment pressure will reach the Tech Spec 3.6.4 (CONTAINMENT PRESSURE) limit in a MAXIMUM of ____(2)____ minutes.

Which ONE (1) of the following completes the statements above?

A. 1. as designed
2. 2

B. 1. later than designed
2. 3

C. 1. as designed
2. 3

D. 1. later than designed
2. 2

Q7 Parent Question (2014 MNS NRC Q70 (Bank 5980)

General Discussion

According to Lesson Plan OP-MC-PS-NC, the PRT Rupture Discs will lift at 100 PSIG to protect the PRT.

According to Technical Specification LCO 3.6.4, the upper Technical Specification Containment Pressure limit is 0.3 PSIG. Since initial pressure was 0.1 PSIG, and Containment pressure is rising at .1 PSIG per minute, the limit will be reached in 2 minutes.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part plausible if the applicant confuses PSIA and PSIG. If so, they would conclude that the rupture discs had operated at 100# as designed.

The 2nd part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part is correct.

The 2nd part is plausible if the applicant neglects to calculate the time to reach the TS limit including the starting pressure of 0.1 PSIG. If so, they would calculate the time starting at 0 PSIG in Containment and would calculate that it would take 3 minutes to reach the TS limit for Containment pressure (+0.3 PSIG).

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The 1st part plausible if the applicant confuses PSIA and PSIG. If so, they would conclude that the rupture discs had operated at 100# as designed.

The 2nd part is plausible if the applicant neglects to calculate the time to reach the TS limit including the starting pressure of 0.1 PSIG. If so, they would calculate the time starting at 0 PSIG in Containment and would calculate that it would take 3 minutes to reach the TS limit for Containment pressure (+0.3 PSIG).

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the operator must have knowledge of Tech Spec 3.6.4 (Containment Pressure) to determine the correct response.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory the setpoint at which the PRT rupture discs relieve to protect the PRT. The applicant must then compare that recalled knowledge to determine if the PRT rupture discs have operated as designed.

Next the applicant must recall from memory, the TS limits on Containment pressure (-0.3 PSIG to +0.3 PSIG). The applicant must then perform a calculation using the data given to determine how long it will take for Containment pressure to reach the upper TS limit.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2009 MNS Audit Q5 (Bank 3120)

Development References

References:
Lesson Plan OP-MC-PS-NC
Tech Spec 3.6.4 (Containment Pressure)

Student References Provided

Q7 Parent Question (2014 MNS NRC Q70 (Bank 5980)

ILT-30 MNS SRO NRC Examination QUESTION 70 | 70 | **D**

Learning Objectives: OP-MC-CNT-CNT Objective 9 OP-MC-PS-NC Objective 19

GEN2.2 2.2.38 - GENERIC - Equipment Control
Equipment Control
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

401-9 Comments:	Remarks/Status
	401-9 Comments: SAT

SYS008 K4.09 - Component Cooling Water System (CCWS)
Knowledge of CCWS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
The "standby" feature for the CCW pumps ....

Given the following conditions on Unit 2:

- The unit is in MODE 3
- OP/1/A/6400/005 (COMPONENT COOLING WATER SYSTEM) Enclosure 4.20 (POST OUTAGE KC to NC PUMP FLOW BALANCE) is being performed
- 2A1 KC pump is running, 2A2 KC pump has been stopped for the flow test
- 2B1 and 2B2 KC pumps are available
- The 2B sequencer is in TEST for surveillance testing
- I&E inadvertently generates an SI signal on Unit 2 “B” Train ONLY

Assuming no operator actions, which ONE (1) of the following indicates the Unit 2 KC pumps which are in service?

A. 2A1 KC pump ONLY

B. 2A1 and 2A2 KC pumps ONLY

C. 2A1, 2B1, and 2B2 KC pumps ONLY

D. 2A1, 2A2, 2B1 and 2B2 KC pumps

General Discussion

With the B Train Sequencer in test, when the B Train Safety Injection signal is generated, the Sequencer test relays will de-energize and the B Train SI loads will load normally .

Therefore, for the conditions given the 2A1, 2B1 and 2B2 KC pumps will be running.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant concludes that with the 2B Sequencer in TEST, an SI signal will not initiate the load sequence.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant believes that either Sequencer will initiate the load sequence on both trains and that the B Train load sequence is blocked by the 2B Sequencer being in TEST.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant concludes that an SI signal on either Train will initiate the load sequence on both trains.

Basis for meeting the K

The only "standby" feature for the KC pumps at MNS is associated with the auto-start of the pumps on a Blackout or Safety Injection. There is NO auto-start associated with low KC system discharge header pressure as is the case at other facilities. Therefore, this KA is matched by testing knowledge of KC pump auto-start initiated by a Safety Injection signal.

Basis for Hi Cog

This question is higher cognitive because the applicants are required to perform more than one mental process to answer the question. The applicants are required to know that the unit 2 KC pumps are SI loads and will start if not running or remain running if in service, that placing the 2B sequencer in test removes all local control for safety powered pumps and valves and that the safety signal will override the sequencer switch position and auto start all safety pumps regardless of switch position.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2007 CNS SRO NRC Examination NRC Q36 (Bank 836)

Development References

REFERENCES:
Lesson Plan OP-MC-DG-EQB (Rev 21)

LEARNING OBJECTIVES:
NONE

Student References Provided

SYS008 K4.09 - Component Cooling Water System (CCWS)
Knowledge of CCWS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
The "standby" feature for the CCW pumps ....

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
008K4.09
K/A is ok, this is really testing the sequencer function, but since no other KC auto functions exist this is acceptable.
Are there any actual test procedures that would put the

equipment in this lineup? If so, would it make sense to reference those procedures? Drl 11/9/15

Facility Response:
Agree with chief examiners comments. Added procedure and enclosure that would place KC in this alignment. SLM 11/16/15

c. Transfer bus to Normal (Standby) power source

d. Shutdown diesel generator locally

- **Synchronize and close the main feeder breaker.**
- **Transfer 4160V bus load to the auxiliary transformer and trip the diesel generator breaker.**

3.9 Sequencer Testing

Initial conditions: Unit on line in a normal electrical line-up.

- Test initiation and indication.
  - Momentarily rotating the key operated test actuate switch to the right, the test position, energizes the 7 test relays TSA1 (TSB1) through TSA7 (TSB7). Relay TSA5 (TSB5) seals around the test actuate key switch contacts and maintains all the test relays energized. The test actuate light will also be on.
  - Upon energization, the 7 test relays perform the following functions:
- Manipulates the 4160 volt bus breaker controls which enables the breakers to maintain their present positions while testing the sequencer. Contacts in breaker close and trip circuits disable breaker operation. Indicating lights on the sequencer panel indicate when breaker operation would occur if the sequencer were actually controlling the various loads as the testing progresses.
  - Relay TSA5 (TSB5) closes a contact in the defeat test relay circuit, DTSA (DTSB), to permit sequencer reset if an actual SI or blackout occurs during testing. **If a valid actuation signal occurs (SI and/or BO), the sequencer will come out of test, reset and sequence loads on properly.**
  - Opens or closes contacts across test pushbuttons (P/B) in the following circuits:

    Test P/B 1 - Sequence timers ST1A (ST1B) to ST11A (ST11B)

    Test P/B 2 - ESG aux. relays 1ESGAX2 (1ESGBX2) and 1ESGAX3 (1ESGBX3)

    Test P/B 3 - Accelerated sequence relays AA1 (AB1) and AA2 (AB2)

    Test P/B 4 - Bypasses the normal feeder breaker permissive contacts in the load shed relay circuit when the P/B is depressed to "TEST"

    Test P/B 5 - Blackout logic relays LRA1, LRA2, LRA3, and LRA6 (LRB1, LRB2, LRB3, and LRB6)

    Test P/B 6 - Logic relays LRA4 (LRB4) and LRA5 (LRB5)

    Test P/B 7 - Bypasses the normal feeder breaker permissive contacts in the reset relay circuit, TRA3 (TRB3), when the P/B is depressed to "TEST"

Q8 References

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The Diesel Generator Load Sequencing System (EQB) functions to energize the necessary Blackout and/or Safety Injection loads in such a manner that the diesel generator or auxiliary transformer (ATC, ATD, SATA, SATB) is not momentarily overloaded.

Objective # 2

A power loss to the 4160 Volt Bus or a Safety Injection Actuation Signal from the Solid State Protection System (SSPS) actuates the Load Sequencer.

1.2 General Description

The sequencer has basically two modes of operation: priority and secondary. The priority mode is actuated by a safety injection (SI) signal from the Solid State Protection System (SSPS). The secondary mode is actuated by a loss of voltage (LOV) on the 4160 volt essential bus.

The Sequencing System is designed to be actuated automatically without any operator action and to initiate loading of the Engineered Safeguard bus as rapidly as loading transients permit without overloading the normal transformer or diesel generator.

The controlling parameters of sequencer logic are the ESF signal from SSPS, the time from initial actuation, the voltage on the ESF Bus and the Diesel Generator frequency (speed).

1.3 Redundancy requirements

There are two identical systems, one associated with each diesel. They are independent of each other and in no way can the failure of one affect the other. The single failure is considered to be the entire loss of one system.

1.4 Sequencer Actuation Signals

Signal	Setpoint	Coincidence	Interlock	Protection
Manual Safety Injection		1/2 Switches		Operator Judgment
Low Pressurizer Pressure	1845 psig	2/4 Channels	P-11	LOCA
High Containment Pressure	1.0 psig	2/3 Pressure Switches		Steam Break LOCA

2/3 Under-voltage on affected 4160 Volt Bus (Blackout)

Q8 Parent Question (2007 CNS NRC Exam Q36 (Bank 836))

EXAM BANK QUESTION: 836 CNS **C**

Unit 2 is at 100% power. Given the following conditions and events:

- 2A1 KC Pump is in service.
- The 2B sequencer is in TEST.
- An inadvertent SI signal is received on Unit 2 "B" train only.
- All systems respond appropriately in automatic.

Assuming no operator actions, which Unit 2 KC pumps are in service?

A. 2A1 KC pump only

B. 2A1 and 2A2 KC pumps only

C. 2A1, 2B1, and 2B2 KC pumps only

D. 2A1, 2A2, 2B1 and 2B2 KC pumps

Q8 Parent Question (2007 CNS NRC Exam Q36 (Bank 836))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 836 CNS **C**

General Discussion

Answer A Discussion

If students think sequencer in test prevents KC pumps from starting. KC pumps cannot be controlled MANUALLY with sequencer in test This is what will occur on A train since SI affects train related pumps

Answer B Discussion

Plausible: If students think sequencer in test prevents KC pumps from starting. KC pumps cannot be controlled MANUALLY with sequencer in test Also, sudent mayb think that any SI signal starts ALL KC pumps (where sequencer is not in TEST).

Answer C Discussion

Answer D Discussion

Plausible: This is the normal sequence assuming a normal SI on both trains. This is partially correct since both B train KC pumps will start because the sequencer does not affect them..

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

Development References

References:
1. KC lesson
2. KC17

Student References Provided

KA	KA_desc
SYS008 K4.09	Knowledge of CCWS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)The "standby" feature for the CCW pumps ....

SYS010 A3.02 - Pressurizer Pressure Control System (PZR PCS)
Ability to monitor automatic operation of the PZR PCS, including: (CFR: 41.7 / 45.5)
PZR pressure ....

Given the following conditions on Unit 2:

- A unit runback has occurred
- Steam Dump valves failed to modulate OPEN
- The Pressurizer Pressure Calculated Error observed on the Ovation Soft Panel is +76 PSIG

Based on the conditions above, the Pzr Spray Control valves will be ___(1)___ OPEN.

Pzr PORVs (2NC-32B and 2NC-36B) will OPEN if actual Pzr pressure increases to a MINIMUM of ___(2)___ PSIG.

Which ONE (1) of the following completes the statements above?

A. 1. full
2. 2335

B. 1. throttled
2. 2335

C. 1. full
2. 2385

D. 1. throttled
2. 2385

General Discussion

The Pressurizer Spray Controller output is ramped linearly from 0% - 100% as the Pressure Master Controller output goes from +25 psig (Error) to +75 psig (Error).
There are three PORVs with each having two "OPEN-AUTO-CLOSE" control switches. There is one on the MCB and one on the Aux Shutdown Panel (ASP). The control switch desired for control is selected via the 'C/R-STATUS-LOCAL' switch on the ASP. When in 'AUTO', the PORV will OPEN provided Pressurizer Pressure is above the interlock pressure (2185 psig) and the control pressure is above 2335 psig for PORVs NC-32B and NC-36B.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant confuses the error signal at which the spray valves are full open (+75 psig) with the error signal that closes NC-34 after auto opening (+80 psig).

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because this is the pressurizer pressure high reactor trip setpoint.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant confuses the error signal at which the spray valves are full open (+75 psig) with the error signal that closes NC-34 after auto opening (+80 psig).

Second part is plausible because this is the pressurizer pressure high reactor trip setpoint.

Basis for meeting the K

The KA is matched because the applicant demonstrates the ability to monitor automatic operation of various Pressurizer Pressure Control components by knowing their status as actual pzr pressure increases.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
OP-MC-PS-IPE-DCS (Pressurizer Pressure Control) Rev 04F

LEARNING OBJECTIVES:
OP-MC-PS-IPE Objective 5

Student References Provided

SYS010 A3.02 - Pressurizer Pressure Control System (PZR PCS)
Ability to monitor automatic operation of the PZR PCS, including: (CFR: 41.7 / 45.5)
PZR pressure ....

ILT-16-1 MNS SRO NRC Examination **QUESTION 9** 9 **A**

401-9 Comments:	Remarks/Status

Q9 References

the MCB Spray Controller is in AUTO, the Pressure Master Controller controls the Spray Controller output.

Objective #5

The Spray Controller output is ramped linearly from 0% - 100% as the Pressure Master Controller output goes from +25 psig (Error) to +75 psig (Error). Positive feedback of spray valve position (OPEN, INTERMEDIATE, or CLOSED) is provided via illuminated windows on the PV bar graph on the spray controller (Soft Control and SLIMs). These lights are generated from signals received from the valve limit switches. When the full

CLOSED limit switch is made up, the bottom window will be the only window that is lit. When the valve comes off the full CLOSED limit switch the middle window will illuminate and now both the bottom and middle windows will be lit. When the Valve reaches the full open position and the full OPEN limit switch is made up the top window will illuminate. At this point all windows, bottom, middle, and top will all be lit.

If the PV value is selected for display on the SLIMs, there are three values that will be displayed over the full range of valve motion. When the valve is full CLOSED the display will indicate 10%. When the valve comes off of the full CLOSED limits switch the display will indicate 60% and when the full OPEN limit switch is made up the display will indicate 100%. These are not actual valve position values, but artificial values set up in the SLIMs to provide the desired light indication representing valve position.

The spray valves fail closed on loss of air signal. There are Industry Operating Events where Unit Trips have been caused by a pressurizer spray valve failure to close. Spray valves are designed to fail close on loss of instrument air. However, a positioner failure could cause a valve to open or close. A “Pressurizer Spray Emergency Close” switch has been added to the Main Control Board. These switches operate in parallel with the existing SSF controls. Selecting “Close” will energize solenoid valves which will isolate operating air to the valves.

The spray valves have bypass flow. Manual valves in parallel with the spray valves are throttled to provide approximately 0.5 gpm bypass flow. This prevents thermal shock to the spray line and provides for mixing between the NCS and the PZR. The spray lines are equipped with low temperature alarms to provide indication of low bypass flow. During boration or dilution events, PZR Heaters should be placed in **MANUAL** and energized. This will result in pressure trying to increase, with resultant spray flow. Doing this will allow faster mixing of the NCS and the PZR to maintain a closer boron concentration.

When EMXA-4 is swapped to its alternate supply (SMXG), Capability to close the Spray Valves, NC-27C and NC-29C is given to SSF.

2.7 PORVs

2.7.1 PORV Operation

On an ‘OPEN’ signal, a solenoid actuates to align air to operate the PORVs. Normally the operating air is supplied from VI. Refer to Drawing 7.7, (PORV N_2 Backup). All three PORV’s are provided with back-up N_2 from the Cold Leg Accumulators, to be used if VI is lost. NC-32B & NC-36B get N_2 from CLA 'B' via NI-431B, and NC-34A from CLA 'A' via NI-430A. The N_2 regulator is set slightly less than VI press to allow VI as first choice supplier. Any time 'Low Press Mode' is selected, NI-430A & NI-431B will automatically open provided NC temperature < 320°F. NI-430A & NI-431B can be manually opened anytime with control board switch.

Note:
Refer to Annunciator Response's
1AD6-F9 (PORV NC-34A EMERG CLA N_2 ENABLED)
1AD6-F10 (PORV NC-32B EMERG CLA N_2 ENABLED)
Emphasize fact that alarms only indicate that NC34 & 32 have N_2 available but NC-34, NC-32 and NC-36 get N_2 backup.

2.7.2 PORV Control

Objective #5

Note:
Refer to Annunciator Response 1AD6
A6 (PZR Lo Press PORV NC34 Blocked) and 1AD6
B6 (PZR Lo Press PORV NC
32 & NC
36 blocked) and 1AD2
B7 (PCS PWR Supply Failure Control Cab)

Refer to Drawing 7.10, P.O. Relief Valve Control. There are three PORVs with each having two "OPEN-AUTO-CLOSE" control switches. There is one on the MCB and one on the Aux Shutdown Panel (ASP). The control switch desired for control is selected via the 'C/R-STATUS-LOCAL' switch on the ASP. When in 'AUTO', the PORV will OPEN provided Pressurizer Pressure is above the interlock pressure (2185 psig) and the control pressure is above 2335 psig for PORVs NC-32B and NC-36B.

PORV NC-34A, which is controlled by the Master Controller, will OPEN when the Error signal on the Master Controller output reaches +100 psig (Error) which is displayed on the "NC - Pressurizer and PRT" DCS Graphic.

PORVs NC-32B and NC-36B will CLOSE when Pressurizer Pressure lowers to 2327 psig. PORV NC-34A will CLOSE when the Master Controller output lowers to +80 psig (Error) displayed on the "NC - Pressurizer and PRT" DCS Graphic.

Q9 References

7.11 PZR Pressure Control Setpoints 6/2/11

Pressure/Error (psig)	Actuation	Alarm
2485	SAFETIES OPEN	
2385	REACTOR TRIP (2/4)	PZR HI PRESS ALERT (1/4)
2335	PORV's NC-32B & NC-36B OPEN	
+100 psig (Error)	PORV's OPEN NC-34A	
2327	PORV's NC-32B & NC-36B CLOSE	
+80 psig (Error)	PORV NC-34A CLOSE	
+75 psig (Error)	SPRAY VALVES OPEN	PZR HI PRESS DEV CONTROL PZR HI PRESS (2310 psig)
+25 psig (Error)	SPRAY VALVES CLOSE	
+15 psig (Error)	"C" HEATERS OFF	
0 psig (Error) 2235 (NORMAL)	"C" HEATERS HALF ON	
- 15 psig (Error)	"C" HEATERS FULL ON	
- 17 psig (Error) (17% PZR LVL)	B.U. HEATERS OFF	
- 25 psig (Error) (+5% LVL > PROG)	B.U. HEATERS ON	PZR LO PRESS CONTROL
2185 (Increasing)	PORV's UNBLOCKED	
2177 (Decreasing)	PORV's BLOCKED	PZR LO PRESS PORV BLOCKED
1955	P-11 (2/3)	
1945	REACTOR TRIP (2/4)	PZR LO PRESS ALERT (1/4)
1845	SAFETY INJECTION (2/4)	PZR LO PRESS SI ALERT (1/4)
380 (<320 F/L.P. MODE)	PORV 34 (TR-A) OPEN PORV 32 (TR-B) OPEN	

SYS010 K6.04 - Pressurizer Pressure Control System (PZR PCS)
Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: (CFR: 41.7 / 45.7)
PRT ....

Given the following conditions on Unit 1:

- NC system pressure is 1985 PSIG and slowly lowering due to a leaking Pressurizer Code Safety Valve (1NC-1)
- PRT pressure is currently 65 PSIG
- Discharge temperature downstream of 1NC-1 is 310°F
- Containment pressure is currently 0.1 PSIG

When the PRT rupture disc ruptures,

1) the rate of NC system depressurization will _______.

2) the temperature downstream of 1NC-1 will _______.

Which ONE (1) of the following completes the statements above?

REFERENCE PROVIDED

A. 1. increase
2. remain the same

B. 1. remain the same
2. remain the same

C. 1. remain the same
2. decrease

D. 1. increase
2. decrease

General Discussion

NC system pressure of 1985 PSIG ≈ 2000 PSIA.

The enthalpy of saturated steam at 2000 PSIA ≈ 1140 BTU/lbm (precisely 1138.71 BTU/lbm).

Following the constant enthalpy line on the Mollier diagram to the constant pressure line of 80 PSIA (65 PSIG), and then following that constant pressure line up to the saturation curve yields a temperature of approximately 310°F.

If the applicant then follows the contant enthalpy line to the "Standard Atmosphere" pressure line (≈15 PSIA or 0 PSIG), then follows that constant pressure line up to the saturation curve, this would yeild a temperature of approximately 200°F.

Based on this, the applicant should determine that when the rupture disc ruptures, temperature downstream of 1NC-1 will decrease.

When the PRT rupture disc ruptures the differential pressure across the leaking Safety Valve will increase thereby increasing the rate of leakage and the rate of depressurization.

Flow Rate = α x (Square Root of the DP)

where: α = constant based on the flow characteristics of the system

Another way to view this is that the pressure downstream of the safety valve acts as a resistance to flow through the safety valve discharge line. Therefore, if the resistance to flow decreases (i.e. pressure decrease), the flow through the safety valve and its disharge line will increase.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is correct and therefore plausible.

Part 2 is plausible if the applicant does not comprehend that the Safety Valve is now discharging to a lower pressure when the PRT rupture disc fails.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE
Part 1 is plausible if the applicant does not comprehend that the larger DP across the valve will result in a higher leak rate.

Part 2 is plausible if the applicant does not comprehend that the Safety Valve is now discharging to a lower pressure when the PRT rupture disc fails.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE
Part 1 is plausible if the applicant does not comprehend that the larger DP across the valve will result in a higher leak rate.

Part 2 is correct and therefore plausible.

Answer D Discussion

CORRECT: See explanation above

Basis for meeting the K

The KA is matched because the applicant must determine what happens to the rate of the NC system pressure decrease when the PRT rupture disc ruptures.

Basis for Hi Cog

This is a comprehension level question because the applicant must evaluate a change in conditions (i.e. before and after PRT rupture disc failure) and determine the consequence to NC system leak rate and Safety Valve discharge line temperature.

Basis for SRO only

ILT-16-1 MNS SRO NRC Examination **QUESTION 10** 10 **D**

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2009 MNS RO NRC Retake Examination NRC Q9 (Bank 2209)

Development References
REFERENCES: Lesson Plan OP-BNT-TH03 Steam Properties Rev 4a Lesson Plan OP-BNT-TH04 Thermodynamic Processes Rev. 5 LEARNING OBJECTIVES: OP-BNT-TH03 Objectives 14 & 15 TH04007

Student References Provided
Steam Tables

SYS010 K6.04 - Pressurizer Pressure Control System (PZR PCS)

Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: (CFR: 41.7 / 45.7)

PRT ....

401-9 Comments:

Remarks/Status

Q10 References

To the right of this point along the saturation line, the water is a saturated vapor. To the left, it is a saturated liquid. Points underneath the saturation line, then, are in the wet vapor state while points above the saturation line are in the superheated vapor state. If we hold pressure constant for a saturated vapor and transfer heat into the vapor, it becomes superheated and both its enthalpy and entropy increase (h ↑ and s → on the h-s diagram). Conversely if we keep pressure constant and remove heat from the saturated vapor state it becomes a wet vapor and both its enthalpy and entropy decrease (h ↓ and s ← on the h-s diagram).

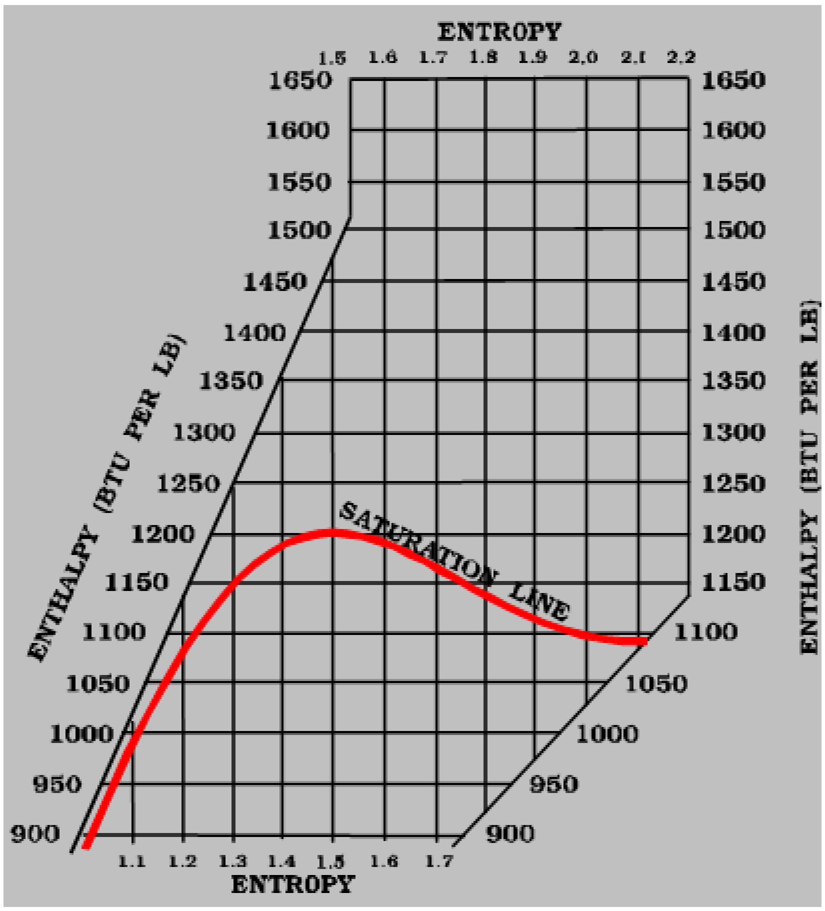


Figure 8 Mollier Diagram (simplified)

Thus, **constant pressure** lines run diagonally from the upper right to the lower left on the Mollier diagram. (See Figure 9). In the wet vapor region, these are also constant temperature lines, since the heat transfer in this region is a latent heat transfer. Pressure decreases from left to right across the Mollier diagram. Standard atmospheric pressure (14.696 psia) is indicated with a dashed line labeled "Standard Atmosphere." Constant pressure lines on property diagrams are called **isobars**.

$$\eta_p = \frac{w_{p,\,ideal}}{w_{p,\,real}}$$

Solving for $w_{p,\,real}$:

$$w_{p,\,real} = \frac{w_{p,\,ideal}}{\eta_p}$$

Substituting W_p with Δh:

$$h_{out\ real} = \frac{(h_{out} - h_{in})_{ideal}}{\eta_p} + h_{in,\,real}$$

Solving Δh_{ideal}:

$$(h_{out} - h_{in})_{\ ideal} = (600 - 200)\ \frac{BTU}{lb_m}$$

$$= 400\frac{BTU}{lb_m}$$

Substituting Δh_{ideal}:

$$h_{out,\,real} = \frac{400\frac{BTU}{lb_m}}{0.75} + 200\ \frac{BTU}{lb_m}$$

$$h_{out,\,real} = 533.3\ \frac{BTU}{lb_m} + 200\ \frac{BTU}{lb_m}$$

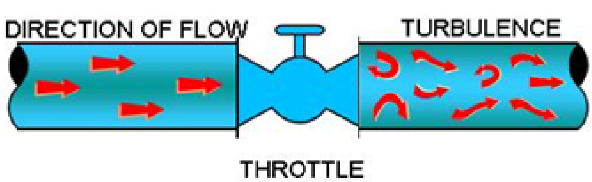
$$h_{out,\,real} = 733.3\ \frac{BTU}{lb_m}$$

5.6 THROTTLING

5.6.1 GENERAL ENERGY EQUATION ANALYSIS

Objective 29, 30

A throttling process is one in which the fluid is made to flow through a restriction (for example, a partially opened valve, or orifice, although the concept also applies to a pipe break) causing a considerable drop in the pressure of the fluid.



Q10 References

Figure 15 Throttling Process by a Valve

In performing an analysis of the throttling process, we again assume steady flow conditions ($\dot{m}_1 = \dot{m}_2$). We also select boundary locations sufficiently away from the throttling location for flow to have returned to a stable, uniform flowing condition. With these conditions, we can analyze the process as follows:

The elevation change from boundary 1 to boundary 2 is insignificant.	$PE_1 = PE_2$
Inlet piping and outlet piping diameter are equal and there is no change in fluid velocity.	$KE_1 = KE_2$
There is no work done on or done by the fluid as it flows through the throttle.	$W_{IN} = W_{OUT} = 0$
The piping is perfectly insulated so there is no heat transferred into or out of the fluid.	$Q_{IN} = Q_{OUT} = 0$

This gives us the following results for a throttling process:

$$\frac{P_1 v_1}{J} + u_1 = \frac{P_2 v_2}{J} + u_2$$

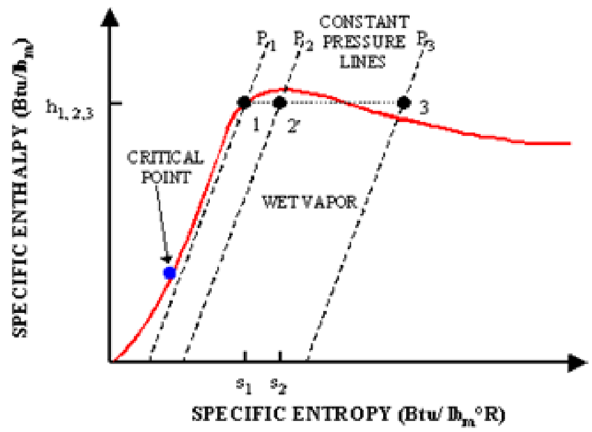
$$h_{in} = h_{out}$$

Equation 17

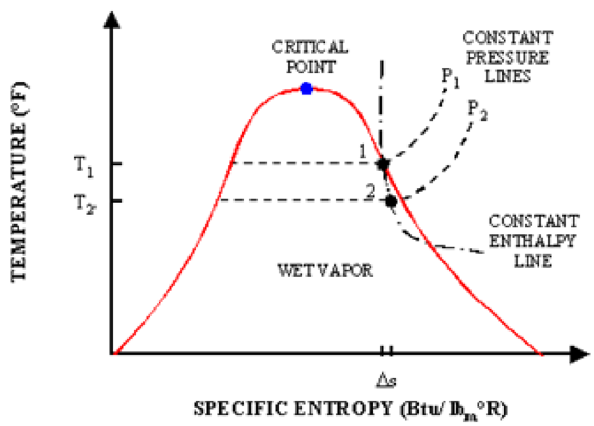
An ideal throttling process is a constant enthalpy process.

Throttling is a constant enthalpy process as shown in the T-s and h-s diagrams in Figure 16. Enthalpy remains constant while entropy increases, no work is done, and no heat is added. The result is a pressure drop and slight velocity increase.

Q10 References



(a) h-s DIAGRAM



(b) T-s DIAGRAM

Figure 16 Property Diagrams of a Throttling Process

Throttling can be beneficial, particularly in controlling flow rate to maintain desired conditions in a system. However, the nature of the process (that is, constant enthalpy) must be understood in order to recognize throttling conditions. This was a key indication that was not clearly recognized by operators during the event at Three Mile Island.

Objective 31

Throttling problems involving steam are easily solved by using a Mollier diagram. First, determine the condition upstream of the throttle (temperature, pressure, quality or superheating) and find the corresponding point on the Mollier diagram. Then determine the downstream pressure. Go from the initial condition point along a perfectly horizontal line (constant enthalpy) until the constant pressure line for the downstream pressure is reached. The final condition is established by this point (temperature, quality or superheating).

Q10 References

Example

A power-operated relief valve is stuck open at 2,200 psia in the pressurizer. The valve is discharging to the pressurizer relief tank at 25 psig. What is the temperature of the fluid downstream of the relief valve?

On the Mollier diagram, go to the 2,200-psia point on the saturation line. Cross the constant enthalpy line (throttling is a constant enthalpy process) to the 40 psia line (25 psig + 15 psi atmospheric = 40 psia). Follow that line up to the saturation curve. The constant temperature line that ends at that point on the curve establishes the temperature of the fluid. The temperature is approximately 270°F.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2009 RO NRC Retake Examination QUESTION 9 **B**

QuestionBank #	KA_system	KA_number
1809	SYS010	K6.04

KA_desc
Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: (CFR: 41.7 / 45.7)□PRT

Given the following conditions on Unit 1:

- NC system pressure is 1985 PSIG and slowly decreasing due to a leaking Pressurizer Code Safety Valve (1NC-1)
- PRT pressure is currently 65 PSIG
- Discharge temperature downstream of 1NC-1 is 310°F
- Containment pressure is currently 0.1 PSIG

Which ONE (1) of the following completes the statement below?

If the PRT rupture disc fails prematurely given the conditions above, the rate of NC system depressurization will ___(1)___ AND the temperature downstream of 1NC-1 will ___(2)___.

A. (1) increase
(2) remain the same

B. (1) increase
(2) decrease

C. (1) increase
(2) increase

D. (1) remain the same
(2) decrease

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2009 RO NRC Retake Examination QUESTION 9 **B**

General Discussion

When the PRT rupture disc fails the differential pressure across the leaking Safety Valve will increase thereby increasing the rate of leakage and the rate of depressurization. With the Safety Valve now discharging to a lower pressure (Containment atmospheric pressure), the isenthalpic throttling process will now result in a lower discharge temperature on the Safety Valve discharge line.

The KA is matched because the applicant must determine what happens to the rate of the NC system pressure decrease when the PRT rupture disc fails.

This is a comprehension level question because the applicant must evaluate a change in conditions (i.e. before and after PRT rupture disc failure) and determine the consequence to NC system leak rate and Safety Valve discharge line temperature.

Answer A Discussion

Incorrect. Part 1 is correct. Part 2 is plausible if the applicant does not comprehend that the Safety Valve is now discharging to a lower pressure when the PRT rupture disc fails.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Part 1 is correct. Part 2 is plausible if the applicant does not understand isenthalpic throttling because it is plausible to believe that an increased flowrate will result in greater heater transfer and thus and increase in temperature.

Answer D Discussion

Incorrect. Part 2 is correct. Part 1 is plausible if the applicant does not comprehend that the larger DP across the valve will result in a higher leak rate.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

☑ Developed
☑ OPT Approved
☑ OPS Approved
☑ NRC Approved

Development References	Student References Provided
Lesson Plan BNT-TH03R3 Steam Properties Objective 14 page 32 BNT-CP02R8P, Sensors and Detectors - Process Objective 16A page 46 and 47	

QuestionBank #	KA_system	KA_number
1809	SYS010	K6.04

KA_desc

Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: (CFR: 41.7 / 45.7)□PRT

401-9 Comments:

010K6.04
It's common knowledge that the Pzr relief valves discharge to the PRT. If the PRT ruptures, it will result in a lower pressure. This also is common knowledge. Therefore, distracter C is NP. Change C to increase, increase.
RFA 10/27/09

401-9 Comments RESPONSE

Per Chief Examiner's comment, changed distractor "C" answers to "increase/increase". Also, revised distractor analysis to match new answers. Also, added WOOTF question per Chief Examiner's general comments. HCF 11/02/09

SYS012 A4.06 - Reactor Protection System (RPS)
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)
Reactor trip breakers ....

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- Train 'B" SSPS testing is in progress
- Reactor Trip Bypass breaker (BYB) is racked in and closed

Based on the conditions above, a General Warning alarm for ___(1)___ train SSPS will be generated.

If Reactor Trip Bypass breaker (BYA) is racked in and closed, ___(2)___ would receive a trip open signal.

Which ONE (1) of the following completes the statements above?

A. 1. A
2. RTA, RTB, BYA, and BYB breakers

B. 1. A
2. RTA and RTB breakers <u>ONLY</u>

C. 1. B
2. RTA, RTB, BYA, and BYB breakers

D. 1. B
2. RTA and RTB breakers <u>ONLY</u>

General Discussion

Anytime a bypass breaker is racked in to the Connected Position and Closed, a General Warning alarm is generated for the associated train of SSPS. The General Warning alarm is provided to indicate a loss of protection on the train of SSPS that is in test. Racking in to the Connected Position and closing the bypass breaker on the opposite train of SSPS would produce a General Warning of both trains and cause an automatic reactor trip.

Any AUTOMATIC Reactor Trip sends a trip signal to two (2) breakers:

1.Trips the corresponding train's main reactor trip breakers by de-energizing the UV coil which in turn will energize that breaker's shunt coil as described in Note 3.

2.De-energizes the opposite train's bypass reactor trip breaker's UV coil through the SSPS.
Since the Reactor trip signal is generated on both trains all four breakers will open.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes the general warning is provided on the train NOT in test to prevent racking that breaker in.

The second part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes the general warning is provided on the train NOT in test to prevent racking that breaker in.

The second part is plausible because the applicant may conclude that only the RT breakers are tripped when two General Warning Annunciators are received.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because the applicant may conclude that only the RT breakers are tripped when two General Warning Annunciators are received.

Basis for meeting the K

KA is matched because the applicant demonstrates the ability to monitor (in the Control Room) the operation of the Reactor Trip and Bypass breakers by demonstrating the requisite knowledge related to how the Reactor Trip and Bypass breakers operate under different conditions.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

The applicant must analyze the conditions given to determine what signal specifically would cause the reactor trip and/or bypass breakers to open to determine which breakers would receive a signal to open.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-IC-IPE Section 2.5 (Reactor Trip Switchgear) Rev. 33

Student References Provided

LEARNING OBJECTIVES:
OP-MC-IC-IPE Objective 9

SYS012 A4.06 - Reactor Protection System (RPS)

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

Reactor trip breakers ....

401-9 Comments:	Remarks/Status

Q11 References

Located on the front of the breaker door cubicle is a red "TRIP" plate. Depressing this trip plate will operate a mechanical linkage to trip the breakers when closed. This linkage is redundant to the Trip Plate on the breaker itself.

Inside the cubicle, located on the breaker, are:

- *Trip Plate (red) - this plate is used to ensure that the breaker is tripped prior to engaging the breaker racking tool. This plate must be depressed to allow opening the Racking Shutter.*
- *Racking Shutter (Levering Plate) - covers the area where the racking tool is inserted. To lower this plate, you must depress the trip plate and then pull down on this plate.*
- *Springs Charged/Discharged indication window.*
- *"Push-To-Close" pushbutton.*
- *Manual Charging Lever for manual charging of springs.*
- *Test-Connect-Disconnect position indicator.*

Located in the back of the reactor trip breaker cabinet are two test pushbuttons:

- *ST Test - used to test the shunt trip coil. Depressing this pushbutton will energize the shunt trip coil and open the reactor trip breaker.*
- *UV Test - this pushbutton is used to prevent the Shunt coil from energizing during a test of the UV coil. This allows verification that the UV coil and not the ST coil caused the breaker to open.*

Position indication for the reactor trip breakers is also provided beside each of the Manual Reactor Trip switches on the main control board.

NOTE: If the Red CLOSED Light appears to be burned out, a potential breaker operability condition may exist as the Shunt Trip Coil may be inoperable. Refer to OE Item 5.8.

2.5.2 Bypass Breakers

The bypass breakers are normally racked out to the DISC (disconnect) position and thus not in the circuit. There is one bypass breaker in parallel with each reactor trip breaker, BYA for train "A" and BYB for train "B." When the bypass breaker is closed in parallel with the main reactor trip breaker, the main reactor trip breaker can be opened without causing a loss of power to the Rod Control System. This arrangement allows testing of the Reactor Protection System and reactor trip breaker operation without having to shutdown the unit.

Objective # 3

The UV coils for the train related bypass breakers are supplied from the opposite train of SSPS. Therefore BYA's UV coil is de-energized upon an automatic trip signal from "B" train of SSPS and BYB's UV coil is de-energized upon an automatic trip signal from "A" train of SSPS. This arrangement allows the train of SSPS that is "not-in-test" to trip its normal RT breaker plus the BY breaker for the other

Q11 References

train. **The bypass breakers shunt trip coils are only energized from a MANUAL reactor trip or MANUAL SI signal.**

Objective # 4

Anytime a bypass breaker is racked in to the Connected Position and Closed, a General Warning alarm is generated for the associated train of SSPS. **The General Warning alarm is provided to indicate a loss of protection on the train of SSPS that is in test.** ***Racking in to the Connected Position and closing the bypass breaker on the opposite train of SSPS would produce a General Warning of both trains and cause a reactor trip.*** *For this reason, only one bypass breaker is connected and closed at any one time.* When IAE performs testing of the SSPS and associated breakers, the opposite train's bypass breaker will be placed in the TEST position and Closed. In this alignment, the testing verifies that the SSPS signal will trip the "In-Test" train's reactor trip breaker and the "opposite" train's bypass breaker. Both bypass breakers will be closed but only one will be in the CONNECT position, therefore only one train of General Warning. *Never Connect and Close a bypass breaker when the opposite train of SSPS is in test. This will result in both train General Warnings which will produce a reactor trip.*

The bypass breaker cubicles and breakers are identical to the main breaker cubicles except that the bypass breakers have *TRIP and CLOSE pushbuttons on the front of the cubicle above the door of each breaker.* Indication of bypass breaker position is provided beside each of the Manual reactor trip switches on the main control board. The indication only functions when the breaker is in the CONNECTED position.

Operator Fundamental Focus; Control
Knowing which steps result in undesired (many times irreversible) consequences and utilizing human performance tools to ensure those steps are performed correctly are important Operator Fundamental attributes. The discussion above provides an an opportunity to ***reinforce*** *this Operator Fundamental by asking the following questions:*

- *Why is it undesirable to Connect and Close a bypass breaker when the opposite train of SSPS is in test?*
- *Their answer should include: "This will result in both train General Warnings which will produce a reactor trip."*

An annunciator in the control room alerts the operator when a bypass breaker is closed, 1AD2-C10, "RX TRIP BYP BKRS CLOSED."

2.5.3 Position Switch (W-2 Cell Switch)

Several automatic functions are initiated as a result of a P-4 / Reactor Trip Breaker Open condition. These include Turbine Trip, Steam Dump Arming, and Feedwater Isolation (coincident with Lo TAVG). The Reactor Trip Breakers contain "b"-contacts that close when the breakers open to produce the P-4 signal to initiate these automatic functions. (Note: Train "A" P-4 requires closed "b"-contacts from both RTA and BYA while Train "B" P-4 requires closed "b"-contacts from both RTB and BYB.) Should the breaker be racked-out, the P-4 signal would be lost when the circuit is broken. The

SYS013 K1.13 - Engineered Safety Features Actuation System (ESFAS)

Knowledge of the physical connections and/or cause effect relationships between the ESFAS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)

HVAC ....

Given the following conditions on Unit 1:

- A Safety Injection has occurred on the unit

Which ONE (1) of the following indicates the status of the VL (Lower Containment Ventilation) and VU (Upper Containment Ventilation) fans five (5) minutes after the Safety Injection signal?

	VL	VU
A.	Running in LOW speed	Running in MAX COOL mode
B.	Running in HIGH speed	Running in MAX COOL mode
C.	Running in LOW speed	Shunt tripped OFF
D.	Running in HIGH speed	Shunt tripped OFF

General Discussion

The VU units are shunt-tripped from the essential power system upon receipt of an SS signal and the "ON-OFF" indication on the HVAC panel is lost.

On a Safety Injection signal, the VL Units are shunt tripped off, swap to emergency power, and then start in HIGH speed.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because both VL fans would be sequenced on and running in low speed during a Blackout.

The second part is plausible because the VU fans are sequenced on during a Blackout and would be running in whatever mode was selected on the control switch for the fans.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct and therefore plausible.

The second part is plausible because the VU fans are sequenced on during a Blackout and would be running in whatever mode was selected on the control switch for the fans.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because both VL fans would be sequenced on and running in low speed during a Blackout.

The second part is correct and therefore plausible.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the cause effect relationship between ESFAS and the Containment Cooling fans due to an SI signal.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2013 MNS NRC Q11 (Bank 5242)

Development References

REFERENCES:
OP-MC-CNT-VUL Rev. 31 Section 3.2

LEARNING OBJECTIVES:
OP-MC-CNT-VUL Objective 5

Student References Provided

SYS013 K1.13 - Engineered Safety Features Actuation System (ESFAS)

Knowledge of the physical connections and/or cause effect relationships between the ESFAS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)

HVAC ....

ILT-16-1 MNS SRO NRC Examination **QUESTION 12** 12 **D**

401-9 Comments:	Remarks/Status

Q12 References

Operator Fundamental Focus; Knowledge
The following table provides a basic summary of AHU and Fan status following an emergency signal. Use this table as a means of conducting a review of system response to a Blackout and S/I with the trainees.
Refer to the appropriate sections of this lesson for more details if necessary.
***Reinforce** that this information supports an understanding of component function, operation, and interactions (knowledge) and will equip the operator with the ability to better monitor the ventilation systems for automatic response to plant events.*

	BLACKOUT (on affected bus)	SAFETY INJECTION
VL UNITS	BOTH START IN LOW SPEED. (Regardless of Switch Position)	SHUNT TRIPPED OFF, SWAPS TO EMERGENCY POWER, STARTS & RUNS IN HIGH SPEED (Regardless of Switch Position)
PIPE TUNNEL FANS	FAN STARTS AND RUNS IN LOW (Regardless of Switch Position)	SHUNT TRIPPED OFF (Control Power and Indication lost)
PZR BOOSTER FAN	THE TRAIN RELATED FAN WILL START IF SELECTED.	SHUNT TRIPPED OFF, SWAPS TO EMERGENCY POWER AND SELECTED FAN STARTS
S/G BOOSTER FANS	NOT AFFECTED IF BLACKOUT (Not on essential bus) IF LOOP THEY WILL BE OFF (No power – must be manually restarted when power restored)	NOT AFFECTED
VR FANS	BOTH START (Regardless of Switch Position)	ALL FANS SWAP TO EMERGENCY POWER AND START (Regardless of Switch Position)
VT UNITS	START (Regardless of Switch Position) (Can be swapped to "NORM" or "MAX")	ALL FANS SWAP TO EMERGENCY POWER AND START (Regardless of Switch Position) (Can be swapped to "NORM" or "MAX")
VU UNITS	BOTH START (Regardless of Switch Position) (Can be swapped to "NORM" or "MAX")	SHUNT TRIPPED OFF (Control Power and Indication lost)

Q12 Parent Question (2013 MNS NRC Exam Q11 (Bank 5242))

C

2013A MNS SRO NRC Examination QUESTION 11 11

SYS022 K2.01 - Containment Cooling System (CCS)
Knowledge of power supplies to the following: (CFR: 41.7)
Containment cooling fans ....

Given the following conditions on Unit 1:

- A Safety Injection has occurred on the unit

Which ONE (1) of the following indicates the status of the VL (Lower Containment Ventilation) and VU (Upper Containment Ventilation) fans five (5) minutes after the Safety Injection signal?

	VL	VU
A.	Running in HIGH speed	Running in MAX COOL mode
B.	Running in LOW speed	Running in MAX COOL mode
C.	Running in HIGH speed	Shunt tripped OFF
D.	Running in LOW speed	Shunt tripped OFF

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 11 11 **C**

General Discussion

The VU units are shunt-tripped from the essential power system upon receipt of an SS signal and the "ON-OFF" indication on the HVAC panel is lost.

On a Safety Injection signal, the VL Units are shunt tripped off, swap to emergency power, and then start in HIGH speed.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because the VU fans are sequenced on during a Blackout and would be running in whatever mode was selected on the control switch for the fans.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because both VL fans would be sequenced on and running in low speed during a Blackout.

The second part is plausible because the VU fans are sequenced on during a Blackout and would be running in whatever mode was selected on the control switch for the fans.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because both VL fans would be sequenced on and running in low speed during a Blackout.

The second part is correct.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the power supplies to Containment Cooling fans during emergency conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

References:
Lesson Plan OP-MC-CNT-VUL Rev. 30 Sections 2.1 and 3.2

Learning Objectives:
OP-MC-CNT-VUL Objective 5

Student References Provided

SYS022 K2.01 - Containment Cooling System (CCS)
Knowledge of power supplies to the following: (CFR: 41.7)
Containment cooling fans ....

401-9 Comments:

Remarks/Status

401-9 Comment: UNSAT

C

2013A MNS SRO NRC Examination **QUESTION 11** 11

022K2.02 Question appears to match the K/A. This appears to be a series of True/false statements. Could we put them in a situation Blackout or SI and state which fans would be running, or something similar? 2003 MNS Audit 10/22/2013

Changed question per Chief Examiner's suggestion. This makes the question a new question. HCF 10/28/13

Changes reviewed by Chief Examiner. Question approved by Chief Examiner.
HCF 11/18/13

SYS022 A4.01 - Containment Cooling System (CCS)
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)
CCS fans ....

Given the following conditions on Unit 2:

- A Large Break LOCA has occurred
- The ΔP between Lower Containment and Upper Containment is 0.3 PSID at 15 seconds into the event
- 6 minutes after the event initiation, an operator checks the status of the Containment Air Return Fans (CARFs)

Based on the conditions above,

1) the Containment Air Return Isolation dampers (RAF-D-2/4) are ________.

2) the Containment Air Return Fans are ________.

Which ONE (1) of the following correctly completes the statements above?

A. 1. CLOSED
2. OFF

B. 1. CLOSED
2. ON

C. 1. OPEN
2. OFF

D. 1. OPEN
2. ON

General Discussion

The Containment Air Return Isolation Dampers (RAF-D-2/4) are normally closed. Ten seconds after the receipt of a Hi-Hi Containment Pressure Signal (SP) signal, they get a signal to open, provided its associated D/P interlock is met and the 0.35 PSIG CPCS signal is present. When the lower compartment pressure gets less than or equal to 0.5 psi above the upper compartment, the interlock is met to allow the damper motor to energize without overloading. This interlock uses a D/P switch across the damper blade. The D/P switch is qualified for only 5 minutes in a LOCA environment, but the damper should be opened within the first minute. Once the damper opens, open limit switches operate a relay to isolate this interlock from the rest of the control circuitry. Because of this, when the operator checks the position of the damper at 6 minutes, both dampers will be OPEN. Containment Air Return Fans automatically start 10 minutes after an SP of 3 PSIG if the CPCS interlock requirements are met. Since 10 minutes has NOT elapsed since the SP Signal, these fans will be OFF.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant concludes that the CAR fan and damper both have a 10 minute time delay.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant concludes that the CARF fan and damper both have a 10 minute time delay.

The second part is plausible because the applicant may conclude that the Time Delay is 5 minutes rather than 10 minutes for Fan Start. Five minutes is the time the D/P switch is qualified for in a LOCA environment,.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct and therefore plausible.

The second part is plausible because the applicant may conclude that the Time Delay is 5 minutes rather than 10 minutes for Fan Start. Five minutes is the time the D/P switch is qualified for in a LOCA environment,.

Basis for meeting the K

The KA is matched because the applicant must demonstrate the ability to monitor CAR Fans and their isolation dampers in the control room.

Basis for Hi Cog

This is a high cognitive question since the applicant is required to analyze given conditions to determine a high-high containment pressure condition exists and then determine the effect these conditions will have on the CAR fans and dampers.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2009 MNS Audit SRO Examination AUDIT Q25 (Bank 3141)

Development References

REFERENCES:
Lesson Plan OP-MC-CNT-VX (Containment Air Return and Hydrogen Skimmer System) Rev 26

LEARNING OBJECTIVES:
OP-MC-CNT-VX Objective 4

Student References Provided

SYS022 A4.01 - Containment Cooling System (CCS)
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)

ILT-16-1 MNS SRO NRC Examination **QUESTION 13** 13 **C**

CCS fans ....

401-9 Comments:	Remarks/Status

Q13 References

Dampers in the VX system consist of air stream operated check dampers, electric motor operated isolation dampers, and pneumatically operated test dampers. The normal position for these dampers are closed.

2.0 Component Description

NOTE: For the following components, **refer to Drawing 7.1 and 7.2** , as appropriate.

2.1. Containment Air Return Fans (C.A.R.Fs)

Objective #3

Each fan has a capacity of 30,000 cfm. The discharge of the fan flows through backdraft (check) dampers and then either test dampers or an isolation damper. Through the isolation damper the fans discharge into the equipment area outside the crane wall on both sides of the refueling canal. From there, it flows along the radial walls into the fan rooms, and through ports into lower compartment. After discharge into the lower compartment, the flow, mixed with steam, goes through the ice bed, and into upper containment to start the cycle over. The fans operate continuously after actuation or cycle within the CPCS setpoints, circulating air through the containment volume. The air return fans have sufficient head to overcome the backdraft dampers and the divider barrier differential pressure (a maximum of 7.17 psf) resulting through the lower doors. The C.A.R.Fs play an important role in maintaining containment pressure low during the long transient of a LOCA by circulating air through the ice condenser and mixing/circulating the air being cooled by the Containment Spray System. Without the C.A.R.Fs operating, the natural circulation flow rate between upper to lower containment would result in a much lower air flow rate producing a lower energy removal rate and therefore a higher containment pressure.

Test results indicate the air returns to the lower compartment by natural convection without the air return fans. To assure the rapid return of air, the fans are provided. After the fan has reduced pressure, the ice condenser and Containment Spray are capable of maintaining the pressure less than 5 psig with the assumption of steam generation by residual energy until the ice bed is completely melted. If core steam generation is assumed after complete ice melt, the Containment Spray System maintains the pressure below design with the return fans circulating air through the Containment volume.

Objective #4

The Containment Air Return Fans will automatically start following a Hi Hi Containment Pressure signal 10 minutes (actual is 9 minutes ± 1 minute) after the 3.0 psig in Containment if the following interlocks are met:

1) Air Return Isolation Damper (RAF-D-2/4) is open

2) The 0.35 psig CPCS signal is present

If pressure decreases to less than 0.35 psig following an auto start, the C.A.R.F.s will stop, but the Isolation Dampers (RAF-D-2/4) will remain open. If the S_P signal has not been reset using the VX Reset Pushbutton, and the CPCS increases to 0.8 psig, the

Q13 References

2.2. Containment Air Return Back Draft Dampers (RAF-D-1/3)

A back draft damper is provided at the discharge of each C.A.R.F. It serves as a check valve and should be closed during the initial blowdown phase of a LOCA. By the time the pressures in the upper and lower compartments equalize, and the C.A.R.F.s start, the fans ought to be able to generate sufficient head to open the back draft dampers.

2.3. Containment Air Return Isolation Dampers (RAF-D-2/4)

An isolation damper is provided on the discharge of each C.A.R.F. It's normally closed. Ten seconds after the receipt of an S_P signal, it gets a signal to open, provided it's D/P interlock is met and the 0.35 psig CPCS signal is present. When the lower compartment pressure gets less than or equal to 0.5 psi **above** the upper compartment, the interlock is met to allow the damper motor to energize without overloading. This interlock uses a D/P switch across the damper blade. The D/P switch is qualified for only 5 minutes in a LOCA environment, but the damper should be opened within the first minute. Once the damper opens, open limit switches operate a relay to isolate this interlock from the rest of the control circuitry. During logic testing this interlock will be reset with the VX System reset, but not following an actual LOCA. Special action is required to restore the interlock afterwards. There is a contact from the 10 minute time delay relay that will bypass the D/P switch so that the damper will open as required by the CPCS in case the D/P switch fails. The open limit switches for the damper also feed an interlock to allow the C.A.R.F.'s to start. The Control Room HVAC Annunciator Panel 0AD11 provides alarms for 1(2)RAF-D-2 and 1(2) RAF-D-4 damper protection disabled.

2.4. Containment Air Return Bypass Test Dampers

The Bypass Test Dampers (5/6/&7 for 'A' Train, 8/9/&10 for 'B' Train) are provided to allow testing of their respective C.A.R.F.s by recirculating flow in the upper compartment. They are interlocked with the C.A.R.F. Isolation Dampers, which must be closed while running the test, to avoid opening the Ice Condenser doors.

2.5. Hydrogen Skimmer Fans

Each fan has a capacity of 3000 cfm. They take a suction from dead ended spaces in Lower Containment. A cross-connect between the suction lines help to ensure FSAR flow requirements are met. The fan suctions also contain a motor operated isolation valve and a check damper. The check damper prevents reverse flow through a failed fan. The spaces the fans take a suction on are:

* Pressurizer compartment
* Steam Generator compartments
* Reactor compartment
* Accumulator rooms
* Fan rooms
* Incore Instrumentation room

Q13 Parent Question (2009 MNS Audit Exam Q25 (Bank 3141))

Examination Outline Cross-reference:	McGuire	RO		SRO
	WEC	2		
		1		
	R	022	A4.01	
	Importance Rating	3.6		

Ability to manually operate and/or monitor in the control room: CCS fans

Proposed Question: RO Question # 25

With Unit 2 at 20% RTP a Large Break LOCA occurs.

- The difference between Lower Containment Pressure and Upper Containment Pressure is 0.3 PSID 45 seconds into the event
- 6 minutes after the event initiation, an operator is sent to verify the automatic operation of the Containment Air Return Fans (CARFs)

Which ONE (1) of the following correctly completes the statement below?

The Containment Air Return Isolation dampers (RAF-D-2/4) are ____1____, AND the CARFs are ____2____.

A.	(1) CLOSED (2) OFF
B.	(1) OPEN (2) OFF
C.	(1) CLOSED (2) ON
D.	(1) OPEN (2) ON

Proposed Answer: B

Q13 Parent Question (2009 MNS Audit Exam Q25 (Bank 3141))

Explanation (Optional):		
A.		**Incorrect.** This is plausible because the operator may believe incorrectly that both the damper and fan depend on a 10 minute timer elapsing.
B.		**Correct.** According to CNT-VX (p19, Rev 22), the Containment Air Return Isolation Dampers (RAF-D-2/4) are normally closed. Ten seconds after the receipt of a Hi-Hi Containment Pressure Signal (S_P) signal, they get a signal to open, provided its associated D/P interlock is met and the 0.35 PSIG CPCS signal is present. When the lower compartment pressure gets less than or equal to 0.5 psi above the upper compartment, the interlock is met to allow the damper motor to energize without overloading. This interlock uses a D/P switch across the damper blade. The D/P switch is qualified for only 5 minutes in a LOCA environment, but the damper should be opened within the first minute. Once the damper opens, open limit switches operate a relay to isolate this interlock from the rest of the control circuitry. Because of this, when the operator checks the position of the damper at 6 minutes, both dampers will be OPEN. According to CNT-VX, (p13, Rev 22), Containment Air Return Fans automatically start 10 minutes after an S_P of 3 PSIG if the CPCS interlock requirements are met. Since 10 minutes has NOT elapsed since the S_P Signal, these fans will be OFF.
C.		**Incorrect.** This is plausible because the operator may confuse the Isolation Dampers with the Backdraft Dampers. According to CNT-VX, (p17, Rev 22), a back draft damper is provided at the discharge of each CAR Fan that serves as a check valve and should be closed during the initial blowdown phase of a LOCA. By the time the pressures in the upper and lower compartments equalize, and the CAR Fans start, the fans ought to be able to generate sufficient head to open the back draft dampers. This means that there will be a time when the CAR Fans are running and the Backdraft dampers are closed.
D.		**Incorrect.** This is plausible because the operator may incorrectly believe that the Time Delay is 5 minutes rather than 10 minutes for Fan Start. According to CNT-VX (p19, Rev 22), the Containment Air Return Isolation Dampers (RAF-D-2/4) are normally closed and opened using a D/P Interlock. The D/P switch is qualified for only 5 minutes in a LOCA environment, but the damper should be opened within the first minute.

Q13 Parent Question (2009 MNS Audit Exam Q25 (Bank 3141))

Technical Reference(s):	CNT-VX, (p13, 17 and 19; Rev 22)	(Attach if not previously provided)

Proposed References to be provided to applicants during examination:	No

Learning Objective:	CNT-VX #3, 4	(As available)

Question Source:	Bank #	X	
	Modified Bank #		(Note changes or attach parent)
	New		

Question History:		

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

10 CFR Part 55 Content:	55.41	X
	55.43	

Comments:
The KA is matched because the operator must demonstrate the ability to monitor in the CAR Fans and their isolation dampers in the control room.

10CFR55.41.7

SYS025 K5 02 - Ice Condenser System

Knowledge of operational implications of the following concepts as they apply to the ice condenser system: (CFR: 41.5 / 45.7)

Heat transfer ....

Regarding the effect of prolonged operation with elevated Ice Condenser temperatures,

1) sublimation rates would ________.

2) if a high energy line break occurs inside Containment, peak Containment pressure would be ________.

Which ONE (1) of the following completes the statements above?

A. 1. increase
 2. higher

B. 1. increase
 2. unaffected

C. 1. decrease
 2. higher

D. 1. decrease
 2. unaffected

General Discussion

The process of sublimation is accelerated with prolonged operation with elevated Ice Condenser temperatures. This would result in a loss of ice inventory and would decrease the total heat transfer capability of the ice condenser system. This would result in an increase in the energy remaining in the containment atmosphere during a high energy line break and a corresponding increase in the peak containment pressure.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since it is common in refrigeration cycles for sublimation to be occurring at the same time as frosting. Sublimation is the process of water going directly from the solid state to water vapor and frosting is the process of water vapor in the air freezing and depositing on surfaces. Consequently, it is logical to conclude that with an increase sublimation rates (increasing the amount of water vapor in the air inside the Ice Condenser), that frosting rates would also increase by the same amount. That being the case, the net effect would be no change in the surface area in the Ice Condenser and hence no change in heat transfer capability. Since ice buildup is a potential problem in the NF AHUs (hence the reason for the AHU Defrost Cycle), it lends additional plausiblity to the concept of frosting occurring simultaneously with sublimation with a net zero effect on heat transfer capability.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may conclude that the ice would tend to melt at higher temperatures rather than sublimate.

Second part is correct and therefore plausible.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may conclude that the ice would tend to melt at higher temperatures rather than sublimate. This is in part a correct conclusion. Operating at increased Ice Condenser temperatures increases freeze/thaw cycles in the Ice Condenser and the number of freeze/thaw cycles by themselves do not affect sublimation. Sublimation is a separate issue. If they simply recall that the number of freeze/thaw cycles has increases and don't recall that sublimation has also increased, they would conclude that this is a correct answer.

Second part is plausible since it is common in refrigeration cycles for sublimation to be occurring at the same time as frosting. Sublimation is the process of water going directly from the solid state to water vapor and frosting is the process of water vapor in the air freezing and depositing on surfaces. Consequently, it is logical to conclude that with a decrease sublimation rates (decreasing the amount of water vapor in the air inside the Ice Condenser), that frosting rates would also decrease by the same amount. That being the case, the net effect would be no change in the surface area in the Ice Condenser and hence no change in heat transfer capability. Since ice buildup is a potential problem in the NF AHUs (hence the reason for the AHU Defrost Cycle), it lends additional plausiblity to the concept of frosting occurring simultaneously with sublimation with a net zero effect on heat transfer capability.

Basis for meeting the K

KA is matched because the applicant must first understand the process of sublimation (Heat transfer via changing state directly from a solid to a gas) and then understand that this would reduce the overall heat transfer capability of the ice condenser system resulting in the operational implication of a higher peak containment pressure in the event of a HELBIC.

Basis for Hi Cog

This question is high cognitive because the applicant must understand multiple concepts and then predict the impact on plant operation.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2009 MNS RO NRC Retake Examination NRC Q14 (Bank 2214)

ILT-16-1 MNS SRO NRC Examination **QUESTION 14** 14 **A**

Development References
REFERENCES: Lesson Plan OP-MC-CNT-NF (Ice Condenser) Rev 33 LEARNING OBJECTIVES: OP-MC-CNT-NF Objective 16

Student References Provided

SYS025 K5 02 - Ice Condenser System

Knowledge of operational implications of the following concepts as they apply to the ice condenser system: (CFR: 41.5 / 45.7)

Heat transfer ....

401-9 Comments:	Remarks/Status

Q14 References

Operator Fundamental Focus; Control

While discussing normal operation of the ice condenser, ***reinforce*** *the fundamental control principle of "maintain systems and parameters within established limits to ensure that systems are not operated outside of the intended design and that operating margins are not eroded.*

Operation of the NF system with elevated ice condenser temperatures increases sublimation of the ice. Operating with elevated temperatures also creates a cyclic freeze/thaw cycle which has been identified with buckling/elevating the ice condenser wear slab which in turn has resulted in cracks adjacent to the inner portal frame. The combination of elevation of the wear slab and cracks in the inner portal frame has been shown to prevent the ice condenser doors from opening or exceeding their design opening torque.

The cyclic freeze/thaw cycle identified is the movement of the frost line in the foam concrete of the ice condenser floor. This movement is caused by the increase in temperature of the lower part of the floor during power operation. In the warmer spots the frost line moves up more, and water is free to work into cracks in the concrete. When the plant cools during outages the frost line moves lower and more of the water freezes causing the ice to expand pushing the floor upward.

3.2 Abnormal and Emergency Operation

At the beginning of a LOCA, Lower containment pressure will be greater than upper containment pressure. When differential pressure is greater than 1.0 lbs/ft^2 the lower doors will open. The steam /air flow thru the ice condenser will open the intermediate and top deck doors. The ice will absorb large amounts of energy from the steam/hot air mixture as it passes through the ice condenser. This will reduce the peak pressure in containment.

Hydrogen accumulation inside containment during a LOCA presents an explosion hazard. Emergency procedure EP/1or2/A/5000/E-0 (Reactor Trip or Safety Injection) directs the operator to place the Hydrogen Igniters in operation and dispatch an operator to turn off the NF AHUs once a LOCA has been determined. The containment response to hydrogen combustion as a result of the deliberate ignition of hydrogen (Hydrogen Igniters) following core damage has been analyzed. This analysis has **not** been performed with the NF AHUs in service. Since the containment response analysis does **not** consider the impact of the operation of the NF AHUs, they should be stopped prior to the release of hydrogen in a core damage accident and prior to the operation of the igniters.

Objective #17, 18

Iodine presents a radiological problem (internal dose and dose at the site boundary in the event of containment leakage) in containment following a LOCA. By removing iodine, the radiological airborne hazard can be reduced. Some Iodine (about 80%) will be trapped in the containment sump water by hydrolysis:

$$3I_2 + 3H_2O \rightarrow 5I^- + IO_3^- + 6H^+$$

Q14 Parent Question (2009 MNS NRC RO Retake Q14 (Bank 2214))

2009 RO NRC Retake Examination **QUESTION 14** **A**

QuestionBank #	KA_system	KA_number
1814	SYS025	K5 02

KA_desc
Knowledge of operational implications of the following concepts as they apply to the ice condenser system: (CFR: 41.5 / 45.7)Heat transfer

Which ONE (1) of the following completes the statements below regarding the effect of operating with elevated Ice Condenser temperatures on the process of sublimation and the resulting operational implications should a high energy line break occur inside containment?

- Sublimation rates would __(1)__.
- Peak containment pressure would be __(2)__.

A. (1) increase
(2) higher

B. (1) increase
(2) unaffected

C. (1) decrease
(2) higher

D. (1) decrease
(2) unaffected

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2009 RO NRC Retake Examination QUESTION 14

A

General Discussion

As stated in the Ice condenser lesson plan, the process of sublimation is accelerated with prolonged operation with elevated Ice Condenser temperatures. This would result in a loss of ice inventory would decrease the total heat transfer capability of the ice condenser system. This would result in an increase in the energy remaining in the containment atmosphere during a high energy line break and a corresponding increase in the peak containment pressure.

KA is matched because the candidate must first understand the process of sublimation (Heat transfer via changing state directly from a solid to a gas). He must then understand that this would reduce the overall heat transfer capability of the ice condenser system resulting in the operational implication of a higher peak containment pressure in the event of a HELBIC.

This question is high cognitive because the understand multiple concepts and then predict the impact on plant operation.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect: See explanation above. Plausible: First part of the question is correct, second is incorrect. Should the candidate not understand the process of sublimation this could be a creditable answer.

Answer C Discussion

Incorrect: See explanation above. Plausible: It would be reasonable that the candidate would think that the ice would tend to melt at higher temps rather that sublimate. Second part is correct.

Answer D Discussion

Incorrect: See explanation above. Plausible: As described above

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- ☑ Developed
- ☑ OPT Approved
- ☑ OPS Approved
- ☑ NRC Approved

Development References	Student References Provided
Technical Reference(s): LP OP-MC-CNT-NF (Rev 31) Pg 13 & 59 Learning Objective: OP-MC-CNT-NF Obj 16	

QuestionBank #	KA_system	KA_number
1814	SYS025	K5 02

KA_desc

Knowledge of operational implications of the following concepts as they apply to the ice condenser system: (CFR: 41.5 / 45.7)□Heat transfer
....

401-9 Comments:

025K5.02
Whether the ice sublimates or melts, the result is a higher containment temperature which yields higher pressures. Factor in melting instead of pressure. KA is not affected. B2 and D2 are NP.
This Q is U due to 2 NP distracters.
RFA 10/27/09

401-9 Comments RESPONSE

Changed B2 and D2 from "lower" to "unaffected". Should add some degree of plausiblility of these distracters. Dificult K/A need to keep question is tact. Revised wording of stem to say "Which ONE (1) of the following completes the statements..."

SYS026 A2.07 - Containment Spray System (CSS)

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

Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit

---

Given the following conditions on Unit 1:

- The crew has implemented ECA-1.1 (LOSS OF EMERGENCY COOLANT RECIRCULATION)
- Both NS Pumps are off
- FWST Level is 35 inches
- Containment pressure is 2.5 PSIG and rising slowly
- (CONT SUMP LEVEL GREATER THAN 3.0 FT) is LIT on 1AD-14 and 1AD-15

Based on the conditions above, ECA-1.1 ___(1)___ direct NS to be aligned for recirc.

Aligning NS for recirc in accordance with ECA-1.1, requires ___(2)___ train(s) of NS to be aligned.

Which ONE (1) of the following completes the statements above?

A. 1. will
   2. ONLY one

B. 1. will
   2. both

C. 1. will NOT
   2. ONLY one

D. 1. will NOT
   2. both

General Discussion

Per ECA-1.1, Containment sump level must be in alarm at greater than 3.0 feet on either 1AD-14 or 1AD-15 and Containment pressure must be greater than 3.0 psig to proceed to aligning NS to recirc, otherwise the procedure will skip around this step and return to it when either alarm is lit.
Only one train of NS is aligned to recirc mode in ECA-1.1 and ES-1.3. One of the first steps when aligning asks if the opposite train pump is running. If it is, you are directed to the next step of the procedure.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the sump level requirement, in ECA-1.1, of greater than 3.0 feet is met and thus would allow alignment of NS to recirculation.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the sump level requirement, in ECA-1.1, of greater than 3.0 feet is met and thus would allow alignment of NS to recirculation.

Second part is plausible because unlike ES-1.3, the other safety pumps are all secured in ECA-1.1 and it is plausible to conclude both NS pumps aligned to the sump are needed.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because unlike ES-1.3, the other safety pumps are all secured in ECA-1.1 and it is plausible to conclude both NS pumps aligned to the sump are needed.

Basis for meeting the K

The KA is matched because the applicant is required to predict the impacts of operating the NS system with containment sump level below the required value for pump operation and how ECA-1.1 is used to control this occurrence.

Basis for Hi Cog

This question is high cog because the applicant is required to analyze the conditions in the stem, determine what effect each of these conditions will have on plant operational alignment and recall what procedural guidance is given to control this occurrence.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	ILT 2013 PreAudit 3 SRO Examination AUDIT Q56 (Bank 4986)

Development References

REFERENCES:
ECA-1.1 (Loss of Emergency Coolant Recirc) Rev 16

LEARNING OBJECTIVES:
OP-MC-EP-E1 Objective 6

Student References Provided

SYS026 A2.07 - Containment Spray System (CSS)
Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to

correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit

401-9 Comments:

Remarks/Status

Q15 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC	PAGE NO. 8 of 109 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Check criteria to align NS System for recirc:**	
__ a. Check both NS pumps - OFF.	a. **IF** both of the following conditions exist, **THEN GO TO** Step 9: __ • Any NS pump running with suction on containment sump __ • RN established to associated NS Hx.
__ b. Check at least one alarm "CONT SUMP LEVEL GREATER THAN 3 FT" on 1AD-14 or 1AD-15 - LIT.	b. Perform the following: __ 1) **WHEN** either alarm is lit, **THEN** observe Note prior to Step 8.c and perform Step 8.c. __ 2) **GO TO** Step 9.

NOTE An invalid containment orange path may briefly exist between opening NS sump valve and starting NS pump with RN established. FR-Z.1 should not be entered unless NS pump fails to start.

__ c. Align NS for recirc **PER** Enclosure 5 (NS Alignment To Containment Sump).

Q15 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC **Enclosure 5 - Page 4 of 6** **NS Alignment To Containment Sump**	PAGE NO. **72 of 109** Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. **Align A Train NS to containment sump as follows:**	
__ a. Check 1NI-185A (1A ND Pump Suction From Cont Sump Isol) - OPEN.	__ a. **GO TO** Step 7.
__ b. Check 1B NS pump - OFF.	__ b. **IF** 1B NS pump is running, **THEN GO TO** Step 8.
__ c. Check 1A RN pump - ON.	__ c. **GO TO** Step 7.
__ d. OPEN 1NS-32A (1A NS Hx Outlet Cont Outside Isol).	__ d. **GO TO** Step 7.
__ e. OPEN 1NS-29A (1A NS Hx Outlet Cont Outside Isol).	__ e. **GO TO** Step 7.
__ f. Check 1NS-20A (1A NS Pump Suction From FWST Isol) - CLOSED.	__ f. **GO TO** Step 7.
__ g. OPEN 1NS-18A (1A NS Pump Suction From Cont Sump Isol).	__ g. **GO TO** Step 7.
h. Wait up to 30 seconds for the following valves to OPEN: __ • 1NS-32A __ • 1NS-29A __ • 1NS-18A.	__ h. **IF** any valve remains closed or intermediate for over 30 seconds, **THEN GO TO** Step 7.
__ i. Start 1A NS pump.	__ i. **GO TO** Step 7.
__ j. OPEN 1RN-134A (A NS Hx Inlet Isol).	j. Perform the following: __ 1) Stop 1A NS pump. __ 2) **GO TO** Step 7.
__ k. **WHEN** 1RN-134A begins to open, **THEN** THROTTLE OPEN 1RN-137A (A NS Hx Outlet Isol) to establish 3600 GPM to 1A NS Hx.	__ k. **IF** RN flow cannot be established to 1A NS Hx, **THEN** stop 1A NS pump.

Step 6 and Step 7 indicate that only one train of NS is required

Q15 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC Enclosure 5 - Page 5 of 6 **NS Alignment To Containment Sump**	PAGE NO. 73 of 109 Rev. 16

Step 6 and Step 7 indicate that only one train of NS is required

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7. **Align B Train NS to containment sump as follows:**	
__ a. Check 1NI-184B (1B ND Pump Suction From Cont Sump Isol) - OPEN.	__ a. **GO TO** Step 8.
__ b. Check 1A NS pump - OFF.	__ b. **IF** 1A NS pump is running, **THEN GO TO** Step 8.
c. Check 1B RN pump - ON.	__ c. **GO TO** Step 8.
d. OPEN 1NS-12B (1B NS Hx Outlet Cont Outside Isol)	__ d. **GO TO** Step 8.
e. OPEN 1NS-15B (1B NS Hx Outlet Cont Outside Isol).	__ e. **GO TO** Step 8.
__ f. Check 1NS-3B (1B NS Pump Suction From FWST Isol) - CLOSED.	__ f. **GO TO** Step 8.
__ g. OPEN 1NS-1B (1B NS Pump Suction From Cont Sump Isol).	__ g. **GO TO** Step 8.
h. Wait up to 30 seconds for the following valves to OPEN: __ • 1NS-12B __ • 1NS-15B __ • 1NS-1B.	__ h. **IF** any valve remains closed or intermediate for over 30 seconds, **THEN GO TO** Step 8.
__ i. Start 1B NS pump.	__ i. **GO TO** Step 8.
__ j. OPEN 1RN-235B (B NS HX Inlet Isol).	j. Perform the following: __ 1) Stop 1B NS pump. __ 2) **GO TO** Step 8.
__ k. **WHEN** 1RN-235B begins to open, **THEN** THROTTLE OPEN 1RN-238B (B NS Hx Outlet Isol) to establish 3600 GPM to 1B NS Hx.	__ k. **IF** RN flow cannot be established to 1B NS Hx, **THEN** stop 1B NS pump.

SYS026 K2.01 - Containment Spray System (CSS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
Containment spray pumps ....

Given the following conditions on Unit 2:

- I&E has requested that the 2B Containment Spray Pump breaker be racked out for an oil change.

To which ONE (1) of the following locations should an AO be dispatched to rack out the breaker?

A. 2 ETA

B. 2 ETB

C. 2 TA

D. 2 TD

General Discussion

The 2B Containment Spray Pump is powered from emergency bus 2ETB.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because it is the correct unit and 2ETA is the supply to the 2A NS pump.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because 2TA normally supplies 2ETA which supplies the 2A NS pump.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because 2TD normally supplies 2ETB which supplies the 2B NS pump.

Basis for meeting the K

The K/A is matched because the applicant must know the power supply for the Containment Spray pumps.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Leson Plan OP-MC-ECC-NS (Containment Spray) Rev 33

LEARNING OBJECTIVES:
OP-MC-ECC-NS Objective 12

Student References Provided

SYS026 K2.01 - Containment Spray System (CSS)
Knowledge of bus power supplies to the following: (CFR: 41.7)
Containment spray pumps ....

401-9 Comments:

Remarks/Status

Q16 References

2.2. Containment Spray Pumps

Two identical containment spray pumps are installed in the Containment Spray System. Each pump is sized to deliver sufficient spray flow to the containment atmosphere through the spray heat exchangers to meet containment cooling requirements. The pumps deliver 3400 gpm to the spray headers. Pump discharge pressure is ≈200 psig.

Objective #12

The two containment spray pumps are of the vertical single stage, end-suction, side discharge centrifugal type driven by electric motors. The 400 hp, 4160 VAC, 60 cycle motors, are powered from the ETA/ETB Busses. The NS pumps have a start/stop pushbutton in the Control Room for manual operation.

Pump motors are direct-coupled and large enough for the maximum power requirement of the pump. Materials of construction suitable for use in mild boric acid solutions (such as stainless steel or equivalent corrosion resistant material) are used. The Containment Spray System is designed so that adequate net positive suction head (NPSH) is provided to the Containment Spray Pumps.

A flow element, located downstream of each Containment Spray Pump, provides indication of pump flow in the Control Room.

The NS pumps are interlocked with the Diesel Generator Load Sequencer such that the train related sequencer must be reset in order to allow the associated NS pump to start. The NS pump will be locked out because it is not an S/I or a Blackout load. This prevents the NS pump from being started while the sequencer is loading. This feature prevents the NS pump from interfering with high priority loads.

Objective #7

Each pump room has an Air Handling Unit (AHU) to provide a suitable environment for the NS Pump. The AHU starts when the pump starts or a safety injection signal is actuated. Cooling water for the AHU is provided by RN. The AHU is designed to maintain room temperature below SLC 16.9.16 requirements for pump operability.

2.3. Containment Spray Heat Exchangers

Shell and tube type heat exchangers (one per train) with the tubes welded to the tube sheet. Borated water from the lower compartment of the Containment circulates through the tubes while Nuclear Service Water circulates through the shell side. The spray heat exchangers are designed to assure adequate heat removal capacity from the water during the recirculation mode.

SYS039 2.4.1 - Main and Reheat Steam System (MRSS)

SYS039 GENERIC

Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)

Given the following conditions on Unit 1:

- Unit is at 70% RTP
- A steam leak has occurred
- The crew has implemented AP-01 (STEAM LEAK)

AP-01 directs a Reactor trip if Pressurizer level is still GOING DOWN after crew actions to: OPEN 1NV-238 (CHARGING LINE FLOW CONTROL), ___(1)___.

If the main turbine fails to trip upon Reactor trip, AND can NOT be manually tripped, the NEXT action directed by E-0 (REACTOR TRIP OR SAFETY INJECTION), is to CLOSE ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. and isolate Letdown ONLY
   2. governor valves in FAST action

B. 1. and isolate Letdown ONLY
   2. all MSIVs and MSIV Bypass Valves

C. 1. isolate Letdown AND start an additional NV pump
   2. governor valves in FAST action

D. 1. isolate Letdown AND start an additional NV pump
   2. all MSIVs and MSIV Bypass Valves

ILT-16-1 MNS SRO NRC Examination **QUESTION 17** 17 **C**

General Discussion

AP-01 (Steam Leak) will direct a Reactor trip if Pzr level is still going down with MAXIMUM charging flow. Maximum charging flow is achieved by fully opening NV-238, isolating letdown and starting an additional charging pump.
E-0 (Reactor Trip or Safety Injection) immediate actions require "checking the turbine tripped". If the answer is NO, the RNO will direct placing the turbine in Manual and closing the governor valves in fast action. If still unsuccessful, the RNO will direct closing all MSIVs and MSIV Bypass valves.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since these are two of the three actions required to maximize charging flow. However, starting an additional NV pump is also required.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since these are two of the three actions required to maximize charging flow. However, starting an additional NV pump is also required.

Second part is plausible since this is required by the immediate action RNO step to trip the main turbine. However, closing the governor valves using manual control is directed first.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since this is required by the immediate action RNO step to trip the main turbine. However, closing the governor valves using manual control is directed first.

Basis for meeting the K

The KA is matched since the applicant must have knowledge of the reactor trip requirements in the steam leak procedure (E-0 entry conditions) and the immediate actions contained in E-0 that apply to the Main Steam system.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
E-0 (Reactor Trip or Safety Injection) Rev 35
AP-01 (Steam Leak) Rev 18

LEARNING OBJECTIVES:
OP-MC-AP-01 Objective 5

Student References Provided

SYS039 2.4.1 - Main and Reheat Steam System (MRSS)
SYS039 GENERIC
Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:	Remarks/Status

Q17 References

MNS AP/1/A/5500/01 **UNIT 1**	STEAM LEAK	PAGE NO. 4 of 38 Rev. 18

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Check Pzr level - STABLE OR GOING UP.**	**Perform the following as required to maintain level:** __ a. Maintain charging flow less than 200 GPM at all times in subsequent steps. __ b. Ensure 1NV-238 (U1 Charging Hdr Control) OPENING. __ c. OPEN 1NV-241 (U1 Seal Water Inj Flow Control) while maintaining NC pump seal flow greater than 6 GPM. __ d. Reduce or isolate letdown. __ e. Start additional NV pump. __ f. <u>IF</u> Pzr level going down with maximum charging flow, **<u>THEN</u> <u>GO</u> <u>TO</u>** Step 9.
__ 7. **<u>IF</u> <u>AT</u> <u>ANY</u> <u>TIME</u> while in this procedure Pzr level cannot be maintained stable, <u>THEN</u> <u>RETURN</u> <u>TO</u> Step 6.**	
__ 8. **<u>GO</u> <u>TO</u> Step 12.**	

Q17 References

MNS EP/1/A/5000/E-0 **UNIT 1**	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. 3 of 38 Rev. 35

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor the Foldout page.**	
2. **Check Reactor Trip:**	**Perform the following:**
__ • All rod bottom lights - LIT	__ a. Trip reactor.
__ • Reactor trip and bypass breakers - OPEN	b. **IF** reactor will not trip, **THEN** perform the following:
__ • I/R power - GOING DOWN.	__ • Implement EP/1/A/5000/F-0 (Critical Safety Function Status Trees).
	__ • **GO TO** EP/1/A/5000/FR-S.1 (Response to Nuclear Power Generation/ATWS).
3. **Check Turbine Trip:**	**Perform the following:**
__ • All throttle valves - CLOSED.	__ a. Trip turbine.
	b. **IF** turbine will not trip, **THEN** perform the following:
	__ 1) Place turbine in manual.
	__ 2) CLOSE governor valves in fast action.
	3) **IF** governor valves will not close, **THEN** CLOSE the following valves:
	__ • All MSIVs
	__ • All MSIV Bypass Valves.

SYS039 K3.03 - Main and Reheat Steam System (MRSS)
Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: (CFR: 41.7 / 45.6)
AFW pumps ....

Given the following Unit 2 initial conditions:

- The Unit is at 100% RTP
- 2B MDCA Pump is tagged out

Subsequently,

- The 2B S/G Main Steam line breaks
- The 2A MDCA Pump fails to start
- E-2 (FAULTED STEAM GENERATOR ISOLATION) has been implemented

In accordance with E-2, what valve(s), if any, will be closed to isolate the steam supply to TD CA pump from 2B S/G?

COMPONENT LEGEND:

- 2SA-2 (2B S/G SM SUPPLY TO UNIT 2 TD CA PUMP TURB MAINT ISOL)
- 2SA-78 (2B S/G SM SUPPLY TO UNIT 2 TD CA PUMP TURB LOOP SEAL ISOL)
- 2SA-49AB (SM FRM S/G 2B TO TD CA PUMP ISOL)

A. Do NOT isolate steam supply to the U2 TDCA Pump from 2B S/G

B. 2SA-2 AND 2SA-78

C. 2SA-49AB ONLY

D. 2SA-2 ONLY

General Discussion

Per E-2, if the TDCA is the only source of feedwater, then ensure at least one S/G available to supply steam to TDCA pump and ensure feed flow is maintained to that S/G.
To isolate the steam supply from 2B S/G to the TDCA pump an operator is dispatched to close 2SA-2 and 2SA-78.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since neither of the MDCA pumps started and therefore the TDCA pump is the only source of feedwater available . However, a steam supply to the TDCA pump would still be available from the 2C S/G

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since the applicants may conclude that having 2SA-49AB closed provides complete isolation of steam to the U2 TDCA pump from 2B S/G.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since this is the maintenance isolation and is required to be closed. However, an additional valve is required to be closed for full isolation due to a parallel flowpath via the loop seal line.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of how a steam break on the 2B S/G would affect the operation of the U2 TDCA pump.

Basis for Hi Cog

This question is high cognitive because the applicant is required to analyze the conditions in the stem to first determine if isolating the steam supply to the TDCA pump is prudent, then recall from memory the actions required to perform the isolation.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	CNS ILT 2013 PreAudit 3 Examination (Bank 5025)

Development References

REFERENCES:
E-2 (Faulted Steam Generator Isolation) Rev10

LEARNING OBJECTIVES:
NONE

Student References Provided

SYS039 K3.03 - Main and Reheat Steam System (MRSS)
Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: (CFR: 41.7 / 45.6)
AFW pumps ....

401-9 Comments:

Remarks/Status

Q18 References

MNS EP/2/A/5000/E-2 **UNIT 2**	FAULTED STEAM GENERATOR ISOLATION	PAGE NO. 7 of 17 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. (Continued)	
__ 3) Check at least one MD CA pump - RUNNING.	3) **IF** TD CA pump is the only source of feedwater, **THEN** perform the following: __ a) Maintain at least one S/G available to supply steam to TD CA pump. __ b) Ensure feed flow is maintained to S/G being used to supply steam to TD CA pump. __ c) **IF** desired to isolate TD CA pump from 2B S/G, **THEN GO TO** Step 9.b.4). __ d) **IF** 2B S/G required for TD CA pump steam supply, **THEN GO TO** Step 9.b.6).
__ 4) CLOSE 2CA-54AC (U2 TD CA Pump Disch To 2B S/G Isol).	4) Perform the following: __ a) CLOSE 2CA-52AB (U2 TD CA Pump Disch To 2B S/G Control). __ b) Dispatch operator to CLOSE 2CA-54AC (U2 TD CA Pump Disch To 2B S/G Isol) (Unit 2 interior doghouse, 750+8, DD-60, southeast corner against inner wall). __ c) **IF** interior doghouse not accessible **OR** CA cannot be isolated, **THEN** dispatch operator to unlock and CLOSE 2CA-51 (Unit 2 TD CA Pump Disch To 2B S/G Control Inlet Isol) (Unit 2 CA pump rm, 716+10, CC-60, above aux shutdown panel).

Q18 References

MNS EP/2/A/5000/E-2 **UNIT 2**	FAULTED STEAM GENERATOR ISOLATION	PAGE NO. 8 of 17 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. (Continued)	
5) Dispatch operator to unlock and CLOSE the following valves:	
__ • 2SA-2 (2B S/G SM Supply to Unit 2 TD CA Pump Turb Maint Isol) (Unit 2 interior doghouse, 767+12, FF-59)	
__ • 2SA-78 (2B S/G SM Supply to Unit 2 TD CA Pump Turb Loop Seal Isol) (Unit 2 interior doghouse, 767+10, FF-59).	
6) Check BB valves - CLOSED:	6) Perform the following:
__ • 2BB-2B (2B S/G Blowdown Cont Outside Isol Control)	__ a) CLOSE valves.
__ • 2BB-6A (B S/G BB Cont Inside Isol).	__ b) CLOSE 2BB-124 (2B S/G Blowdown Flow Control).
__ 7) CLOSE 2SM-89 (B SM Line Drain Isol).	

Q18 Parent Question (CNS ILT 2013 Pre-Audit Exam 3 (Bank 5025) MODIFIED)

Given the following Unit 1 initial conditions:

- The Unit is at 100% power
- 1A CA Pump is tagged out

Subsequently:

- The 1C S/G Main Steam line breaks in the doghouse
- The 1B CA Pump fails to start
- E-2 (FAULTED STEAM GENERATOR ISOLATION) has been implemented

In accordance with E-2, what valve(s), if any, should be used to isolate steam supply to TD CA pump from 1C S/G?

COMPONENT LEGEND:

- 1SA-1 (1C S/G SM SUPPLY TO UNIT 1 TD CA PUMP TURB MAINT ISOL)
- 1SA-77 (1C S/G SM SUPPLY TO UNIT 1 TD CA PUMP TURB LOOP SEAL ISOL)
- 1SA-48ABC (SM FRM S/G 1C TO TD CA PUMP ISOL)

A. 1SA-1 ONLY

B. 1SA-48ABC ONLY

C. 1SA-1 AND 1SA-77

D. Do not isolate steam supply to the CA Pump #1 from 1C S/G

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 5025 MNS **C**

General Discussion

Answer A Discussion

Answer B Discussion

Answer C Discussion

Answer D Discussion

Basis for meeting the KA

The KA is matched because the applicant must have knowledge of local operator actions outside of the control room to be able to coordinate those activities.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered by knowing systems knowledge alone. This is detailed procedure content knowledge from AP-40 and AP-41.
2) The question can NOT be answered by knowing immediate Operator actions. There are no immediate operator actions associated with AP-40 or AP-41.
3) The question can NOT be answered by knowing AOP or EOP entry conditions. Knowledge of AP-40 entry conditions will not enable the applicant to correctly answer this question.
4) The question can NOT be answered by knowing the purpose, overall sequence of events, or overall mitigative strategy of AP-40 or AP-41.
5) The question requires the applicant to assess plant conditions and then prescribing a procedure or section of a procedure to mitigate the consequences of the event. Specific to this event, initial entry would be into AP-41 (Loss of SFP Cooling or Level). However, since 1KF-122 is open the operator is directed out of AP-41 and into AP-40 (Loss of Refueling Canal Level) where they are directed to perform the appropriate actions.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	MNS Exam Bank Question FHFCN014

Development References
Learning Objective: 1) References: 1) Lesson Plan OP-MC-FH-FC Section 3.2.2 2) AP-40

Student References Provided

KA	KA_desc
APE040 AK3.04	Knowledge of the reasons for the following responses as they apply to the Steam Line Rupture: (CFR 41.5,41.10 / 45.6 / 45.13)Actions contained in EOPs for steam line rupture ....
KA	**KA_desc**
APE040 AK2.01	Knowledge of the interrelations between the Steam Line Rupture and the following: (CFR 41.7 / 45.7)Valves ....
KA	**KA_desc**
APE040 AA1.03	Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: (CFR 41.7 / 45.5 / 45.6)Isolation of one steam line from header ....

Q18 Parent Question (CNS ILT 2013 Pre-Audit Exam 3 (Bank 5025) MODIFIED)

EXAM BANK QUESTION: 5025 MNS **C**

KA	KA_desc
APE040 AA1.10	Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: (CFR 41.7 / 45.5 / 45.6)AFW system ....
KA	**KA_desc**
GEN2.1 2.1.8	Conduct of OperationsAbility to coordinate personnel activities outside the control room. (CFR: 41.10 / 45.5 / 45.12 / 45.13)

SYS059 K4.08 - Main Feedwater (MFW) System

Knowledge of MFW design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

Feedwater regulatory valve operation (on basis of steam flow, feed flow mismatch) ....

Given the following conditions on Unit 1:

- The unit is at 12% RTP
- Power increase is in progress

DCS will maintain S/G Level Control for each S/G in the LO Power mode until a MAXIMUM Selected CF Flow of ____(1)___ is reached on each S/G.

With DCS in the LO Power mode, the CF Control Valves will start to OPEN when the CF Control Bypass Valves demand signal reaches a MINIMUM of ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. 13%
   2. 65%

B. 1. 13%
   2. 75%

C. 1. 18%
   2. 65%

D. 1. 18%
   2. 75%

General Discussion

As the plant increases power, CF flow will increase. When an individual S/G's Selected CF flow reaches 18%, DCS will swap to the HI Power mode of operation for that individual S/G's Level Control.

DCS provides programming to the CF Control Valves and the CF Control Bypass Valves. The plant is started up using the CF Control Bypass Valves with DCS in the LO Power mode of operation. The CF Control Valves Start to open when the CF Control Bypass Valve demand signal reaches 65%. The CF Control Bypass Valves close a proportional amount, to maintain Steam Generator Level stable

Answer A Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
Part 1 is plausible because this is the correct number for DCS selecting the LO power mode on a unit down power.

Part 2 is correct and therefore plausible.

Answer B Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
Part 1 is plausible because this is the correct number for DCS selecting the LO power mode on a unit down power.

Part 2 is plausible because this is the correct value for percent steam flow that DCS will send a signal to the CF control bypass valves to ramp closed on a unit down power.

Answer C Discussion

CORRECT. See explanation above.

Answer D Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
Part 1 is correct and therefore plausible.

Part 2 is plausible because this is the correct value for percent steam flow that DCS will send a signal to the CF control bypass valves to ramp closed on a unit down power.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the design features of DCS that provide for operation of the Feed Control and Feed Control Bypass valves during Lo and Hi power modes (Based on individual S/G feed flow and steam flow mismatch).

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-CF-IFC Section 2.3.3. Rev 6

LEARNING OBJECTIVES:
OP-MC-CF-IFC Objectives 6 & 7

Student References Provided

SYS059 K4.08 - Main Feedwater (MFW) System
Knowledge of MFW design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
Feedwater regulatory valve operation (on basis of steam flow, feed flow mismatch) ....

401-9 Comments:	Remarks/Status

Q19 References

The S/G "A" (B, C, D) Total Feedwater Flow Demand signal will be used to adjust the position of the feedwater control valves in order to control the feedwater flow to the steam generator.

The S/G "A" (B, C, D) Total Flow Demand output of the level controller represents the flow mismatch required to bring the level back to the setpoint. The S/G "A" (B, C, D) Total Feedwater Flow Demand signal sent (via the R-Line RLI) to the valve positioner to adjust flow to bring level back to setpoint. (If the level is too high, the feedwater flow must be reduced and if level is too low, feedwater flow must be increased).

Objective #6, #7, & #13

2.3.3 Automatic Feedwater Control

DCS provides programming to the CF Control Valves and the CF Control Bypass Valves. The plant is started up using the CF Control Bypass Valves with DCS in the LO Power mode of operation. The CF Control Valves Start to open when the CF Control Bypass Valve demand signal reaches 65%. The CF Control Bypass Valves close a proportional amount, to maintain Steam Generator Level stable.

As the plant increases power, CF flow will increase. When an individual S/G's Selected CF flow reaches 18%, DCS will swap to the HI Power mode of operation for that individual S/G's Level Control. Once CF flow is >8000 gpm the Main Feedwater Pump Recirc Valve should have automatically Closed.

Steam Flow is used as a control input to start the process to Close the CF Control Bypass Valves. At 30% Selected Steam Flow (the average of the specific S/G steam flow input signals) the DCS inserts a 0% demand signal to the bypass valves but ramps them full closed with a ramp time of approximately two minutes. As the CF Control Bypass Valves close the CF Control Valves signal compensates and increases the flow demand proportionally to maintain level stable. At 50% - 55% Rated Thermal Power the second CF Feedwater Pump will be placed in service by the operator. Power will continue to be increased until the plant reaches 85% Steam Flow. At 85% Steam Flow DCS inserts a 100% demand signal to the CF Control Bypass Valves and will ramp full open with a ramp time of approximately two minutes with the CF Control Valves signal compensating for the increase in flow through the CF Control Bypass Valve Flow Path.

With Power at 100% and the plant being shut down, the CF Control Valves are open and controlling Steam Generator Level with the CF Control Bypass Valves full Open in Auto. As plant power is reduced and the plant reaches 75% Steam Flow, DCS send a 0% demand signal to the CF Control Bypass Valves and ramps them closed with a ramp time of approximately two minutes. As the CF Control Bypass Valves close, the CF Control Valves open more to control Steam Generator Level, which also keeps them above the 25% Open setpoint to avoid an AMSAC actuation.

When the plant power is reduced to where Steam Flow is 25%, DCS inserts a signal that allows the CF Control Bypass Valves to begin opening and to ramp to the Total Flow Demand position.

As plant power continues to decrease the individual CF Feedwater Pump Recirc valve will begin to open when the individual CF Feedwater Pump Suction flow drops <8000

SYS061 K5.03 - Auxiliary / Emergency Feedwater (AFW) System

Knowledge of the operational implications of the following concepts as the apply to the AFW: (CFR: 41.5 / 45.7)

Pump head effects when control valve is shut ....

Given the following conditions on Unit 1:

- A Reactor trip has occurred
- 1A and 1B MDCA pumps are running
- 1A and 1B MDCA pump Discharge Flow Control valves are in MANUAL controlling S/G NR levels at program

1) If 1B MDCA pump Discharge Flow Control valves are closed, minimum flow protection will be provided by __________.

2) The 1B MDCA pump recirculation flow path will be to the __________.

Which ONE (1) of the following completes the statements above?

A. 1. recirculation orifices
   2. Upper Surge Tank

B. 1. recirculation orifices
   2. Auxiliary Feedwater Storage Tank (CAST)

C. 1. an automatic recirculation control valve
   2. Upper Surge Tank

D. 1. an automatic recirculation control valve
   2. Auxiliary Feedwater Storage Tank (CAST)

General Discussion

The Auxiliary Feedwater (CA) Automatic Recirculation Valves (ARV), CA22, CA26 and CA31, provide an assured minimum pump flow path. These valves are self-modulating, 3-way valves that function without instrument air or electrical power. Operation of the recirc valves is based on the discharge pressure (discharge head) of the pump increasing to a specfic value (i.e. when the Discharge Flow Control valves are closed).

All three CA pumps share a common recirc line back to the Auxiliary Feedwater Storage Tank (CAST).

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since each recirc line has an orifice downstream of the ARV that functions to provide DP, which actuates a switch to provide Flow/NO Flow indication in the C/R.

Second part is plausible since the Auxiliary Feedwater Storage Tank (CAST) is supplied from the Hotwell pump discharge header and the UST provides makeup flow to the Hotwell.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since each recirc line has an orifice downstream of the ARV that functions to provide DP, which actuates a switch to provide Flow/NO Flow indication in the C/R.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible..

Second part is plausible since the Auxiliary Feedwater Storage Tank (CAST) is supplied from the Hotwell pump discharge header and the UST provides makeup flow to the Hotwell.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched since the applicant is required to have knowledge of the effects of a closed control valve and how the automatic recirc valves respond to protect the MDCA pump (operational implication). Operation of the ARVs is based on the discharge pressure (discharge head) of the pump increasing to a specfic value (i.e. when the Discharge Flow Control valves are closed).

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-CF-CA (Auxiliary Feedwater) Rev 51

LEARNING OBJECTIVES:
OP-MC-CF-CA Objective 9

Student References Provided

SYS061 K5.03 - Auxiliary / Emergency Feedwater (AFW) System
Knowledge of the operational implications of the following concepts as the apply to the AFW: (CFR: 41.5 / 45.7)
Pump head effects when control valve is shut ....

401-9 Comments:	Remarks/Status

Q20 References

The CAST has the following features:

- 300,000 gallon capacity
- Supply line from the hotwell pump discharge header to the tank
- Overflow line to the Condensate Storage Tank (CST)
- Recirculation line from the CA pumps to the CAST
- Supply line for the nitrogen sparger
- Three local level indicators
- Two channels of control room level instrumentation
- Temperature sensors that alarm in the control room via the OAC
- Sample line from the CAST to the CT Lab

Objective # 4

The 16" header doubles as the supply line to the tank and a discharge line to the CA pumps. The CAST is supplied with condensate grade water from the hotwell. A 3" supply line from the hotwell pumps' discharge connects into the 16" header. The supply line is used as a continuous 100-150 gpm make-up to the tank for maintaining water chemistry. The continuous make-up requires a 6" overflow line from the CAST Tank to the CST.

Operator Fundamental Focus; Monitoring
Track degraded and inoperable technical specification and other equipment important to safe and reliable plant operations.

Downstream of the hotwell discharge connection the 16" header reduces to an 8" line that supplies the CA Pumps. CA-2 is a normally open electric motor operated valve located between the CAST and the CA pumps on the 8" line. This valve is required to be open with the electric motor operator de-energized during Modes 1 through 4 where the steam generators are relied upon for heat removal per Technical Specifications. This measure prevents the loss of all condensate sources due to the possible spurious signals that may result from an event, such as a fire in the turbine building.

If CA-2 is closed or the electric motor operator is energized, then all three auxiliary feedwater pumps shall be declared inoperable. An option to align to another condensate source (i.e., Upper Surge Tanks or Aux. Feedwater Condensate Storage Tanks) with the power to the associated isolation valves removed is acceptable to ensure all three CA pumps are operable.

The Regulatory 1.47 Bypass indication alarms upon CAST trouble:

- CA-2 in the intermediate or closed position, or
- Auxiliary Feedwater Storage Tank low level exits.

Q20 References

2.8 CA Pump Recirculation and Minimum Flow

2.8.1 Auxiliary Feedwater Automatic Recirculation Valves

Objective # 9

The Auxiliary Feedwater (CA) Automatic Recirculation Valves (ARV), CA22, CA26 and CA31, provide an assured minimum pump flow path. These valves are self-modulating, 3-way valves that function without instrument air or electrical power. These valves are capable of functioning during all fire related events.

The ARV operates as a combined check valve and globe valve with the globe valve port providing an assured flow path to prevent deadheading conditions on the pump. The Check valve port is the main discharge flow path and is operated in the same manner as the previous discharge check valve. The ARV valve is designed such that the globe port closes as the check port opens assuring a continuous discharge path for the pump and automatically eliminating recirculation flow as sufficient normal discharge flow is established. This flowpath ensures that either the normal discharge flowpath or the recirculation flowpath is always available.

The operation of the ARV is such that when the pump is off, the "check valve" of the ARV is closed to prevent reverse flow, with the "side outlet" of the ARV open. The design specifications of each ARV is such that, when the associated pump is started with the main flow path isolated (all associated pump Steam Generator isolations closed, for example), the required minimum flow passes through the "side outlet" to the recirc line.

As a normal flowpath is established with the fraction of total pump flow to a Steam Generator increasing, the fraction of flow through the "side outlet" recirc decreases correspondingly, so that when the total flow through the normal flowpath equals or exceeds the required minimum pump flow, the "side outlet" flow is reduced to zero.

So, for the Motor Driven CA Pumps, the flow through the new recirc path will range from 200 gpm to 0 gpm and the flow through the new recirc path for the Turbine Driven CA Pump will range from 360 gpm to 0 gpm.

Control Board indication for each CA pump minimum flow status consists of lighted lenses for:

"FLOW" (red)

and

"NO FLOW" (green)

Q20 References

An orifice downstream of each ARV provides DP which actuates a switch when flow corresponding to 20% of pump required minimum flow passes through the associated "side outlet" recirc flowpath.

When Motor Driven recirc flow exceeds 40 gpm, the red "FLOW" light will illuminate and the green "NO FLOW" light will extinguish. When Turbine Driven recirc flow exceeds 72 gpm, the red "FLOW" light will illuminate and the green "NO FLOW" light will extinguish.

Objective # 9

Pump "runout" protection is provided by the Maximum Flow Travel Stops on the discharge control valves.

2.8.2 CA Pump Assured Recirculation Flowpath

Objective # 9

It was determined that because all three CA pumps share a common recirc line back to the Auxiliary Feedwater Storage Tank (CAST), there exists a vulnerability to lose the recirculation flowpath during tornado or seismic events which damage the CA system piping in the Service and Turbine Buildings and in the Yard area. This could potentially compromise the minimum flow protection for the pumps. To prevent this, a modification was made to the CA system to install additional piping and individual rupture discs for each pump that discharge to the Turbine Building basement. The rupture discs are designed to rupture at a pressure of 275 psid.

2.9 Instrumentation and Controls

2.9.1 CA System Automatic Operations

2.9.1.1 MD CA Pump Auto Starts

Objective # 10

The auto-start signals for the CA Motor Driven pumps are: (Refer to Figure 7.13.)

- 2/4 detectors low-low level in any one SG (17%)
- Trip of both Main Feedwater pumps
- SS signal
- Blackout signal
- AMSAC
  1. Both Feedwater pumps tripped
  2. Loss of flow to 3/4 SGs

SYS062 A3.01 - AC Electrical Distribution System

Ability to monitor automatic operation of the ac distribution system, including: (CFR: 41.7 / 45.5)

Vital ac bus amperage ....

Given the following conditions on Unit 1:

- 1ETA Normal incoming breaker has opened
- 1A D/G started and loaded
- While monitoring D/G parameters, the crew notes that D/G 1A "VOLTS" is at 4000 V

When D/G 1A voltage is adjusted to NORMAL, how will 1A D/G Amps AND Power Factor indications respond to this adjustment?

	AMPS	Power Factor
A.	decrease	more lagging
B.	decrease	stay the same
C.	increase	more lagging
D.	increase	stay the same

General Discussion

The applicants must understand that the D/G is not in parallel with the grid and that voltage must be adjusted UP. When voltage is increased, D/G /ETA amps will decrease. This has no effect on Power Factor.
This is OE from an AO who was attempting to control power factor while operating in the isochronous mode.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because if the D/G was operating parallel to the grid this would be correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since voltage needs to be increased and applicant may conclude that amps will increase if voltage and current relationship is misunderstood.

Second part is plausible because if the D/G was operating parallel to the grid this would be correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since voltage needs to be increased and applicant may conclude that amps will increase if voltage and current relationship is misunderstood.

Second part is correct and therefore plausible.

Basis for meeting the K

The K/A is matched because the applicant must determine D/G voltage is low by monitoring operation of the D/G after an automatic start. Then monitor D/G / ETA bus voltage and D/G power factor as adjustments are made to correct the low voltage condition.

Basis for Hi Cog

This question is high cognitive because the applicant must know what normal voltage is and apply it to this situation to determine which way to adjust voltage AND must understand how the change in voltage affects current and power factor in the isochronous mode.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2008 CNS RO NRC Retake Examination NRC Q47 (Bank 1747)

Development References

REFERENCES:
Lesson Plan OP-MC-DG-DG (Standby Diesel Generator) Rev 30D

LEARNING OBJECTIVES:
OP-MC-DG-DG Objectives 7 & 8

Student References Provided

SYS062 A3.01 - AC Electrical Distribution System
Ability to monitor automatic operation of the ac distribution system, including: (CFR: 41.7 / 45.5)
Vital ac bus amperage ....

401-9 Comments:

Remarks/Status

Q21 References

indicates that the droop permissive is available and the droop contact on the diesel generator feeder breaker is closed.

Objective # 7, 8

The diesel generator control circuit will place the Governor and Voltage Regulator in the Droop Mode if all of the following conditions are true:

- **Either the 4160 Volt Bus Normal or Standby breaker is closed**
- **The Diesel Generator Output Breaker is closed**
- **The Diesel Generator start relay is energized**

While in the Droop mode, (with the D/G tied to the power grid), adjusting the "Gov Cntrl" pushbutton changes KW (load), but does NOT affect FREQUENCY (D/G speed). Adjusting the ""Volt Adjust" switch changes Power Factor and KVars, but does NOT affect VOLTAGE.

The diesel generator control circuit will place the Governor and Voltage Regulator in the Isochronous Mode if all of the following conditions are true:

- **The 4160 Volt Bus Normal and Standby breakers are open,**
- **The Diesel Generator Output Breaker is closed, and**
- **The Diesel Generator start relay is energized**

While in the Isochronous mode, (with the D/G separated from the power grid), adjusting the "Gov Cntrl" pushbutton changes FREQUENCY (D/G speed), but does NOT affect load (KW). Adjusting the ""Volt Adjust" switch changes VOLTAGE, but does NOT affect Power Factor or KVars.

Operator Fundamental Focus; Control

Operators must anticipate the impact of component operation prior to its operation and then verify that the expected effects occur during and following the operation.

***Ensure** operators understand the following:*

While in the Droop mode, (with the D/G tied to the power grid), adjusting the "Gov Cntrl" pushbutton changes KW (load), but does NOT affect FREQUENCY (D/G speed). Adjusting the ""Volt Adjust" switch changes Power Factor and KVars, but does NOT affect VOLTAGE.

While in the Isochronous mode, (with the D/G separated from the power grid), adjusting the "Gov Cntrl" pushbutton changes FREQUENCY (D/G speed), but does NOT affect load (KW). Adjusting the ""Volt Adjust" switch changes VOLTAGE, but does NOT affect Power Factor or KVars.

Q21 Parent Question (2008 CNS NRC RO Retake Q47 (Bank 1747))

EXAM BANK QUESTION: **1747** **CNS**

D

Given the following:

- The incoming breaker to 1ETB spuriously opened
- 1B D/G automatically started and loaded
- While monitoring D/G operating parameters, the crew noted that D/G 1B "VOLTS" was 4000 V
- Voltage was adjusted to normal

How did 1B D/G output "AMPS" and "P/F" indications respond to this adjustment?

	AMPS	P/F
A.	increase	more lagging
B.	increase	stay the same
C.	decrease	more lagging
D.	decrease	stay the same

Q21 Parent Question (2008 CNS NRC RO Retake Q47 (Bank 1747))

EXAM BANK QUESTION: 1747 CNS **D**

General Discussion

Students must understand that the D/G is not in parallel and that voltage must be adjusted UP. When voltage is increased, D/G /ETA amps decrease. This has no effect on Power Factor. This is OE from an NLO who was attempting to control power factor while operating in the isochronous mode.

Answer A Discussion

Voltage needs to be increased. Amps increasing is plausible if voltage and current relationship is misunderstood.
More lagging is plausible because if the D/G was operating parallel to the grid this would be correct.

Answer B Discussion

Voltage needs to be increased. Amps increasing is plausible if voltage and current relationship is misunderstood.
Power factor will be unaffected

Answer C Discussion

Amps will decrease as voltage is increased.
More lagging is plausible because if the D/G was operating parallel to the grid this would be correct.

Answer D Discussion

Correct: Amps will decrease as voltage is increased and power factor is will stay the same because it is unaffected in the isochronous mode.

Basis for meeting the KA

The K/A is met because the student is monitoring operation of the D/G after an automatic start. The question goes on to question the manual actions necessary to control voltage once the monitoring notes that a parameter is out of the normal range. The parameter being monitored is the amperage of the vital bus that the D/G is carrying.

Basis for Hi Cog

High cog because the student must know what normal voltage is and appy it to this situation to determine which way to adjust voltage AND must understand how the change in voltage affects current and how power factor is affected (in this case no affect) in the isochronous mode.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2008 NRC Q47 (Bank 553)

Development References
DG3 lesson

Student References Provided

KA	KA_desc
SYS062 A3.01	Ability to monitor automatic operation of the ac distribution system, including: (CFR: 41.7 / 45.5)Vital ac bus amperage

SYS063 A3.01 - DC Electrical Distribution System

Ability to monitor automatic operation of the DC electrical system, including: (CFR: 41.7 / 45.5)

Meters, annunciators, dials, recorders, and indicating lights ....

Given the following conditions on Unit 2:

- A Loss of Offsite Power has occurred
- 2B D/G started but subsequently tripped on overspeed
- 60 seconds have passed since the Loss of Offsite Power occurred

Based on the conditions above,

1) 125 VDC Power Panel Board 2EVDD will be energized from ________.

2) this can be verified by checking control power available to 4160V pumps powered from ________.

Which ONE (1) of the following completes the statements above?

A. 1. Battery EVCD
   2. 2ETA

B. 1. Battery EVCD
   2. 2ETB

C. 1. Standby Charger EVCS
   2. 2ETA

D. 1. Standby Charger EVCS
   2. 2ETB

General Discussion

During a blackout or LOOP event, the essential motor control centers feeding the vital I & C battery chargers associated with the affected train, will be load-shed by the diesel generator loading sequencer. Normally the battery chargers would be reloaded but in the scenario given the associated D/G has tripped and is not available. During the time period that the battery chargers are de-energized, the batteries alone feed the vital instrumentation and control loads. In this case it would be Battery EVCD feeding power panel board 2EVDD.
Normal alignment of the vital busses is for Unit 1 to power battery chargers EVCA and EVCB and Unit 2 to power battery chargers EVCC and EVCD.
EVDA and EVDD supply control power to ETA and ETB respectively.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since this would be correct if verifying 125VDC power panel board 2EVDA was energized.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since other busses in the vital and aux power systems will automatically swap to a standby source upon loss of normal power. This alignment can be made but all actions are performed manually.

Second part is plausible since this would be correct if verifying 125VDC power panel board 2EVDA was energized.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since other busses in the vital and aux power systems will automatically swap to a standby source upon loss of normal power. This alignment can be made but all actions are performed manually.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant must demonstrate the ability to monitor operation of the DC electrical system as it applies to a LOOP with the failure of one emergency D/G and use alternate indications to prove the DC bus is energized.

Basis for Hi Cog

This is a high cognitive question because it involves a level of analysis of the given stem conditions to determine the effect it will have on the DC electrical distribution system.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-EL-EPL (125 VDC (EPL) and 120 VAC (EPG) VITAL I & C POWER) Rev 26C

OBJECTIVES: OP-MC-EL-EPL Obj: 20

Student References Provided

SYS063 A3.01 - DC Electrical Distribution System
Ability to monitor automatic operation of the DC electrical system, including: (CFR: 41.7 / 45.5)
Meters, annunciators, dials, recorders, and indicating lights ....

401-9 Comments:	Remarks/Status

Q22 References

1.0 INTRODUCTION

1.1. Purpose

Objective # 1

The 125 VDC and 120 VAC Vital Instrumentation and Control Power System provides a reliable source of continuous power for the safety related controls and instrumentation required for plant start up, normal operation, and an orderly shutdown of each unit.

1.2. General Description

125 VDC Vital Instrumentation and Control Power System

Objective # 3

The 125 VDC Vital Instrumentation and Control Power System consists of five chargers, four 125 VDC batteries, four distribution centers (with associated breakers), and eight separate panelboards. The system is designed to support a manual connection of two distribution centers (either EVDA and EVDC or EVDB and EVDD) during periods of battery maintenance.

The DC System is divided into four independent and physically separated load groups. With each load group comprised of the following: one battery, one battery charger, one DC distribution center, and two DC power panelboards.

This system is shared between the two units (Unit 1 and 2) and provides four normally independent power channels for reactor control and instrumentation. Three of the four channels will ensure that the overall system functional capability is maintained, comparable to the original design standards for safe operation. However, a loss of any two of these channel sources will result in a shutdown of both units (Unit 1 and 2).

Objective # 4

Operator Fundamental Focus; Knowledge
Explain *to the class that knowing the loads that are powered from these systems will aid in understanding how a loss of these systems will affect Integrated Plant operations.*

The following is a list of typical loads powered from the 125 VDC Vital Instrumentation and Control Power System Distribution Centers (EVDA, EVDB, EVDC, and EVDD):

- Auxiliary Safeguards Cabinets Control Power
- Turbine Trip
- ETA and ETB Control Power
- Diesel Generator Sequencers Control Power
- Miscellaneous NV System Solenoids
- Pressurizer PORV Solenoids
- Reactor Trip Switchgear Control Power
- 600 V Load Centers ELXA, ELXB, ELXC, and ELXD Control Power
- Power supplies to the Reactor Vessel Head Vents

Q22 References

Objective # 12

Each battery is sized to supply the continuous emergency loads and momentary loads fed from its distribution center **(two DC buses which includes the two inverters and their panelboards)**, plus supply the loads of its sister distribution center **(two DC buses which includes the two inverters and their panelboards)**, if required, for a period of one hour. The basis for selecting a one-hour capacity is a conservative time estimate for the restoration of power to the battery chargers under the most adverse credible conditions. This one-hour duty cycle capacity was assumed during the plant's safety analysis (documented in the UFSAR) and is verified every 18 months during a battery service test.

Operator Fundamental Focus; Knowledge
Reinforce *the need to understand the design criteria and basis for system operation. The students' understanding of the loads on the battery and the reason for the one-hour capacity will reinforce the urgency to restore power to the battery prior to the time limit.*

The minimum design ambient temperature in the battery room is 60 °F; hence the battery is sized based on its capacity at 60° F since the battery capacity would be greater at a higher temperature.

Since each battery is, electrically, in parallel with its battery charger, and the battery charger output voltage is slightly higher than the battery voltage during the "floating charge", the battery charger actually supplies power to the respective DC loads during normal operation. However, the battery will automatically assume those DC loads, without interruption, upon loss of its respective battery charger or AC power source.

Battery bus voltage is indicated by voltmeters located on the 125 VDC vital control distribution centers. The battery bus voltage is also monitored by under-voltage relays, which alarm on CR Annunciator Alarm Panel 1AD-11 when the battery bus voltage reaches 127 volts (at this voltage the battery is still capable of performing its intended safety function).

2.3 125 VDC Vital Instrumentation and Control Power System Distribution Centers

Each of the four distribution centers (EVDA, EVDB, EVDC, and EVDD) receive power from a battery and/or a battery charger, and supplies power to two of the eight 125 VDC power panelboards (1EVDA, 1EVDB, 1EVDC, 1EVDD, 2EVDA, 2EVDB, 2EVDC, and 2EVDD), and two of the eight static inverters (1EVIA, 1EVIB, 1EVIC, 1EVID, 2EVIA, 2EVIB, 2EVIC, and 2EVID).

Objective # 13

Either of the two same train-related buses (EVDA and EVDC / Train "A" buses or EVDB and EVDD / Train "B" buses) can be tied together through their respective bus tie breakers. This will allow two distribution centers to be fed from one battery / battery charger combination.

This system is shared between the two units (Unit 1 and 2) and provides four normally independent power channels for reactor control and instrumentation. Three of the four channels will ensure that the overall system functional capability is maintained,

SYS063 K4.02 - DC Electrical Distribution System
Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
Breaker interlocks, permissives, bypasses and cross-ties. ....

Given the following conditions:

- Inverter KXB has experienced an overcurrent condition

Based on the conditions above,

1) an indication used to determine that the backup power supply has been aligned is the ________ light LIT.

2) when Inverter KXB overcurrent condition clears, the normal power supply ________ be automatically realigned.

Which ONE (1) of the following completes the statements above?

A. 1. "In Sync"
   2. will NOT

B. 1. "In Sync"
   2. will

C. 1. "Alternate Source Supplying Load"
   2. will NOT

D. 1. "Alternate Source Supplying Load"
   2. will

General Discussion

The operating procedure specifies that the "Alternate Source Supplying Load" light is to be verified ON as part of the Shutdown and Return to Service procedure. System design is such that once the transfer switch has auto swapped to an alternate source, a 30 second relay is activated. If the transfer was due to inverter overcurrent, inverter failure or inverter undervoltage, the switch will automatically transfer back to the inverter when the conditions have cleared and remained stable for 30 seconds.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the In Sync light indicates that both sources are energized and in sync, but doesn’t indicate which is aligned to supply the load.

Second part is plausible since a manual swap back to inverter supplying load is possible and proceduralized but not needed in this case, since the automatic transfer will occur first.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the In Sync light indicates that both sources are energized and in sync, but doesn’t indicate which is aligned to supply the load.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since a manual swap back to inverter supplying load is possible and proceduralized but not needed in this case, since the automatic transfer will occur first.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because stem conditions involve an inverter operation and it requires knowledge of interlocks and cross-ties (from alternate power source) to correctly answer the question.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS Bank # 4301

Development References

REFERENCES:
Lesson Plan OP-MC-EL-EPK (125 VDC and 240/120 VAC AUXILIARY CONTROL POWER) Rev 29A

LEARNING OBJECTIVES:
OP-MC-EL-EPK Objective 16

Student References Provided

SYS063 K4.02 - DC Electrical Distribution System
Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
Breaker interlocks, permissives, bypasses and cross-ties. ....

401-9 Comments:	Remarks/Status

Objective # 14

125 VDC Auxiliary Control Power Distribution Centers, DCA and DCB, can be tied together through their respective bus tie breakers. The bus ties will normally be open but are manually closed during an "equalizing charge" on one of the associated batteries or when a battery is removed from service.

Whenever DCA and DCB are cross tied, both normal chargers (CXA & CXB) are connected to their respective bus, even though either charger can supply all of the normal baseline loads of both combined busses. In the event that one of these chargers should fail or trip, DC Loads will be supplied by the other charger without draindown of the "available" battery. In addition, the "available" battery is still there ready to provide the ultimate backup if needed.

If only one charger was connected and a loss occurred, then the "available" battery would be required to supply the DC loads until the other charger could be aligned. The resulting battery draindown can be avoided by merely aligning both chargers to their respective bus during such operations.

2.4 240/120VAC Auxiliary Control Power System

Objective # 15

The two 120 VAC auxiliary control power panelboards and the two 240/120 VAC operator aid computer power panelboards normally receive power from the 125 VDC Auxiliary Control Power System through the auxiliary control power static inverters (KXA, 1KU, KXB, and 2KU). Power from each inverter is directed through their respective automatic static transfer switch (in the "Inverter to Load" position), their manual bypass switch (in the "Normal" position), then through a Disconnect Switch to each power panelboard. Static Inverter KXA, KXB, and spare inverter SKX are of a newer design than 1KU and 2KU. In the following sections, any differences between the two types will be described.

Objective # 16

The automatic static transfer switch, associated with each auxiliary control power static inverter, provides automatic power transfer to an alternate power source (regulated power). The alternate power source is provided from 240/120 VAC Regulated Power Distribution Centers MKA (for 1KU and KXA) and MKB (for 2KU and KXB).

Objective # 16

This switch provides an automatic, uninterrupted power transfer during the following:

1. Inverter over current (> 120%).

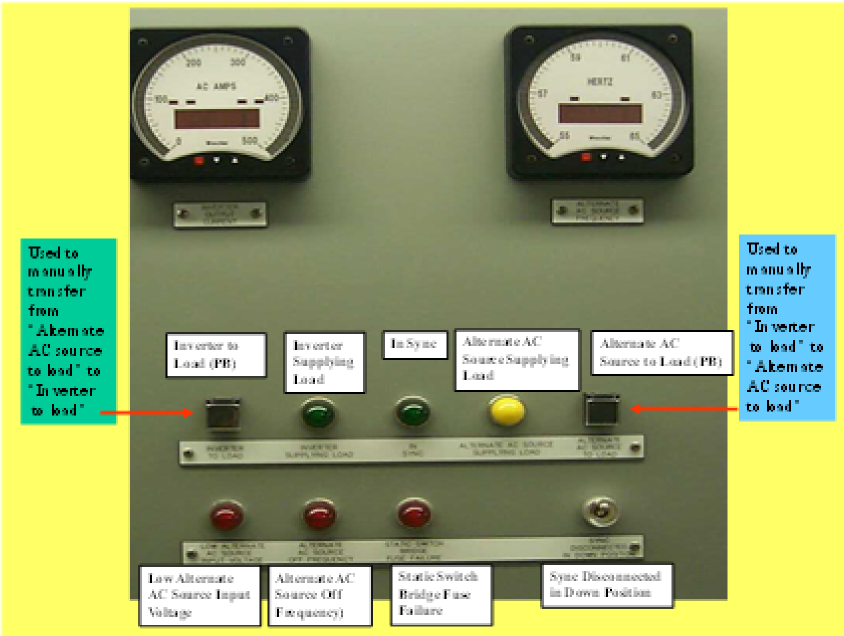
2. Inverter failure.

3. Inverter under voltage.

The Static Switch will automatically return to the "Inverter Supplying Load" position, if the condition clears and remains stable for thirty (30) seconds. A manual transfer of the Static Switch is also possible using the "Alternate AC

<u>Q23 References</u>

Source to Load" push button on the front of the Static Switch Panel. In this case, the transfer back to the normal ("Inverter Supplying Load") position is also a manual operation, accomplished by pressing the "Inverter to Load" push-button.



Objective # 17

(Refer to Drawings 7.3, 7.4, and 7.5)

The manual bypass switch, associated with KXA, 1KU, KXB and 2KU static inverters, is a three position switch which allows bypassing the automatic static transfer switch while still providing power to the associated AC loads. Because the manual bypass switch is a "make before break" switch, with overlapping contacts, transfer of the power source can be accomplished without an interruption of power.

The following describes the three positions of the wall mounted manual bypass switch for 1KU AND 2KU:

- **Normal - position aligns the inverter AC output to the associated AC loads.**
- **Total System Bypassed -Alternate Source To Load - position aligns the regulated power source (from MKA or MKB) to the associated AC loads and totally bypasses the inverter and automatic static transfer switch. This type of transfer should only be made when "in sync" conditions exist as indicated by the "in sync" light at the inverter panel.**
- **Static Switch Bypassed-Inverter To Load - position aligns the inverter AC output to the associated AC loads but bypasses the automatic static transfer switch.**

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4301 CNS

C

Given the following condition:

- Inverter 1KXIA experienced a total loss of output voltage.

Which ONE of the following describes:

(1) an indication used to aid in determining that the backup power supply has aligned to 1KXPA;

AND

(2) Once 1KXIA has returned to normal operating parameters, how will 1KXPA supply be swapped back to 1KXIA?

A. (1) 1KMAA "In Sync" light is LIT.
(2) Automatically after 60 seconds.

B. (1) 1KMAA "In Sync" light is LIT.
(2) Manually.

C. (1) 1KXAA "Alternate Source Supplying Load" light is LIT.
(2) Automatically after 60 seconds.

D. (1) 1KXAA "Alternate Source Supplying Load" light is LIT.
(2) Manually.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4301 CNS C

General Discussion

The operating procedure specifies that the "Alternate Source Supplying Load" light is to be verified ON as part of the 1KXIA Shutdown and Return to Service procedure. System design is such that once the transfer switch has auto swapped to alternate source, a 60 second relay is activated. After 60 seconds, if the transfer was due to a total loss of inverter output voltage, the switch will transfer back to the inverter whenever voltage and frequency have returned to normal.

Answer A Discussion

Plausible, since the In Sync light indicates that both sources are energized and in sync, but doesn't indicate which is aligned to supply 1KXPA. The swap is automatic, unlike vital which has no auto swaps.

Answer B Discussion

Plausible, since the In Sync light indicates that both sources are energized and in sync, but doesn't indicate which is aligned to supply 1KXPA. The swap is automatic unlike vital which has no auto swaps.

Answer C Discussion

Answer D Discussion

Plausible, since Part 1 is correct. Manually swapping back to 1KXIA is plausible if the applicant has a misconception of system design and function, and believes a manual transfer is required.

Basis for meeting the KA

The K/A is matched because stem conditions involve an inverter operation and it requires knowledge of interlocks and cross-ties (from alternate power source) to correctly answer the question.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

Development References

OP-CN-EL-EPF, Lesson Plan for 125V DC Aux Control Power
OP/1/B/6350/009, (125 VDC-240/120 VAC Auxiliary Control Power System), Enclosure 4.10 and Enclosure 4/13, Rev. 29

Student References Provided

KA	KA_desc
SYS063 K4.02	Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)Breaker interlocks, permissives, bypasses and cross-ties. ....

SYS064 A2.14 - Emergency Diesel Generator (ED/G) System

Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Effects (verification) of stopping ED/G under load on isolated bus ....

Given the following initial conditions on Unit 1:

- A switchyard transient causes a loss of offsite power on Unit 1
- 1A D/G starts and trips on overspeed
- 1B D/G starts
- D/G Sequencers have not been reset

Based on the conditions above, ___(1)___ of AP-07 (LOSS OF ELECTRICAL POWER) will be entered.

When desired, the 1B D/G ___(2)___ be secured from the control room.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

AP-07, Case I (LOSS OF NORMAL POWER TO BOTH 1ETA AND 1ETB)
AP-07, Case II (LOSS OF NORMAL POWER TO EITHER 1ETA OR 1ETB)

A. 1. Case I
2. can

B. 1. Case I
2. can NOT

C. 1. Case II
2. can

D. 1. Case II
2. can NOT

General Discussion

Case I of AP-07 is entered for a loss of "normal" power to both 1ETA and 1ETB.
Case II of Ap-07 is entered for a loss of "normal" power to either 1ETA or 1ETB.
Since the switchyard transient caused a loop on unit 1, both emergency busses lost their normal power supply.

Following any automatic start of the diesel generator, diesel shutdown is accomplished by way of the local stop switch on the local diesel generator control panel.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since on any other D/G start (slow start, fast start, etc..) the applicable D/G can be shutdown using the pushbutton in the control room.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since case II would be correct for the loss of normal power to one of the essential busses and based on the conditions in the stem, one essential bus is energized by its emergency D/G.

Second part is plausible since on any other D/G start (slow start, fast start, etc..) the applicable D/G can be shutdown using the pushbutton in the control room.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since case II would be correct for the loss of normal power to one of the essential busses and based on the conditions in the stem, one essential bus is energized by its emergency D/G.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant is required to predict the impact that a loss of offsite power has on the ability to stop a running D/G that is tied to an isolated bus and then select which abnormal plant procedure case should be entered to mitigate this occurrence.

Basis for Hi Cog

This question is high cog because the applicant is required to analyze the indications given in the stem and then determine what affect these indications have on operational alignment and operation of plant equipment. The applicant is also required to recall from memory AP entry conditions.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
AP-07 (Loss of Electrical Power) Rev 36
OP-MC-DG-EQB (Diesel Generator Load Sequencer) Rev 21

LEARNING OBJECTIVES:
NONE

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 24** 24 **B**

SYS064 A2.14 - Emergency Diesel Generator (ED/G) System

Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Effects (verification) of stopping ED/G under load on isolated bus ....

401-9 Comments:	Remarks/Status

Q24 References

MNS AP/1/A/5500/07 **UNIT 1**	LOSS OF ELECTRICAL POWER	PAGE NO. **1 of 469** Rev. 36

A. Purpose

The purpose of this procedure is to ensure proper response in the event of a loss of electrical power for the following cases:

Case I Loss of Normal Power to BOTH 1ETA and 1ETB

Case II Loss of Normal Power to EITHER 1ETA or 1ETB.

Q24 References

3.0 SYSTEM OPERATION

This section will describe Sequencer operation for various plant events / conditions. This information supports the Operator Fundamentals:

Control: Recognize automatic actions that don't occur and take manual action accordingly.

Knowledge: Integrated plant knowledge; understanding system and component design.

Objective # 10

3.1 Limits and Precautions

PT/2/A/4350/04A, D/G 2A Load Sequencer Test

- Manual control of A(B) Train 4160V switchgear is unavailable to Control Room while sequencer is in test mode

  Basis: **This informs the Control Room Operator that while in the test mode he cannot start or stop equipment on the affected bus.**

- Surveillance testing of DGLSA(B) requires 1A(B) D/G Auto Start.

  Basis: **The Auto Start Signal will bypass the Manual Mode Circuit thus preventing any Manual Mode Actuation Signal from tripping the Diesel. This also allows those Automatic Mode signals to trip the Diesel if their limits are exceeded.**

- Circuits inside DGCP1(2)A(B) (Diesel Generator Control Panels 1A, 1B, 2A, 2B) are energized at 120 VAC and 125 VDC.

  Basis: **This information is used to warn the operator or technician of the dangers inside the control panel and that care must be taken when working near energized circuits.**

3.2 Sequencer Operation following Degraded Voltage

The degraded voltage relays are not part of the sequencer circuitry, but they can initiate a Blackout. When the degraded voltage relays open the 4 KV normal and standby circuit breakers, the loss of voltage relays will be actuated.

There is one degraded voltage relay per phase connected in a two-out-of-three logic scheme to detect a degraded voltage condition of less than 3703 Volts. Once the degraded voltage is detected, two time delay relays begin timing to verify the event is sustained. If the first timer, 62TA1 (62TB1), completes its cycle (9.7 seconds), an alarm will be initiated in the control room. The second time delay relay, 62TA2 (62TB2), is provided to allow additional time following the first time delay for the operators to improve voltage. If the degraded voltage condition is still present when the second timing cycle (10 minutes) is complete, a blackout will be initiated on that train by opening the 4 KV normal and standby incoming circuit breakers.

SYS073 2.2.12 - Process Radiation Monitoring (PRM) System
SYS073 GENERIC
Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)

While performing the daily surveillance checks on 1EMF-33 (CONDENSER AIR EJECTOR EXHAUST), it is determined that the OPERATE light is OFF.

Which ONE (1) of the following actions is required in accordance with PT/1/A/4600/003 B (Daily Surveillance Items)?

COMPONENT LEGEND:

1EMF-36L (UNIT VENT GAS MONITOR)

A. Verify operability of 1EMF-36L.

B. Perform a source check of 1EMF-33.

C. Depress CLR (Clear) on the 1EMF-33 touch controls.

D. Place the sample Pump in OFF and depress the RUN pushbutton for a MINIMUM of 5 seconds.

General Discussion

The Daily Surveillance PT requires the 1EMF-33 OPERATE light to be lit.

If the OPERATE light is not lit, PT/1/A/4600/003 B requires a source check to be performed.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible since 1EMF-36L monitors the unit vent for gaseous activity levels which includes atmosphere from the containment purge system, annulus ventilation system, aux building ventilation system, condenser air ejector and fuel pool ventilation system. Therefore applicant may conclude that 1EMF-36L is allowed to replace 1EMF-33.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the applicant may conclude that depressing "CLEAR" will reset any EMF malfunctions and cause the OPERATE light come back on.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the applicant may conclude that the OPERATE light being off is due to a low flow condition on the EMF, cause by a tripped sample pump. The applicant may conclude that taking the sample pump to OFF and back to RUN would reset the sample pump and cause the OPERATE light to come back on.

Basis for meeting the K

The KA is matched because the applicant must demonstrate knowledge of the surveillance procedures and must determine the correct actions from the Daily Surveillance procedure to mitigate the abnormal condition.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2007 MNS NRC Q25 (Bank 3546)

Development References

REFERENCES:
Lesson Plan OP-MC-WE-EMF (Radiation Monitoring) Rev. 38
PT/1/A/4600/003 B Daily Surveillance Items Rev. 161

LEARNING OBJECTIVES:
OP-MC-WE-EMF Objective 9

Student References Provided

SYS073 2.2.12 - Process Radiation Monitoring (PRM) System
SYS073 GENERIC
Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)

401-9 Comments:

Remarks/Status

Q25 References

2.1.2 Condenser Air Ejector Monitor:

The following channels monitor the condenser air ejectors via the unit vent::

- 1(2) EMF 33 Unit 1(2) Condenser Air Ejector

Objective # 2

Their function is to monitor the gaseous activity levels released to the unit vent by the condenser air ejector exhaust. This monitor will aid in the detection of a primary to secondary leak since a steam generator tube leak will result in activity readings in the non-condensable gases evacuated from the condenser. No control action is performed by this channel.

These EMFs use a single range gamma (NaI Scint.) type channel. The detector is mounted directly into the CSAE exhaust header.

2.1.3 Steam Generator Sample Monitor

The following channels are used to monitor steam generator sample flow:

- 1(2) EMF 34 (L) - Unit 1 (2) Steam Generator Sample (Low Range)
- 1(2) EMF 34 (H) - Unit 1 (2) Steam Generator Sample (High Range)

Objective # 2

These channels are located in the steam generator sample lines to monitor for non-volatile radioactive contamination in the lower portion of the steam generator. By sampling one steam generator at a time, the specific steam generator(s) with the primary to secondary leak can be identified.

Objective # 3

On a Trip 2 high radiation alarm (EMF-34 low range only), the following valves will be closed:

- SG Sample Header Radiation Monitor Inlet Isolation Valve NM267 will be closed to stop flow through the monitor to the TB sump via the WZ Groundwater Sump "A". This interlock may be overridden locally by selecting MANUAL on switch NM55 located on the Operating Panel in the Primary Sample (NM) Lab.
- SG Blowdown Blowoff Automatic Isolation Valves BB123, BB124, BB125, and BB126 are closed to stop flow to the SG Blowdown Blowoff Tank. This interlock may also be overridden locally by selecting MANUAL on switch NM55
- SG Sample Header to Conventional Sampling System valves NM269, NM270, NM271, and NM272 are closed. This interlock may also be overridden locally in the CT lab by selecting bypass on switch NM61A.

Operator Fundamental Focus; Control
***Reinforce** the fact that understanding the auto actions, and their purpose, supports the operator by giving the sound reasoning behind why isolating these flow paths is the proper thing to do upon reaching the isolation setpoint. Further **explain** that it is the operator's responsibility to take these actions manually, if they fail to isolate automatically, to prevent the undesired consequences described.*

Q25 References

The purpose of the auto actions:

- EMF34 effluent is directed to ground water drainage sump "A", therefore isolating this flowpath prevents contaminating this sump.
- S/G blowdown blowoff tank effluent may be directed to either the condensate system or the turbine building sump, isolating blowdown will prevent contaminating these systems via the blowdown pathway.
- Conventional sampling effluent may be directed to the CST or turbine building sump, isolating conventional sampling will prevent contaminating these systems via this pathway.

These channels use dual range gamma liquid assembly. The low range uses a gamma liquid (NaI Scint) while the high range uses a GM detector.

2.1.4 Unit Vent Airborne Monitor

The following channels are used to monitor the unit vent:

- 1(2) EMF 35 (L) Unit 1(2) Unit Vent Particulate (Low Range)
- 1(2) EMF 36 (L) Unit 1(2) Unit Vent Gas (Low Range)
- 1(2) EMF 36 (H) Unit 1(2) Unit Vent Gas (High Range)
- 1(2) EMF 37 Unit 1(2) Unit Vent Iodine

Objective # 2

These EMFs monitor the Unit Vent for particulate, gaseous, and iodine activity levels released to the atmosphere from the combined ventilation systems within the station. A sample pump draws a single gas stream in series through a particulate paper filter, an iodine cartridge, and a gas chamber.

Atmosphere from the Containment Purge, Containment Annulus Ventilation, Auxiliary Building Ventilation, Condenser Air Ejector, Fuel Pool Ventilation and other potentially radioactive systems are discharged through the Unit Vent.

Objective # 2, 3

The automatic actions for these EMFs are as follows:

- A Trip 2 high radiation alarm on 1EMF 35 (L), 1EMF 37, 2EMF 35 (L), or 2EMF 37 will stop Auxiliary Building Unfiltered Exhaust Fans 1ABFXF-1A, 1ABFXF-1B, 2ABFXF-1A, and 2ABFXF-2B.
- A Trip 2 high radiation alarm on 1EMF 36 (L) will close 1WG160 to terminate waste gas discharge.
- 1EMF 36 (L) will also alarm and indicate at the Waste Gas Processing Panel.

The purpose of auto actions are:

Activity being released via the Unit Vent could have several sources, (i.e., VP, VE, VQ, VF, WG, VA, CSAE) most of these are monitored by other EMF's or are filtered.

Q25 References

Enclosure 13.1

Daily Surveillance Items Checklist

Surveillance Item	Acceptance Criteria	Applicable Mode(s)							Notes	Initials	Tech Spec / SLC
		1	2	3	4	5	6	No Mode			
Train A Modulating Valves Reset (1MC11)	Reset lit	1	2	3	4	5	6		14		PIP M-96-02018
Train B Modulating Valves Reset (1MC11)	Reset lit	1	2	3	4	5	6		14		PIP M-96-02018
1EMF-31(Turbine Bldg Sump Disch) Channel Check	Operate light lit and loss of sample flow annunciator is NOT in alarm status	1	2	3	4	5	6	No Mode	15,16		SLC 16.11.2-1 (2)
1EMF-33 (Condenser Air Ejector Exhaust) Channel Check	Operate light lit	1	2	3	4	5	6	No Mode	15,17		SLC 16.11.7-1 (2)
0EMF-41 (Aux. Bldg. Ventilation) Channel Check	Operate light lit and loss of sample flow annunciator is NOT in alarm status. Ensure toggle switch in the scan position.	1	2	3	4	5	6	No Mode	15,18,19, 20		SLC 16.11.7-1 (5)

14 IF "Reset" light is dark, this may indicate a failed fuse which would make Modulating Valves inoperable and render associated train of KC and ND systems inoperable. {PIP M-96-02018, MOD 52493}

15 IF operate light dark a source check must be performed on EMF}

16 IF the following conditions are met, 1EMF-31Loss of Sample Flow alarm is invalid:

- Unit 1 Turbine Building Sump aligned to Unit 2
- WU aligned to WWCB
- WU pump off

17 Surveillance required WHEN Air Ejectors are operable.

18 IF Loss of Sample Flow Alarm is lit, place sample pump in operation to clear alarm.

19 IF 1EMF-36 is operable, the following EMFs should be operable but are NOT required: 0EMF-41, 1EMF-42, 0EMF-50 and 1EMF-39 (for Cont. Air Addition and Release only). IF 1EMF-36 is inoperable, the following EMFs shall be operable: 0EMF-41, 1EMF-42, 0EMF-50 (with WG System release isolation valve open), and 1EMF-39 (for Cont. Air Addition and Release only with VQ System release isolation valve open).

20 Sample points 1, 7, and 12 shall be operable to meet the acceptance criteria. Corrective action shall be taken on any channel out of service.

Unit 1

Q25 Parent Question (2007 MNS NRC Q25 (Bank 3546))

EXAM BANK QUESTION: 3546 MNS **A**

While performing daily surveillance checks on 1EMF-33 (Condenser Air Ejector Exhaust), it is determined that the OPERATE light is OFF.

Which ONE (1) of the following actions is required in accordance with PT/1/A/4600/003 B (Daily Surveillance Items)?

A. Perform a source check of 1EMF-33.

B. Verify operability of 1EMF-36L (Unit Vent Gas Monitor) by checking OPERATE light lit and LOSS OF SAMPLE FLOW annunciator NOT in alarm.

C. Depress CLR (Clear) on the 1EMF-33 touch controls.

D. Place the sample Pump in OFF, and then depress the RUN pushbutton for a MINIMUM of 5 seconds.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 3546 MNS **A**

General Discussion

During the unit's Daily Surveillance 1EMF-33 OPERATE light is checked to be lit. One of the failures that can cause the OPERATE light not being lit is a loss of power (either to the instrument of loss of high voltage to the detector).

If the OPERATE light is not lit, PT/1/A/4600/003 B requires a source check to be performed.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant concludes that 1EMF-36L is allowed to replace 1EMF-33 and that no additional actions are necessary.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the applicant may conclude that depressing "CLEAR" will reset any EMF malfunctions and cause the OPERATE light come back on.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant concludes that the OPERATE light being off is due to a low flow conditions on the EMF cause by a tripped sample pump. The could conclude that taking the sample pump to OFF and back to RUN would reset the sample pump and cause the OPERATE light to come back on.

Basis for meeting the KA

The KA is matched because the applicant is given a condition where abnormal EMF indications could be caused by an "erratic or failed power supply" and must determine the correct actions from the Daily Surveillance procedure to mitigate the abnormal condition.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

Development References
References: Lesson Plan OP-MC-WE-EMF Section 2.4 PT/1/A/4600/003 B Daily Surveillance Items Learning Objectives: WEEMF009

Student References Provided

KA	KA_desc
SYS073 A2.01	Ability to (a) predict the impacts of the following malfunctions or operations on the PRM system; and (b) based on those predictions, use procedures to cor- rect, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)Erratic or failed power supply ....

KA	KA_desc
SYS073 A4.03	Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)Check source for operability demonstration ....

SYS076 K1.19 - Service Water System (SWS)

Knowledge of the physical connections and/or cause- effect relationships between the SWS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)

SWS emergency heat loads ....

Given the following initial conditions on Unit 1:

- The Unit is at 100% RTP
- B Train components in service

Subsequently,

- The 1B RN pump trips on overcurrent
- The crew implements AP-20 (LOSS OF RN), and places the 1A RN pump in service
- The remaining 'B' Train components are still in operation
- The BOP operator positions the manual loader for 1RN-190B (RN TO B KC HX CONTROL) to 10% open
- The OATC, monitoring the OAC graphic for RN, notes 1RN-190B is indicating full open

Which ONE (1) of the following identifies the reason for 1RN-190B indicating full open?

A. The manual loader has mechanically failed.

B. 1RN-190B air supply solenoid has de-energized.

C. Minimum flow requirements for the 1B RN Pump are not met.

D. Minimum flow requirements for the 1A RN Pump are not met.

General Discussion

Mini-flow protection for the RN pumps is provided by flow through the KC heat Exchanger (Refer to Drawing 7.4). When an RN pump starts, the train related RN to KC inlet isolation valve (RN86A, RN187B) will open (provided their auto/manual selector switch is in auto). These valves also open on a train related SS or Blackout signal and can be operated by open/close pushbutton on the RN section of MC11. The train related RN to KC heat exchanger flow is controlled by outlet control valve (RN89A, RN190B) manual loaders located on the RN section of MC11. If RN flow falls below 2700 gpm, the auto control feature will override the manual loader and open the valve proportional to flow between 2700 gpm and 0 gpm.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant does not recall the manual loader override feature associated with RN pump minimum flow. If so, the applicant would conclude that because the valve position indication on the OAC does not agree with the manual loader position, that a failure of the manual loader has occurred.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

If the applicant concludes that the control power for 1RN-190B is provided via the 1B RN pump breaker this answer is plausible. It is plausible for the applicant to arrive at this conclusion since 1RN-190B provides minimum flow protection for the 1B RN pump and 1RN-190B fails open on a loss of control power. The fact that the valve is indicating full open with manual loader indicating 10% would be indications that could be seen if a loss of control power to 1RN-190B occurred.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the 1A RN pump is the only pump running. It is plausible for the applicant to conclude that the only pump for which the system would attempt to provide minimum flow protection would be the running pump.

Basis for meeting the K

The KA is matched because by demonstrating knowledge of the automatic operation of 1RN-190B which controls flow through an RN system emergency heat load (KC Hx), the applicant demonstrates knowledge of the cause-effect relationship between the RN system and emergency heat loads.

Basis for Hi Cog

This question is hi cog because the applicants are required to analyze the conditions in the stem to determine RN system alignment and then determine why 1RN-190B has differing indications on the control board and OAC.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2013 MNS NRC Q25 (Bank 4462)

Development References

REFERENCES:
Lesson Plan OP-MC-PSS-RN (Nuclear Service Water) Rev. 51 Section 2.2 (RN Pumps, Strainers and Mini-Flow)

LEARNING OBJECTIVES:
OP-MC-PSS-RN Objective 7

Student References Provided

SYS076 K1.19 - Service Water System (SWS)

ILT-16-1 MNS SRO NRC Examination **QUESTION 26** 26 **C**

Knowledge of the physical connections and/or cause- effect relationships between the SWS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)

SWS emergency heat loads ....

401-9 Comments:	Remarks/Status

Q26 References

- If a Safety Injection only occurs with the local pushbutton in the AUTO position, the backwash pump will continue to run if it was previously running. The backwash motor could already be running while energizing load sequence 1. If the pump was not previously running it will start approximately one second after the main RN pump starts.

Additional Controls

A key operated switch is installed to run the strainer drum motor (for maintenance purposes) when the associated Nuclear Service Pump is not operating. This bypass switch is automatically disabled after Safety Injection/LOOP. The switch will be interlocked to the strainer backwash supply valve (1/2RN-21A, 1/2RN-25B) so that the valve will not open when the strainer drum motor is being manually operated.

Problems encountered while draining the 1B RN strainer.

RN Strainer 1B was isolated and an attempt was made to drain the strainer in order to replace root valves. During the activity planning prior to performing the work the Complex Plan Team was not aware the discharge side of the 1B RN strainer could not be drained due to the presence of an internal baffle. After the strainer was isolated and the drain began Operations identified the discharge side of the strainer remained filled and could only be drained through the small diameter instrument tap. It is important to know that the strainers are constructed in such a way that the discharge side of the strainer may not drain. Refer to PIP 1-M-06-01345 in the lesson plan for additional information.

Operator Fundamental Focus; Knowledge
it is important for an operator to know that the strainers are constructed in such a way that the discharge side of the strainer may not drain, and in this case, a lack of knowledge about the design of these strainers contributed to 6 hours of lost system availability.

***Refer** to PIP 1-M-06-01345 later in the lesson plan for additional information.*

Objective # 7

RN Mini-Flow

Mini-flow protection for the RN pumps is provided by flow through the KC heat Exchanger **(Refer to Drawing 7.4)**. When an RN pump starts, the train related RN to KC inlet isolation valve (RN86A, RN187B) will open (provided their auto/manual selector switch is in auto). These valves also open on a train related Ss or Blackout signal and can be operated by open/close pushbutton on the RN section of MC11. The train related RN to KC heat exchanger flow is controlled by outlet control valve (RN89A, RN190B) manual loaders located on the RN section of MC11. If RN flow falls below 2700 gpm, the auto control feature will override the manual loader and open the valve proportional to flow between 2700 gpm and 0 gpm. A modification to these valves has adjusted the close stops so that the valves will not close completely. The target value of approx. 2000 gpm (+/- 250 gpm) is set for this position. The limit switches are adjusted to show full closed at this position even though the valves will pass flow. Valves RN89A and RN190B will fail open with the aid of springs to open the actuator on loss of air or Ss. Meter indication for the RN to KC A(B)HX flow (0 to 10,000 gpm) is provided on MC9.

Operator Fundamental Focus; Control and Monitoring
Reinforce *the importance of understanding system and component design and operation including how components function in automatic mode, how to properly monitor for automatic component operation, and how to take manual control of system components.*
*In the case of RN89A, RN190B, if RN flow falls below 2700 gpm, the auto control feature will override the manual loader and open the valve proportional to flow between 2700 gpm and 0 gpm (**Control**). A modification to these valves has adjusted the close stops so that the valves will not close completely. The target value of approx. 2000 gpm (+/- 250 gpm) is set for this position. The limit switches are adjusted to show full closed at this position even though the valves will pass flow (**Monitoring**).*

The following **alarms on AD12** are provided for the RN pump and strainer

- "A(B) RN PUMP LO SUCTION PRESS"

  Setpoint: 0 psig

  Origin: Comes off LP side of strainer D/P instrumentation

- "A(B) RN PUMP DISCHARGE LO PRESS"

  Setpoint : 50 psig

  Origin: Comes off a pressure transmitter on the A(B) essential header

- "A(B) RN PUMP ABNORMAL FLOW"

  Setpoint: > 16,000 gpm or < 2,700 gpm; with RN pump breaker closed

  Origin: Flow transmitter of the discharge of the pump

- "RN STRAINER A(B) HI D/P"

  Setpoint: 1.86 psid

  Origin: RN Strainer A(B) D/P switch

Q26 Parent Question (2013 MNS NRC Q25 (Bank 4462))

C

2013A MNS SRO NRC Examination QUESTION 25 25

SYS076 A3.02 - Service Water System (SWS)
Ability to monitor automatic operation of the SWS, including: (CFR: 41.7 / 45.5)
Emergency heat loads ....

Given the following conditions on Unit 1:

- The Unit was initially operating at 100% RTP with B Train components in service
- The 1B RN pump tripped on overcurrent
- The crew implemented AP-20 (LOSS OF RN), and has placed the 1A RN pump in service
- The remaining 'B' Train components are still in operation
- The BOP positions the manual loader for 1RN-190B (RN TO B KC HX CONTROL) to 10% open
- The RO was reviewing the OAC graphic for RN and noted 1RN-190B is indicating full open

Which ONE (1) of the following describes the reason for this?

A. 1RN-190B control power is not supplied unless the 1B RN Pump breaker is closed.

B. Minimum flow requirements for the 1A RN Pump are not met.

C. Minimum flow requirements for the 1B RN Pump are not met.

D. The manual loader has mechanically failed.

Q26 Parent Question (2013 MNS NRC Q25 (Bank 4462))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 25 25 **C**

General Discussion

Mini-flow protection for the RN pumps is provided by flow through the KC heat Exchanger (Refer to Drawing 7.4). When an RN pump starts, the train related RN to KC inlet isolation valve (RN86A, RN187B) will open (provided their auto/manual selector switch is in auto). These valves also open on a train related SS or Blackout signal and can be operated by open/close pushbutton on the RN section of MC11. The train related RN to KC heat exchanger flow is controlled by outlet control valve (RN89A, RN190B) manual loaders located on the RN section of MC11. If RN flow falls below 2700 gpm, the auto control feature will override the manual loader and open the valve proportional to flow between 2700 gpm and 0 gpm.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
If the applicant concludes that the control power for 1RN-190B is provided via the 1B RN pump breaker this answer is plausible. It is plausible for the applicant to arrive at this conclusion since 1RN-190B provides minimum flow protection for the 1B RN pump and 1RN-190B fail open on a loss of control power. The fact that the valve is indicating full open with manual loader indicating 10% would be indications that could be seen if a loss of control power to 1RN-190B occurred.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the 1A RN pump is the only pump running. It is plausible for the applicant to conclude that the only pump for which the system would attempt to provide minimum flow protection would be the running pump.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant does not recall the manual loader override feature associated with RN pump minimum flow. If so, the applicant would conclude that because the valve position indication on the OAC does not agree with the manual loader position, that a failure of the manual loader has occurred.

Basis for meeting the K

By demonstrating a knowledge of the automatic operation of 1RN-190B which controls flow through an RN system emergency heat load (KC Hx), the applicant demonstrates the ability to monitor automatic operation of the RN system as it relates to emergency heat loads. Therefore, the K/A is matched.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2011 AUDIT Q25 (Bank 4462)

Development References

References:
Lesson Plan OP-MC-PSS-RN Section 2.2 (RN Pumps, Strainers and Mini-Flow)

Learning Objectives:
OP-MC-PSS-RN Objective 7

Student References Provided

SYS076 A3.02 - Service Water System (SWS)
Ability to monitor automatic operation of the SWS, including: (CFR: 41.7 / 45.5)
Emergency heat loads ....

Q26 Parent Question (2013 MNS NRC Q25 (Bank 4462))

C

2013A MNS SRO NRC Examination **QUESTION 25** 25

401-9 Comments:	Remarks/Status
	401-9 Comments: UNSAT 076A3.02 Question appears to match the K/A. What is the normal cooling water for the AFW pumps. If it is normally RN then this is a LOD=1. It appears that from objective 10 of Lesson Plan OP-MC-CF-CA, The train related RN pump will automatically start upon any start (including Manual) of the corresponding CA pump to provide necessary cooling to the CA pump motor. RN cools the pumps all of time, whenever started, so it will always be the right answer. Need to Replace question. 2011 MNS NRC Q26 10/23/2013 Question replaced. HCF 10/30/13 Added "mechanically" to original distracter 'A'. Rearranged answers for psychometrics and to not look like bank question. Originally distracter 'A' is now distracter 'D' and original distracter 'C' is now distractor 'B'. This now makes the correct answer 'C'. Chief Examiner reviewed question and approved as SAT. HCF 11/18/13.

SYS078 K3.03 - Instrument Air System (IAS)
Knowledge of the effect that a loss or malfunction of the IAS will have on the following: (CFR: 41.7 / 45.6)
Cross-tied units ....

Regarding the operation of 1VI-820 (VI TO VS SUPPLY VALVE),

1) the valve will automatically close if ________ header pressure decreases to less than 90 PSIG.

2) if the 1VI-820 control switch is inadvertently left in the OPEN position, the valve ________ close on decreasing pressure.

Which ONE (1) of the following completes the statements above?

A. 1. VI
2. will NOT

B. 1. VS
2. will NOT

C. 1. VI
2. will

D. 1. VS
2. will

General Discussion

1VI-820 Supplies the VS from the VI system. The two systems are always cross-connected and the systems are shared between both units.

If VI header pressure decreases to less than 90 PSIG, 1VI-820 will automatically close, separating the VI system from the VS system. This design assumes that the leak may be on the VS. Thus, the two systems are separated to protect the VI system from a leak on the VS system.

Normally, the 1VI-820 control switch is in the "AUTO" position. If an auto closure of 1VI-820 occurs it would require dispatching an AO to manually reopen the valve using the control switch. The dispatched operator would place the 1VI-820 control switch to the OPEN position, verify that the valve opens, and the place the control switch back to the AUTO position.

In this question with 1VI-820 OPEN and its control switch left in the OPEN position, the valve will still close on decreasing pressure. However, it will immediately reopen if VI header pressure increases to greater than 90 PSIG.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because in most cases taking the control switch for a valve which has an AUTO feature to the OPEN or CLOSED position, the valve position will go to that switch position and remain there regardless of any auto signal which might be present.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the purpose of the auto close feature is to protect the VI header from a leak on the VS header. Therfore, it is natural to conclude that 1VI-820 would close on decreasing VS header pressure.

The second part is plausible because in most cases taking the control switch for a valve which has an AUTO feature to the OPEN or CLOSED position, the valve position will go to that switch position and remain there regardless of any auto signal which might be present.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the purpose of the auto close feature is to protect the VI header from a leak on the VS header. Therfore, it is natural to conclude that 1VI-820 would close on decreasing VS header pressure.

The second part is correct.

Basis for meeting the K

The K/A is matched since the operation of 1VI-820 during a loss of VI affects both units.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2008 MNS Audit Exam Q27 (Bank 3345)

Development References

REFERENCES:
Lesson Plan OP-MC-SS-VI (Instrument Air, Station Air, Breathing Air) Rev. 36

LEARNING OBJECTIVES:
OP-MC-SS-VI Objective 7

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 27** 27 **C**

SYS078 K3.03 - Instrument Air System (IAS)

Knowledge of the effect that a loss or malfunction of the IAS will have on the following: (CFR: 41.7 / 45.6)

Cross-tied units ....

401-9 Comments:	Remarks/Status

Q27 References

1.2.11 VI System Air Receivers

Objective # 9

Three air receivers are utilized for air storage by both the reciprocating compressors and the centrifugal compressors. The Air Receivers:

- Limit air compressor operation due to their storage capacity
- Provide a surge volume for sudden changes in air pressure
- Provide a means of removing water collected, within the system.

Each air receiver has a storage capacity of 312 cubic feet with a relief valve setting of 115 psig.

> ***Operator Fundamental Focus; Control***
> ***Reinforce*** *one of the attributes for the Operator Fundamental Control is to know those steps that, if performed incorrectly, result in undesirable consequences.* ***Explain*** *that the information below, regarding the correct sequence and actions to take to isolate a receiver tank, support this fundamental behavior.*

When isolating a receiver tank ensure closure of the corresponding root valve on the common pressure sensing line to prevent depressurization of the sensing line and possible malfunction of the D, E, and/or F VI Compressors. *[PIP #0-M94-04864]*

1.2.12 1VI-820 VI to VS Control Valve

The VI System normally supplies the Low Pressure VS System through control valve 1VI-820.

Controls and indication for 1VI-820 are located at the VI Sequencer Control Panel. The valve control switch is a three position switch:

- Close
- Auto
- Open

Objective # 7

Indication provided at the VI Sequencer Control Panel consists of the following:

- 1VI-820 Close (green light)
- 1VI-820 Open (red light)

This valve is normally in the AUTO position and will automatically close should VI System Pressure decrease to <90 psig. Upon valve closure 1VI-820 can be reopened once VI System Pressure has increased >90 psig by placing the valve to the OPEN position. After opening the valve 1VI-820, the switch should be returned to the AUTO position. If not, the valve will reopen without operator action, after closure, as soon as pressure has increased above 90 psig.

1.2.13 VI System Air Dryers A, B, and C

Objective # 9

VI Dryers A, B, and C (AMLOC-CHA Dryers) are fully automatic, desiccant-type air dryers designed to remove vaporous moisture from the Instrument Air System.

Generally, two of the three desiccant air dryers (A, B, and C) are in-service while one remains in standby, ready and available for service when needed. Each in-service dryer will alternately cycle air through one of the two desiccant chambers for moisture removal, while the other chamber is regenerated (removal of previously adsorbed moisture) and re-pressurized.

Valves and Their Basic Function

Dryer Inlet Switching Valve

- Switches wet inlet gas flow to the left or right chamber for drying, and isolates the opposite chamber during it's regeneration cycle.
- Two solenoid valves are used with each inlet valve to direct inlet air flow to the in-service dryer chamber and isolate air flow to the out of service dryer chamber.
- The solenoid valve used to admit airflow into the in-service chamber will energize to perform this function while the solenoid used to admit airflow to the out-of-service chamber is de-energized.
- Inlet valve position change requires that the associated solenoid valve energize.

Dryer Outlet Switching Valve

- Switches dry outlet gas flow from the left or the right drying chamber to the system and isolates the opposite chamber during it's regeneration cycle.
- Two solenoid valves are used with each outlet valve to allow inlet air flow from the in-service dryer chamber and isolate air flow from the out of service dryer chamber.
- The solenoid valve used to allow airflow from the in-service chamber will energize to perform this function while the solenoid used to isolate airflow from the out-of-service chamber is de-energized.
- Outlet valve position change requires that the associated solenoid valve energize.

Q27 Parent Question 2008 MNS Audit Exam Q27 (Bank 3345)

Examination Outline Cross-reference:	Level	RO	SRO
	Tier #	2	
	Group #	1	
	K/A #	078 K3.03	
	Importance Rating	3.0	

(K&A Statement) Knowledge of the effect that a loss or malfunction of the IAS will have on the following: Cross-tied units

Proposed Question: Common 27

The operator has just opened 1VI-820 (VI Supply to VS Control). The switch is left in the OPEN position.

Which ONE (1) of the following statements correctly describes the adverse effect of leaving the control switch in the OPEN position?

A. The valve will not close on decreasing VI pressure.

B. The valve closes on decreasing VI pressure, but immediately reopens if pressure increases above 90 psig.

C. The valve will not close on decreasing VS pressure.

D. The valve closes on decreasing VS pressure, but immediately reopens if pressure increases above 90 psig.

Proposed Answer: B

Explanation (Optional):

A. Incorrect. The valve will close. Plausible: if the candidate believes that if not in auto, the valve will not respond to decreasing pressure.
B. Correct. The opening will not be under the control of the operator.
C. Incorrect. The valve will close on low VI pressure. Plausible: if the candidate confuses which system is being protected, and believes that if not in auto, the valve will not respond to decreasing pressure.
D. Incorrect. The valve responds to VI pressure. Plausible: candidate believes that the valve will receive an open signal once it is fully closed.

Technical Reference(s): OP-MC-SS-VI p71, Rev 31, Section 1.2.12 (Attach if not previously provided)

Q27 Parent Question 2008 MNS Audit Exam Q27 (Bank 3345)

Proposed references to be provided to applicants during examination: None

Learning Objective:	SS-VI #7		(As available)
Question Source:	Bank #	NRC Bank #580	
	Modified Bank #		(Note changes or attach parent)
	New		
Question History:	Last NRC Exam	NA	
Question Cognitive Level:	Memory or Fundamental Knowledge	X	
	Comprehension or Analysis		
10 CFR Part 55 Content:	55.41	4	
	55.43		

Comments:
Except for formatting changes, same as NRC Exam Bank #580.

SYS103 2.2.22 - Containment System
SYS103 GENERIC
Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)

In accordance with Tech. Spec. 3.6.5 (CONTAINMENT AIR TEMPERATURE), Containment average temperature may be reduced to a MINIMUM of ___(1)___ in MODE(s) ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. 60°F
2. 4 ONLY

B. 1. 60°F
2. 2, 3 and 4

C. 1. 75°F
2. 4 ONLY

D. 1. 75°F
2. 2, 3 and 4

General Discussion

In accordance with TS 3.6.5 (Containment Air Temperature), the minimum containment average air temperature may be reduced to 60°F in Modes 2, 3 and 4.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since the affects of a design Steam Line Break would be less in Mode 4 and the applicant may conclude that the LCO is only applicable in Mode 4.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 75°F is the lower limit for upper containment per TS 3.6.5 LCO.

Second part is plausible since the affects of a design Steam Line Break would be less in Mode 4 and the applicant may conclude that the LCO is only applicable in Mode 4.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 75°F is the lower limit for upper containment per TS 3.6.5 LCO.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the Containment Air Temperature T.S. LCO.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Tech Spec 3.6.5 (Containment Air Temperature) Rev. 184/166

LEARNING OBJECTIVES:

Student References Provided

SYS103 2.2.22 - Containment System
SYS103 GENERIC
Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)

401-9 Comments:

Remarks/Status

Q28 References

3.6 CONTAINMENT SYSTEMS

3.6.5 Containment Air Temperature

LCO 3.6.5 Containment average air temperature shall be:

a. ≥ 75°F and ≤ 100°F for the containment upper compartment, and

b. ≥ 100°F and ≤ 120°F for the containment lower compartment.

-------------------------------------NOTES-------------------------------------

1. The minimum containment average air temperature in MODES 2, 3, and 4 may be reduced to 60°F.

2. Containment lower compartment temperature may be between 120°F and 125°F for up to 90 cumulative days per calendar year provided lower compartment temperature average over the previous 365 days is less than 120°F. Within this 90 cumulative day period, lower compartment temperature may be between 125°F and 135°F for 72 cumulative hours.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment average air temperature not within limits.	A.1 Restore containment average air temperature to within limits.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SYS002 K6.07 - Reactor Coolant System (RCS)
Knowledge of the effect or a loss or malfunction on the following RCS components: (CFR: 41.7 / 45.7)
Pumps ....

Given the following initial conditions on Unit 2:

- Unit is stable at 25% RTP
- Control Rods are in MANUAL

Subsequently:

- 2D NCP trips on overcurrent

Based on the conditions above,

1) an automatic reactor trip ________ occur.

2) when steady-state conditions are achieved, ΔT in the UNAFFECTED loops will be ________.

Which ONE (1) of the following completes the statements above?

A. 1. will NOT
   2. higher

B. 1. will NOT
   2. lower

C. 1. will
   2. higher

D. 1. will
   2. lower

General Discussion

With reactor power less than 48% the single loop loss of flow Reactor Trip is blocked. Therefore the trip of one NCP will NOT result in a reactor trip.

With the loss of one loop, Tavg in the UNAFFECTED loops will initially increase. Steam demand has not changed. However, now the heat to supply that steam demand must be provided by three loops instead of four. Therefore, the steam demand on each of the remaining three steam generators increases, causing Tavg to decrease and the Delta-T of each NC loop increases.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant confuses the overall heat transfer rate with the heat transfer rate in each loop. While the heat transfer rate in each loop must increase, the overall heat transfer rate does not change (i.e. load has not changed). The flow rate in each of the unaffected loops will increase slightly because the backpressure from the discharge of the 2D NCP is no longer present. If the applicant considers the effect using the variables in the heat transfer rate equation incorrectly using overall heat transfer rate they would conclude that Tavg in the unaffected loops should increase. In other words, Q remains the same, mass flow rate in each loop increases, therefore Delta-T would decrease.

Answer C Discussion

PLAUSIBLE:
The first part is plausible if the applicant confuses the single loop loss of flow trip setpoint with the two loop loss of flow trip setpoint. If so, the applicant would conclude that the reactor will trip since power is greater than 10%.

The second part is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant confuses the single loop loss of flow trip setpoint with the two loop loss of flow trip setpoint. If so, the applicant would conclude that the reactor will trip since power is greater than 10%.

The second part is plausible if the applicant confuses the overall heat transfer rate with the heat transfer rate in each loop. While the heat transfer rate in each loop must increase, the overall heat transfer rate does not change (i.e. load has not changed). The flow rate in each of the unaffected loops will increase slightly because the backpressure from the discharge of the 2D NCP is no longer present. If the applicant considers the effect using the variables in the heat transfer rate equation incorrectly using overall heat transfer rate they would conclude that Tavg in the unaffected loops should increase. In other words, Q remains the same, mass flow rate in each loop increases, therefore Delta-T would decrease.

Basis for meeting the K

The K/A is matched because it requires the applicant to be able to determine the effect of a loss of a reactor coolant pump a reactor coolant system parameter.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

The applicant must first analyze the conditions given and determine whether an automatic reactor trip will be generated based on those conditions.

Next, the applicant must determine the effect of the loss of the reactor coolant pump on temperature in the unaffected loops.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

ILT-16-1 MNS SRO NRC Examination **QUESTION 29** 29 **A**

Development References
REFERENCES: Lesson Plan OP-MC-IC-IPE (Reactor Protection System) Rev. 33 Section 3.1.2 LEARNING OBJECTIVES: OP-MC-IC-IPE Objective 10

Student References Provided

SYS002 K6.07 - Reactor Coolant System (RCS)

Knowledge of the effect or a loss or malfunction on the following RCS components: (CFR: 41.7 / 45.7)

Pumps ....

401-9 Comments:

Remarks/Status

Q29 References

NC Pump Bus Low Voltage (2/4 busses = 74%) - this anticipatory loss of coolant flow trip protects against DNB. This "at-power" trip protection is auto-blocked < 10% power (P-7) and is automatically reinstated > P-7.

Objective # 10

NC Pump Bus Under Frequency (2/4 busses = 56 Hz) - this anticipatory loss of coolant flow trip protects against DNB. The trip also trips open all four NC pump breakers to prevent electrical braking of the pump motors during frequency decay. A reduction in pump speed would reduce fly wheel inertia and pump coast down flow capability. This "at-power" trip protection is auto-blocked < 10% power (P-7) and is automatically reinstated > P-7.

SG Lo-Lo Level (2/4 channels on 1/4 SGs = 17%) - protects against a loss of heat sink. This protection also causes an auto-start of the CA motor driven pumps (2/4 channels on 1/4 SGs) and the CA turbine driven Pump (2/4 channels on 2/4 SGs).

Single Loop Loss of Flow (2/3 channels in 1/4 loops = 88%) - protects against DNB. This protection is auto-blocked < 48% (P-8) and automatically reinstated > P-8.

Two Loop Loss of Flow (2/3 channels in 2/4 loops = 88%) - protects against DNB. This protection is auto-blocked < 10% (P-7) and automatically reinstated > P-7.

Safety Injection (any SI signal 1/2 Trains) - initiates a reactor trip during LOCA events.

Turbine Trip (2/3 channels ASO < 45psig, 4/4 stop valves closed) - protects against loss of integrity by preventing Pressurizer PORVs from opening on turbine trip at high power.

Objective # 4, 10

General Warning (2/2 Trains) - protects against a loss of both protection trains. Anytime a General Warning is present on both SSPS trains a reactor trip will occur. General Warning is caused by: loose circuit board card; loss of voltage (AC or DC); SSPS train in "Test"; a Reactor Trip By-pass breaker in the Connected position and Closed; a Logic Ground Return fuse blown.

3.1.3 Protection Permissive Interlocks

Objective # 11

P-4 (Reactor Trip Breaker and Bypass Breaker Open for a given train) - initiates: Turbine Trip; Feedwater Isolation (coincident with low Tavg of 553 °F); Allows reset of SI signal after one minute time-out; Inputs to Steam Dump Control System for plant trip mode.

P-6 (1/2 IR instruments > 10^{-5}%) - allows Manual Block of SR reactor trip. On a power reduction, provides automatic reinstatement of SR reactor trip when 2/2 IR channels < 10^{-5} %.

P-7 (2/4 PR instruments > 10% or Turbine Inlet Pressures > 10%) - Enables (unblocks) the "at power" reactor trips: Pzr Hi-Level, Pzr Lo-Pressure, 2 Loop

SYS015 A2.02 - Nuclear Instrumentation System (NIS)

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: (CFR: 41.5 / 43.5 / 45.3 / 45.5)

Faulty or erratic operation of detectors or compensating components ....

Given the following initial conditions on Unit 2:

- A reactor startup is being performed per OP/2/A/6100/003 (CONTROLLING PROCEDURE FOR UNIT OPERATION)
- Reactor power has increased into the IR and is currently at $5X10^{-6}$ % (IR)

Subsequently,

- IR N-36 detector fails

Indication on Source Range N-32 ___(1)___ affected by the detector failure.

Based on the conditions above, per Tech Spec 3.3.1 (RTS INSTRUMENTATION), the power increase ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. is
2. can continue

B. 1. is
2. must be suspended

C. 1. is NOT
2. can continue

D. 1. is NOT
2. must be suspended

General Discussion

The two channels of Source and Intermediate range each use a common detector assembly which consists of two (2) redundant fission chambers. Both fission chambers provide input to the SR channel for increased sensitivity. One of the two chambers provides the input to the IR channel.

Since the detector which feeds IR Channel N-36 has failed (causing N-36 indication to fail low), and since both detectors feed SR Channel N-32, its indication will decrease. Assuming that both detector are sensing the same amount of leakage from the core, N-32 indication would decrease by 1/2. However, in practical application since the two detectors would never sense the exact same amount of leakage, the indication decrease by slightly more or less than 1/2.

Per the initial conditions, reactor power is slightly below the P-6 setpoint. Therefore, the actions in condition H (IR) and I (SR)of TS 3.3.1 are applicable. Condition I requires suspending positive reactivity additions.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible since this would be true if the applicant concludes power is above the P-6 setpoint (1 x 10-5 %)

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that, of the two detectors in the same detector housing, one detector feeds the SR and the other feeds the IR.

The second part is plausible since this would be true if the applicant concludes power is above the P-6 setpoint (1 x 10-5 %).

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that, of the two detectors in the same detector housing, one detector feeds the SR and the other feeds the IR.

The second part is correct.

Basis for meeting the K

The K/A is matched because the applicant must "predict" the effect that a failure of the IR detector on SR indication and based on that prediction determine the appropriate action per TS 3.3.1 related to continuing the reactor startup.

Basis for Hi Cog

This question is higher cognitive because the applicant is required to perform more than one mental process. The applicant must first analyze the conditions in the stem and determine unit mode and whether power is greater than or less than the P-6 setpoint, then apply TS 3.3.1 actions based on those conclusions.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2015 MNS NRC Exam Q50 (Bank 5965) MODIFIED

Development References

REFERENCES:
T.S. 3.3.1 (Instrumentation) condition F, G, H and I
OP-MC-IC-ENB (Excore Nuclear Instrument System) Unit 2 pgs 9 & 10, figure 7.2 and figure 7.4

Student References Provided

LEARNING OBJECTIVES: ICIPE014

SYS015 A2.02 - Nuclear Instrumentation System (NIS)

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: (CFR: 41.5 / 43.5 / 45.3 / 45.5)

Faulty or erratic operation of detectors or compensating components ....

401-9 Comments:

Remarks/Status

Q30 References

with a certain time-constant, but if other radioactive particles arrive at the detector during the period of discharge and recovery, the instrument will not respond properly or fully. Beyond the Geiger region, the detectors will undergo continuous discharge. This region is not useable in any application of interest to us.

The type of gas filled detector used by the Excore Nuclear Instrumentation are:

- Uncompensated Ion Chamber (operates in the Ion Chamber Region) - Power Range.

The detector type used by the Wide Range Gamma-Metrics system:

- Fission Chamber.

The Source and Intermediate range instruments use Fission Chambers manufactured by Thermo Scientific. They are designed to provide to the operator the measure of the neutron flux level at the detector assembly and the measure of the rate-of-change of neutron-flux level from source level (startup & shutdown) to 200% of full power reactor operation.

The signal from the detector is composed of a series of charge pulses. The pulses result from alpha decay of the uranium coating in the detector, from gamma photon interaction with material in the electrodes of the detector, and from the fissioning of uranium atoms when a neutron is absorbed. The pulse signal from alpha decay and from gamma radiation is an unwanted signal and can be eliminated by amplitude discrimination because the neutron pulse signal is much larger. The number of neutron pulses per unit time from the detector is proportional to the magnitude of the neutron flux at the detector. The magnitude of the neutron flux in the reactor core is proportional to the fission power being generated in the reactor. If the magnitude of the neutron-flux at the detector is proportional to the magnitude of the neutron-flux in the reactor core, then the pulse rate from the detector is proportional to reactor power.

The Wide Range Gamma-Metrics system also uses U-235 in a fission chamber.

When a Uranium-235 atom absorbs a neutron, the resulting excited nucleus fissions producing highly charged fission fragments and other products which cause ionization in the gas filled detector. The detectors produce a current pulse for each ionization event as the ions are collected on the electrodes.

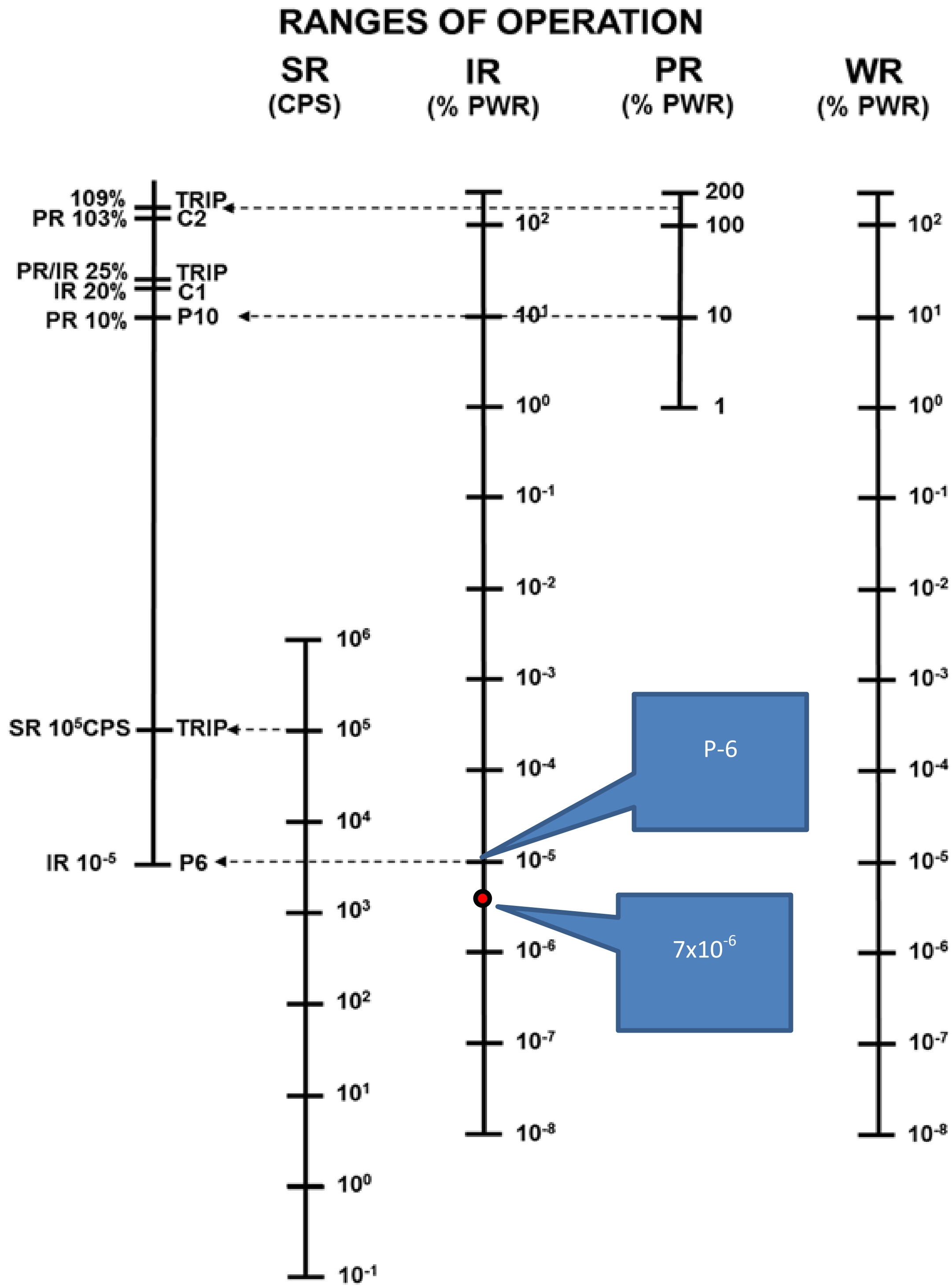
2.0 COMPONENT DESCRIPTION

2.1 Source Range /Intermediate Range Detectors

- The two channels of Source and Intermediate range each use a common detector assembly which consists of two (2), and therefore redundant, fission chambers. Both fission chambers provide input to the SR channel for increased sensitivity. One of the two chambers provides the input to the IR channel. Either of the two fission chambers may be used for IR and the fission chamber signals can be swapped if the necessary precautions are taken.

Q30 References

7.2 Operating Ranges (01/04/11)



Q30 References

Table 3.3.1-1 (page 1 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
1. Manual Reactor Trip	1,2	2	B	SR 3.3.1.14	NA	NA
	3(a), 4(a), 5(a)	2	C	SR 3.3.1.14	NA	NA
2. Power Range Neutron Flux						
a. High	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.16	≤ 110% RTP	109% RTP
b. Low	1(b),2	4	E	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.16	≤ 26% RTP	25% RTP
3. Power Range Neutron Flux Rate						
High Positive Rate	1,2	4	D	SR 3.3.1.7 SR 3.3.1.11	≤ 5.5% RTP with time constant ≥ 2 sec	5% RTP with time constant ≥ 2 sec
4. Intermediate Range Neutron Flux	1(b), 2(c)	2	F,G	SR 3.3.1.1 SR 3.3.1.8(j)(k) SR 3.3.1.11(j)(k)	≤ 30% RTP* ≤ 38% RTP	25% RTP
	2(d)	2	H	SR 3.3.1.1 SR 3.3.1.8(j)(k) SR 3.3.1.11(j)(k)	≤ 30% RTP* ≤ 38% RTP	25% RTP

(continued)

* The ≤ 30% RTP Allowable Value applies to the Westinghouse-supplied compensated ion chamber Intermediate Range neutron detectors. The compensated ion chamber neutron detectors are being replaced with Thermo Scientific-supplied fission chamber neutron detectors. The ≤ 38% Allowable Value applies to the replacement fission chamber Intermediate Range neutron detectors.

(a) With Reactor Trip Breakers (RTBs) closed and Rod Control System capable of rod withdrawal.
(b) Below the P-10 (Power Range Neutron Flux) interlocks.
(c) Above the P-6 (Intermediate Range Neutron Flux) interlocks.
(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.
(j) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.
(k) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine the as-found and the as-left tolerances are specified in the UFSAR.

Q30 References

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One channel inoperable.	---------------NOTE-------------- One channel may be bypassed for up to 12 hours for surveillance testing. ---------------------------------------	
	E.1 Place channel in trip.	72 hours
	OR	
	E.2 Be in MODE 3.	78 hours
F. THERMAL POWER > P-6 and < P-10, one Intermediate Range Neutron Flux channel inoperable.	F.1 Reduce THERMAL POWER to < P-6.	24 hours
	OR	
	F.2 Increase THERMAL POWER to > P-10.	24 hours
	--------------NOTE----------- Limited boron concentration changes associated with RCS inventory control or limited plant temperature changes are allowed. --------------------------------	
G. THERMAL POWER > P-6 and < P-10, two Intermediate Range Neutron Flux channels inoperable.	G.1 Suspend operations involving positive reactivity additions.	Immediately
	AND	
	G.2 Reduce THERMAL POWER to < P-6.	2 hours
H. THERMAL POWER < P-6, one or two Intermediate Range Neutron Flux channels inoperable.	H.1 Restore channel(s) to OPERABLE status.	Prior to increasing THERMAL POWER to > P-6

(continued)

Q30 References

Table 3.3.1-1 (page 2 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
5. Source Range Neutron Flux	2(d)	2	I,J	SR 3.3.1.1 SR 3.3.1.8(j)(k) SR 3.3.1.11(j)(k)	≤ 1.3 E5 cps** ≤ 1.44 E5 cps	1.0 E5 cps
	3(a), 4(a), 5(a)	2	J,K	SR 3.3.1.1 SR 3.3.1.7(j)(k) SR 3.3.1.11(j)(k)	≤ 1.3 E5 cps** ≤ 1.44 E5 cps	1.0 E5 cps
	3(e), 4(e), 5(e)	1	L	SR 3.3.1.1 SR 3.3.1.11	N/A	N/A
6. Overtemperature ΔT	1,2	4	E	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.12 SR 3.3.1.16 SR 3.3.1.17	Refer to Note 1 (Page 3.3.1-18)	Refer to Note 1 (Page 3.3.1-18)
7. Overpower ΔT	1,2	4	E	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.12 SR 3.3.1.16 SR 3.3.1.17	Refer to Note 2 (Page 3.3.1-19)	Refer to Note 2 (Page 3.3.1-19)
8. Pressurizer Pressure						
a. Low	1(f)	4	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.16	≥ 1935 psig	1945 psig
b. High	1,2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.16	≤ 2395 psig	2385 psig

(continued)

** The ≤ 1.3 E5 cps Allowable Value applies to the Westinghouse-supplied boron triflouride (BF_3) Source Range neutron detectors. The BF_3 neutron detectors are being replaced with Thermo Scientific-supplied fission chamber neutron detectors. The ≤ 1.44 E5 cps Allowable Value applies to the replacement fission chamber Source Range neutron detectors.

(a) With Reactor Trip Breakers (RTBs) closed and Rod Control System capable of rod withdrawal.
(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.
(e) With the RTBs open. In this condition, source range Function does not provide reactor trip but does provide indication.
(f) Above the P-7 (Low Power Reactor Trips Block) interlock.
(j) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.
(k) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine the as-found and the as-left tolerances are specified in the UFSAR.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
I. One Source Range Neutron Flux channel inoperable.	---------------NOTE------------ Limited boron concentration changes associated with RCS inventory control or limited plant temperature changes are allowed. I.1 Suspend operations involving positive reactivity additions.	Immediately
J. Two Source Range Neutron Flux channels inoperable.	J.1 Open RTBs.	Immediately
K. One Source Range Neutron Flux channel inoperable.	K.1 Restore channel to OPERABLE status. OR K.2 Open RTBs.	48 hours 49 hours
L. Required Source Range Neutron Flux channel inoperable.	---------------NOTE------------ Plant temperature changes are allowed provided that SDM is maintained and Keff remains < 0.99. L.1 Suspend operations involving positive reactivity additions. AND L.2 Close unborated water source isolation valves. AND L.3 Perform SR 3.1.1.1.	Immediately 1 hour 1 hour AND Once per 12 hours thereafter

(continued)

Q30 Parent Question (2015 MNS NRC Exam Q60 (Bank 5965) MODIFIED

D

ILT-31 MNS SRO NRC Examination QUESTION 60 60

APE033 AK3.01 - Loss of Intermediate Range Nuclear Instrumentation
Knowledge of the reasons for the following responses as they apply to the Loss of Intermediate Range Nuclear Instrumentation: (CFR 41.5,41.10 / 45.6 / 45.13)
Termination of startup following loss of intermediate range instrumentation ....

Given the following initial conditions on Unit 2:

- A reactor startup is being performed per OP/2/A/6100/003 (CONTROLLING PROCEDURE FOR UNIT OPERATION)
- Reactor power increase to allow taking critical rod height data is in progress
- Reactor power is $7X10^{-8}$ % (IR)

Subsequently:

- The IR Signal Processor for detector channel N36 fails

Based on the conditions above,

1) per Tech Spec 3.3.1 (RTS INSTRUMENTATION), the power increase ________.

2) Reactor power indication on ________ has been lost.

Which ONE (1) of the following completes the statements above?

A. 1. can continue
2. N36 ONLY

B. 1. must be suspended
2. N36 ONLY

C. 1. can continue
2. N32 AND N36

D. 1. must be suspended
2. N32 AND N36

Q30 Parent Question (2015 MNS NRC Exam Q60 (Bank 5965) MODIFIED

D

General Discussion

The two channels of Source and Intermediate range each use a common detector assembly which consists of two (2) redundant fission chambers. Both fission chambers provide input to the SR channel for increased sensitivity. One of the two chambers provides the input to the IR channel.
The source range signal processor receives its signals from the IR signal processor.
Since the SR signal is processed in the IR signal processor, a failure of the IR signal processor will result in the loss of SR and IR indication.

Per the initial conditions, reactor power is slightly below the P-6 setpoint. Therefore, the actions in condition H (IR) and I (SR)of TS 3.3.1 are applicable. Condition I requires suspending positive reactivity additions.

We are fully aware that the applicants are provided with a portion of TS 3.3.1 as a reference to Q59. The portion they will be getting does not include the Permissives/Interlocks and their nominal setpoints. The applicant CANNOT answer this question correctly given the reference in Q59. The applicant must know the setpoint for P-6 (new setpoint after NI mod) to determine if current power is above or below that value before they can determine what actions of TS 3.3.1are required.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be true if the applicant concludes power is above the P-6 setpoint (1 x 10-5 %)

Second part is plausible since the IR and SR detectors developed separate signals that fed separate processors prior to installing the new (Thermo-Scientific) fission chamber detectors we have now (MOD complete after Fall 2014 outage).

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since the IR and SR detectors developed separate signals that fed separate processors prior to installing the new (Thermo-Scientific) fission chamber detectors we have now (MOD complete after Fall 2014 outage).

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be true if the applicant concludes power is above the P-6 setpoint (1 x 10-5 %)

Second part is correct and therefore plausible.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the KA

The K/A is matched because the applicant must have knowledge of the effect that a failure of the IR signal processor will have on the SR and IR detectors and thus "why" (reason) the startup must be terminated.

Basis for Hi Cog

This question is higher cognitive because the applicant is required to perform more than one mental process. The applicant must first analyze the conditions in the stem and determine unit mode and whether power is greater than or less than the P-6 setpoint, then apply TS 3.3.1 actions based on those conclusions.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

D

ILT-31 MNS SRO NRC Examination QUESTION 60 | 60

Development References
REFERENCES: T.S. 3.3.1 (Instrumentation) condition F, G, H and I OP-MC-IC-ENB (Excore Nuclear Instrument System) Unit 2 pgs 9 & 10, figure 7.2 and figure 7.4 LEARNING OBJECTIVES: ICIPE014

Student References Provided

APE033 AK3.01 - Loss of Intermediate Range Nuclear Instrumentation
Knowledge of the reasons for the following responses as they apply to the Loss of Intermediate Range Nuclear Instrumentation: (CFR 41.5,41.10 / 45.6 / 45.13)
Termination of startup following loss of intermediate range instrumentation ....

401-9 Comments:

Remarks/Status
Need to ask Chief Examiner for new K/A. New K/A provided 10/15/14 HCF 401-9 Comment from Chief Examiner: ENHANCEMENT Based on the initial conditions, do not believe that choices A.2 and B.2 are plausible. Could the power increase technical continue up to the P-6 set point? Facility Response: Made changes in the stem to add plausibility to A.2 and B.2. NO. the power increase can not continue up to P-6, T.S 3.3.1 (I) - suspend operations involving positive reactivity additions - IMMEDIATELY SLM 04/07/15

SYS016 2.4.4 - Non-Nuclear Instrumentation System (NNIS)

SYS016 GENERIC

Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)

Given the following conditions on Unit 1:

- The unit is stable at 45% RTP
- Turbine Inlet Pressure is 400 PSIG

Which ONE (1) of the following is the MINIMUM condition that would require entry into AP-03 (LOAD REJECTION)?

A. Buslines 1A AND 1B DEENERGIZE

B. Busline 1A ONLY DEENERGIZES

C. CF Pumps 1A AND 1B TRIP

D. CF Pump 1A ONLY TRIPs

General Discussion

The symptoms that would require entry into AP-03 (Load Rejection):
- "DEH TURBINE RUNBACK" alarm
- "OTDT RUNBACK/ROD STOP ALERT" alarm
- "OPDT RUNBACK/ROD STOP ALERT" alarm

Any of the following with Turbine inlet pressure greater than 55% (500 PSIG):
- Either Main CF pump trip
- Either generator breaker open (3 minute runback)
- Loss of one offsite busline (3 minute runback).

Any of the following with Turbine inlet pressure less than 50% (approx. 460 PSIG):
- Buslines 1A and 1B de-energized
- Generator breakers 1A and 1B open.
- Turbine Valve Display Graphic indicates "LDA HAS OCCUR".

For the conditions given the only condition that would cause a Turbine Runback and require entry into AP-03 would be both Buslines de-energized.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since it would result in a Turbine Runback if turbine inlet pressure was greater than 500 PSIG.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Since some of the malfunctions that will result in a turbine runback require a "2 of 2" logic for the runback to occur it is plausible for the applicant to conclude that the same applies to the CF Pump turbine runback. For example, with turbine inlet pressure less than 460 PSIG, it takes a loss of both buslines (1A and 1B) or both main generator breakers (1A and 1B) open to cause a turbine runback. It is therefore plausible for the applicant to conclude that it requires a trip of both CF pumps to cause a turbine runback.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because if Turbine inlet pressure was greater than 500 PSIG the trip of either CF pump would result in a Turbine Runback requiring entry into AP-03.

Basis for meeting the K

The KA is matched because it requires the applicant to recognize conditions and indications that would require entry into Load Rejection abnormal procedure (AP-03).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant has to analyze the conditions given to determine the status of turbine inlet pressure as it relates to potential turbine runback signals. Additionally, the applicant may have to perform a calculation to determine where turbine load is in percent to be able to determine which turbine runback signals could potentially occur.

Next, the applicant has to recall from memory all of the different turbine runback signals and the turbine inlet pressure above which (or below which) those turbine runbacks will occur.

Finally, the applicant has to analyze the conditions in each answer against the conditions given in the stem and setpoints recall from memory to determine the correct response.

ILT-16-1 MNS SRO NRC Examination **QUESTION 31** 31 **A**

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2014 MNS NRC Exam Q73 (Bank 4426)

Development References

REFERENCES:
AP 03 (Load Rejection) Rev 30

LEARNING OBJECTIVES:
OP-MC-AP-03 Objective 2

Student References Provided

SYS016 2.4.4 - Non-Nuclear Instrumentation System (NNIS)
SYS016 GENERIC
Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)

401-9 Comments:

Remarks/Status

Q31 References

MNS AP/1/A/5500/03 **UNIT 1**	LOAD REJECTION	PAGE NO. 2 of 33 Rev. 30

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **"DEH TURBINE RUNBACK" alarm**
- **"OTDT RUNBACK/ROD STOP ALERT" alarm**
- **"OPDT RUNBACK/ROD STOP ALERT" alarm**
- **Any of the following with turbine inlet pressure greater than 55% (500 PSIG):**
  - Either Main CF pump trip
  - Either generator breaker open (3 minute runback)
  - Loss of one offsite busline (3 minute runback).
- **Any of the following with turbine inlet pressure less than 50% (approximately 460 PSIG):**
  - Buslines 1A and 1B de-energized
  - Generator breakers 1A and 1B open
  - Turbine Valve Display Graphic indicates "LDA HAS OCCUR".

Q31 Parent Question 2014 MNS NRC Q73 (Bank 4426))

D

ILT-30 MNS SRO NRC Examination QUESTION 73 73

GEN2.4 2.4.11 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)

Given the following conditions on Unit 1:

- The unit is stable at 45% RTP
- Turbine Inlet Pressure is 400 PSIG

Which ONE (1) of the following is the MINUMUM condition that would require entry into AP-03 (LOAD REJECTION)?

A. CF Pump 1A ONLY TRIPs

B. CF Pumps 1A AND 1B TRIP

C. Busline 1A ONLY DEENERGIZES

D. Buslines 1A AND 1B DEENERGIZE

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO NRC Examination QUESTION 73 73 D

General Discussion

In accordance with the symptoms that would require entry into AP-03 (Load Rejection):

- "DEH TURBINE RUNBACK" alarm
- "OTDT RUNBACK/ROD STOP ALERT" alarm
- "OPDT RUNBACK/ROD STOP ALERT" alarm
- Any of the following with Turbine inlet pressure greater than 56% (500 PSIG):
  - Either Main CF pump trip
  - Either generator breaker open (3 minute runback)
  - Loss of one offsite busline (3 minute runback).
- Any of the following with Turbine inlet pressure less than 50% (approximately 450 PSIG):
  - Buslines 1A and 1B de-energized
  - Generator breakers 1A and 1B open.

For the conditions given the only condition that would cause a Turbine Runback and require entry into AP-03 would be both Buslines de-energized.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because if Turbine inlet pressure was greater than 500 PSIG the trip of either CF pump would result in a Turbine Runback requiring entry into AP-03.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Since some of the malfunctions that will result in a turbine runback require a "2 of 2" logic for the runback to occur it is plausible for the applicant to conclude that the same applies to the CF Pump turbine runback. For example, with turbine inlet pressure less than 450 PSIG, it takes a loss of both buslines (1A and 1B) or both main generator breakers (1A and 1B) open to cause a turbine runback. It is therefore plausible for the applicant to conclude that it requires a trip of both CF pumps to cause a turbine runback.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since it would result in a Turbine Runback if turbine inlet pressure was greater than 500 PSIG.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of the Load Rejection abnormal procedure (AP-03).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant has to analyze the conditions given to determine the status of turbine inlet pressure as it relates to potential turbine runback signals. Additionally, the applicant may have to perform a calculation to determine where turbine load is in percent to be able to determine which turbine runback signals could potentially occur.

Next, the applicant has to recall from memory all of the different turbine runback signals and the turbine inlet pressure above which (or below which) those turbine runbacks will occur.

Q31 Parent Question 2014 MNS NRC Q73 (Bank 4426))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO NRC Examination QUESTION 73 73 **D**

Finally, the applicant has to analyze the conditions in each answer against the conditions given in the stem and setpoints recall from memory to determine the correct response.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2012 MNS Audit Exam Q73 (Bank 4426)

Development References

References:
AP-03 (LOAD REJECTION)

Learning Objectives:
OP-MC-AP-03 Objective 1

Student References Provided

GEN2.4 2.4.11 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:

Remarks/Status

401-9 Comments: SAT

SYS041 K2.01 - Steam Dump System (SDS)/Turbine Bypass Control
Knowledge of bus power supplies to the following: (CFR: 41.7)
ICS, normal and alternate power supply ....

Given the following conditions on Unit 1:

- A SGTR has occurred on 1A S/G
- The crew has implemented E-3 (STEAM GENERATOR TUBE RUPTURE)
- The OATC is performing the initial cooldown

1) Based on the conditions above, when NC system T_{avg} decreases to less than a MAXIMUM of ______, steam dumping will be blocked.

2) If a loss of vital bus ______ occurs during the cooldown, all steam dump valves will CLOSE.

Which ONE (1) of the following completes the statement above?

A. 1. 553°F
2. EVDB

B. 1. 553°F
2. EVDA

C. 1. 551°F
2. EVDB

D. 1. 551°F
2. EVDA

General Discussion

P-12 (2/4 Lo-Lo TAVG < 553□F) - provides Auto-block of steam dumps preventing excessive cooldown by the steam dumps.

Per AP-15 (Loss of vital or aux control power, on a loss of EVDA all condenser steam dump valves fail closed.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because the vital busses are train related with EVDA and EVDC designated as Train "A" busses and EVDB and EVDD designated as Train "B" busses. A loss of either EVDA or EVDD would cause all steam dumps to close.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 551degrees is the OAC alarm for Lo-Lo Tavg.

Second part is plausible because the vital busses are train related with EVDA and EVDC designated as Train "A" busses and EVDB and EVDD designated as Train "B" busses. A loss of either EVDA or EVDD would cause all steam dumps to close.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 551degrees is the OAC alarm for Lo-Lo Tavg.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the power supplies to the steam dump valves.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
AP-15 (Loss of Vital or Aux Control Power) Rev 27, pg 98 of 280
Lesson Plan OP-MC-IC-IPE (Reactor Protections System) Rev. 33

LEARNING OBJECTIVES:
OP-MC-IC-IPE Objective 11

Student References Provided

SYS041 K2.01 - Steam Dump System (SDS)/Turbine Bypass Control
Knowledge of bus power supplies to the following: (CFR: 41.7)
ICS, normal and alternate power supply ....

401-9 Comments:

Remarks/Status

Q32 References

MNS AP/1/A/5500/15 **UNIT 1**	LOSS OF VITAL OR AUX CONTROL POWER **Enclosure 6 - Page 5 of 7** **1EVDA Load List**	PAGE NO. **98 of 280** Rev. 27

11. **RF System:**
    - The following valves fail closed:
    - __ • 1RF-821A (Unit 1 RF Cont Outside Isol)
    - __ • 1RF-832A (Unit 2 RF Cont Outside Isol).

12. **RN System:**
    - The following valve fails closed:
    - __ • 1RN-21A (1A RN Strainer Backwash Automatic Supply Isol).
    - The following valves fail open:
    - __ • 1RN-89A (RN to A KC Hx Control)
    - __ • 1RN-103A (A NV Pump Cooler Sup Isol)
    - __ • 1RN-114A (A NI Pump Cooler Sup Isol)
    - __ • 1RN-126A (A NS Pump ESS AHU Sup Isol)
    - __ • 1RN-130A (A ND Pump ESS AHU Sup Isol)
    - __ • 1RN-140A (A KF Pump ESS AHU Sup Isol).

13. **RV System:**
    - The following valves fail closed:
    - __ • 1RV-79A (U1 VU AHUS RV Cont Outside Supply Hdr Isol)
    - __ • 1RV-101A (U1 VU AHUS RV Cont Inside Return Hdr Isol).

14. **SA System:**
    - The following valves fail open:
    - __ • 1SA-48ABC (SM From S/G C To TD CA Pump Isol)
    - __ • 1SA-49AB (SM From S/G B to TD CA Pump Isol).

15. **SB System:**
    - __ • All Condenser Steam Dump valves fail closed.

Loss of Flow, NCP UV, and NCP UF. The above trips are automatically blocked when below P-7, 3/4 PR < 10% and Turbine Inlet Pressure < 10%.

Objective # 11

P-8 (2/4 PR instruments > 48% power) - enables Single Loop Loss of Flow and Reactor Trip upon Turbine Trip.

P-10 (2/4 PR instruments > 10%) - allows Manual Block of PR High Flux / Low Setpoint reactor trip. Allows Manual block of IR High Flux Rod Stop (C-1) and Reactor Trip. Blocks SR HI Flux Trip. P-10 provides an input to P-7. Below P-10 (3/4 PR instruments < 10%) - allows Manual reset of SR Reactor trip. This is used if one IR channel does not decrease below P-6 to Auto energize the SR circuit.

P-11 (2/3 Presurizer Pressure instruments < 1955 psig) - allows Manual Block of Lo-Pzr pressure SI (Auto instate > P-11); allows Manual block of Lo Press Stm Line Isol (Auto instate > P-11); Allows Manual block of motor driven CA pump Auto-start (Auto instate > P-11); and initiates opening of Cold Leg Accumulator isolation valves when > P-11.

P-12 (2/4 Lo-Lo TAVG < 553°F) - provides Auto-block of steam dumps preventing excessive cooldown by the steam dumps.

P-13 (Turbine Inlet Pressure > 10%) - this turbine at power permissive provides an input to P-7. Signal is developed using a 1/2 Logic from Channels 1 and 2 Turbine Inlet Pressure.

P-14 (2/3 Hi-Hi level instruments on 1/4 SGs > 83%) - actuates a Turbine Trip, CFPT Trip and Feedwater Isolation.

3.1.4 Control Interlocks

Objective # 12

C-1 (1/2 IR channels > 20%) - blocks Auto and Manual rod withdrawal.

C-2 (1/4 PR channels > 103%) - blocks Auto and Manual rod withdrawal.

C-3 (2/4 ΔT channels within 2% of OTΔT setpoint) - blocks Auto and Manual rod withdrawal plus actuates a turbine runback at 200%/min for 2.3 seconds out of 30 seconds.

C-4 (2/4 ΔT channels within 2% of OPΔT setpoint) - blocks Auto and Manual rod withdrawal plus actuates a turbine runback at 200%/min for 2.3 seconds out of 30 seconds.

C-5 (Turbine Inlet Pressure < 15%) - blocks Auto rod withdrawal.

C-7A (Turbine Inlet Pressure step change decrease > 10%.) - arms condenser dump valves on a load rejection. Signal is developed using a 2/3 Logic from Channels 1, 2, and 3 Turbine Inlet Pressure.

SYS033 K1.05 - Spent Fuel Pool Cooling System (SFPCS)
Knowledge of the physical connections and/or cause-effect relationships between the Spent Fuel Pool Cooling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)
RWST ....

Given the following conditions on Unit 1:

- Makeup to the Spent Fuel Pool (SFP) is required
- Chemistry sample results indicate SFP boron concentration at 2750 ppm

Based on the conditions above, ___(1)___ will be used for makeup to the SFP.

Assured makeup to the SFP is provided by the ___(2)___ system.

Which ONE (1) of the following completes the statements above?

A. 1. YM
 2. RN

B. 1. YM
 2. RF/RY

C. 1. the FWST
 2. RN

D. 1. the FWST
 2. RF/RY

General Discussion

Non-borated demineralized water from YM (preferred source) or the Reactor Makeup Water Pumps and Storage Tank can be used for makeup if the last weekly boron sample was greater than 2775 ppm or dilution is desired. A table within OP/1(2)/A/6200/005, Spent Fuel Cooling System provides a conservative addition for makeup to the SFP using YM based upon the last boron sample.

Borated water from the FWST should be used for makeup if the last SFP boron sample indicated less than 2775 ppm or boration is desired.

Non-borated lake water (assured makeup), from the Nuclear Service Water System (RN), can also be used for makeup. The assured makeup should only be used if borated and demineralized water are not available and the SFP Level is low enough to cause a radiation hazard.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this is the preferred source of makeup to the spent fuel pool and would be correct if spent fuel pool boron concentration was greater than 2775 ppm.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this is the preferred source of makeup to the spent fuel pool and would be correct if spent fuel pool boron concentration was greater than 2775 ppm.

Second part is plausible since RF/RY is used by AP-41 (Loss of Spent Fuel Cooling or Level) as an emergency makeup source to the spent fuel pool.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since RF/RY is used by AP-41 (Loss of Spent Fuel Cooling or Level) as an emergency makeup source to the spent fuel pool.

Basis for meeting the K

The KA is matched because by determining the required makeup source, the applicant demonstrates knowledge of the physical connections between the spent fuel cooling system and the FWST.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Lesson Plan: OP-MC-FH-KF (Spent Fuel Pool Cooling) Rev 36

LEARNING OBJECTIVES:
OP-MC-FH-KF Objective 4

Student References Provided

SYS033 K1.05 - Spent Fuel Pool Cooling System (SFPCS)

ILT-16-1 MNS SRO NRC Examination **QUESTION 33** 33 **C**

Knowledge of the physical connections and/or cause-effect relationships between the Spent Fuel Pool Cooling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)

RWST ....

401-9 Comments:

Remarks/Status

Q33 References

SFP temperature is maintained less than 90°F during normal operating conditions to minimize evaporation of the SFP water. Evaporation of SFP water is a major source of airborne tritium released from the site.

Spent Fuel Pool Purification Loop

The purification loop removes particulates, dissolved fission products, and surface dust from the fuel pool and the canal. It also maintains optical clarity for visual observation of underwater operations within the canal or fuel pool. The purification subsystem can also be used to remove dissolved fission products from the FWST.

SFP water or refueling water is circulated through a pre-filter for particulate removal, then directed through a demineralizer for ionic exchange, and finally discharged through a post-filter before it returns to the SFP or the FWST.

The purification subsystem also contains a SFP skimmer loop, which removes floating debris from the SFP surface and maintains optical clarity of the SFP. An adjustable skimmer trough, which collects water from the fuel pool surface, provides suction through a strainer to the KF Skimmer Pump; the pump discharge passes through a filter and is then discharged below the pool surface, above the fuel assemblies, at four discharge points throughout the SFP located about 2 feet below normal SFP level. The suction and return lines of the skimmer loop are arranged so that the maximum area of surface water is circulated through the skimmer loop.

Spent Fuel Pool Makeup

SFP makeup capability is provided to control and maintain fuel pool water volume to ensure radiation shielding. Makeup is manually initiated and manually terminated.

Makeup Demineralized Water (YM) is the preferred make up source due to concerns with elevated site airborne Tritium releases compared with industry averages. The FWST and RMWST contain higher levels of Tritium than the SFP but due to evaporation the SFP is a major source of the airborne Tritium released from the site. SFP makeup requires coordination with RP and Chemistry and is accomplished by routing a hose from a YM connection near the pool. (PIP M-04-04820)

Non-borated demineralized water from YM (preferred source) or the Reactor Makeup Water Pumps and Storage Tank can be used for makeup if the last weekly boron sample was greater than 2775 ppm or dilution is desired. A table within OP/1(2)/A/6200/005, Spent Fuel Cooling System provides a conservative addition for makeup to the SFP using YM based upon the last boron sample.

Borated water from the FWST should be used for makeup if the last SFP boron sample indicated less than 2775 ppm or boration is desired.

Non-borated lake water (assured makeup), from the Nuclear Service Water System (RN), can also be used for makeup. The assured makeup should only be used if borated and demineralized water are not available and the SFP Level is low enough to cause a radiation hazard.

SYS034 A1.02 - Fuel Handling Equipment System (FHES)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: (CFR: 41.5 / 45.5)

Water level in the refueling canal ....

Given the following conditions on Unit 1:

- Unit 1 refueling is in progress
- A fuel assembly is in the Reactor Building Manipulator Crane mast

Subsequently, the following alarms are received:

- 1AD-13, B/6 (INCORE INSTRUMENT ROOM SUMP HI LEVEL)
- 1RAD-3, D/1 (1EMF 16 CONTAINMENT REFUELING BRIDGE)

Based on the conditions above,

1) the Tech Spec MINIMUM required refueling cavity water level is ≥ ________ above the top of the reactor vessel flange.

2) the crew will implement ________ to mitigate this event.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

AP-25 (SPENT FUEL DAMAGE)
AP-40 (LOSS OF REFUELING CAVITY LEVEL)

A. 1. 23
2. AP-25

B. 1. 23
2. AP-40

C. 1. 33
2. AP-25

D. 1. 33
2. AP-40

General Discussion

In accordance with Tech Spec 3.9.7, refueling cavity water level shall be maintained greater than or equal to 23 feet above the top of the reactor vessel flange.
AP-40 entry conditions are follows:
"SPENT FUEL POOL LEVEL LOW" computer alarm
Level in refueling cavity going down
"INCORE INST ROOM SUMP HI LEVEL" alarm
1EMF-16 "CONTAINMENT REFUELING BRDG" alarm
1EMF-17 "SPENT FUEL BUILDING BRDG" alarm
AP-25 entry conditions are follows:
"1EMF-36 UNIT VENT GAS HI RAD" alarm
"1EMF-38 CONTAINMENT PART HI RAD" alarm
"1EMF-39 CONTAINMENT GAS HI RAD" alarm
"1EMF-40 CONTAINMENT IODINE HI RAD" alarm
"1EMF-42 FUEL BLDG VENT HI RAD" alarm
"1EMF-16 CONTAINMENT REFUELING BRIDGE" alarm
"1EMF-17 SPENT FUEL BLDG REFUEL BRDG" alarm
Gas bubbles originating from the damaged assemblies
Visible evidence of spent fuel damage anywhere on site with the potential for radioactive releases.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because AP-25 and AP-40 both have 1EMF -16 in alarm as entry conditions. However, the Incore instrument sump hi level alarm is only associated with AP-40.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 33 feet is the distance below the spent fuel pool operating deck that the fuel is stored in the spent fuel pool.

Second part is plausible because AP-25 and AP-40 both have 1EMF -16 in alarm as entry conditions. However, the Incore instrument sump hi level alarm is only associated with AP-40.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 33 feet is the distance below the spent fuel pool operating deck that the fuel is stored in the spent fuel pool.

Second part is correct and therefore plausible.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of when the Tech Spec required level in the refueling canal will be exceeded.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall the requirements of Tech Spec 3.9.7 (Refueling Cavity water Level).

Next, the applicant must analyze the conditions in the stem and determine which abnormal procedure entry requirements are met.

Basis for SRO only

ILT-16-1 MNS SRO NRC Examination **QUESTION 34** 34 **B**

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2006 CNS NRC Q92 (BANK # 4821)

Development References

REFERENCES:
Technical Specification 3.9.7 (Refueling Cavity Water Level) Rev 261/241
AP-40 Loss of Refueling Cavity Level Rev 8
AP-25 Spent Fuel Damage Rev 8
Lesson Plan OP-MC-FH-KF Spent Fuel Cooling Rev 36

LEARNING OBJECTIVES:
OP-MC-PS-ND Objective 11

Student References Provided

SYS034 A1.02 - Fuel Handling Equipment System (FHES)

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: (CFR: 41.5 / 45.5)

Water level in the refueling canal ....

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
034A1.02
K/A is NOT met.
A better tack might be to set them up at the end of refueling (last assembly in upender) when a leak occurs in containment. Ask TS minimum fuel pool level and what to do per AP-40 (fill or close KF-122). Drl 11/9/15

Facility Response:
Replaced question to better match the KA based on chief examiners comments. SLM 11/16/15

Q34 References

3.9 REFUELING OPERATIONS

3.9.7 Refueling Cavity Water Level

LCO 3.9.7 Refueling cavity water level shall be maintained ≥ 23 ft above the top of reactor vessel flange.

APPLICABILITY: During CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts,
During movement of irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Refueling cavity water level not within limit.	A.1 Suspend CORE ALTERATIONS. AND A.2 Suspend movement of irradiated fuel assemblies within containment.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.7.1 Verify refueling cavity water level is ≥ 23 ft above the top of reactor vessel flange.	In accordance with the Surveillance Frequency Control Program

Q34 References

2.0 COMPONENT DESCRIPTION

Reference drawings 7.1 and 7.2.

2.1 Spent Fuel Pool

Objective # 1

The SFP is approximately 67 feet long, 21½ feet wide, and 47 feet 4 inches deep. It is a Category 1 Structure made of four foot reinforced concrete walls and lined with 3/16 inch thick stainless steel plates.

The SFP stores fuel assemblies approximately 33 feet 4 inches below the fuel pool operating deck with approximately 25 feet of borated water above the top of the assemblies.

A concrete structure encloses the SFP, except on the north end where it is enclosed by a steel structure with siding. The concrete structure provides missile barrier protection for the spent fuel assemblies, while the steel structure does not. Missiles generated by tornado winds or turbine generator operation could penetrate the steel structure, enter the SFP area, and cause fuel damage. An analysis was performed to determine the extent of the postulated damage and determined a maximum of 38 fuel assemblies could be ruptured resulting in a maximum 2-Hour Dose at the Exclusion Area Boundary of 190 rem Thyroid and 770 mrem Whole Body; within the 10CFR100 limits of 300 rem Thyroid and 25 rem Whole Body.

2.2 Spent Fuel Pool Cooling Pumps

Objectives # 1, 6, 7, & 8

Two Spent Fuel Pool Cooling Pumps (KF Pumps) are provided for each unit. Each pump receives power from its respective 4160V Essential Bus, 1(2)ETA or 1(2)ETB.

The KF Pumps take suction through their own suction line from the SFP. Each pump is limited to a maximum flow of 2900 gpm. The flow rate is controlled by positioning KF Heat Exchanger Outlet Throttle valves 1(2)KF-155 and/or 1(2)KF-156. Purification loop flow, if in service, must be added to cooling loop flow to determine total system flow.

The controls and indications associated with KF Pump operation are located on MC-11 and consist of the following:

- START / STOP Control Switch
  - Momentary START / STOP pushbuttons to START and STOP the pump
- ON / OFF (Red / Green) Indicating Lights
  - Mounted on the START / STOP Control Switch and provide indication when the KF Pump breaker is CLOSED (ON) or OPEN (OFF).

Each pump has mechanical seals provided with leakoff, vent, and drain connections. The KF Pump motors are air-cooled with Air Handling Units (AHU) provided to cool the KF Pump Rooms to ensure adequate cooling of the motors.

MNS AP/1/A/5500/40 UNIT 1	LOSS OF REFUELING CAVITY LEVEL	PAGE NO. 2 of 18 Rev. 8

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **"SPENT FUEL POOL LEVEL LOW" computer alarm**
- **Level in refueling cavity going down**
- **"INCORE INST ROOM SUMP HI LEVEL" alarm**
- **1EMF-16 "CONTAINMENT REFUELING BRDG" alarm**
- **1EMF-17 "SPENT FUEL BUILDING BRDG" alarm.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Announce occurrence on page.**	
__ 2. **Check - FUEL MOVEMENT IN PROGRESS.**	**Perform the following:** __ a. IF any radioactive component is being handled in the spent fuel pool or refueling cavity, **THEN** have fuel handling crew lower component to fully down. __ b. IF cavity level is dropping more than one inch per minute, **AND** 1FW-27A (Unit 1 FWST to ND Pumps Isol) is open, **THEN** initiate makeup **PER** Enclosure 3 (Refueling Cavity Makeup Using ND Pump) while continuing in this AP. __ c. GO TO Step 4.

Q34 References

MNS AP/1/A/5500/25 **UNIT 1**	SPENT FUEL DAMAGE	PAGE NO. 2 of 11 Rev. 8

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. **Symptoms**

- **"1EMF-36 UNIT VENT GAS HI RAD" alarm**
- **"1EMF-38 CONTAINMENT PART HI RAD" alarm**
- **"1EMF-39 CONTAINMENT GAS HI RAD" alarm**
- **"1EMF-40 CONTAINMENT IODINE HI RAD" alarm**
- **"1EMF-42 FUEL BLDG VENT HI RAD" alarm**
- **"1EMF-16 CONTAINMENT REFUELING BRIDGE" alarm**
- **"1EMF-17 SPENT FUEL BLDG REFUEL BRDG" alarm**
- **Gas bubbles originating from the damaged assemblies**
- **Visible evidence of spent fuel damage anywhere on site with the potential for radioactive releases.**

EXAM BANK QUESTION: 4821 CNS **A**

- Unit 1 core unload is in progress.
- A fuel assembly is in the Reactor Building Manipulator Crane mast.

While the fuel assembly is being transferred to the refueling canal upender, the following alarms are received:

- OAC point C1D2638 (Incore Inst Sump Level) – HI HI Alarm
- 1RAD-3, D/2 (1EMF 17 Reactor Bldg Refuel Bridge) Lit

1) What is the required procedure to be entered?
2) What is the FIRST action to take for the symptoms described?

A. 1) AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Pool Level)
   2) Lower any fuel assembly in the reactor building manipulator crane to fully down in the core or the deep end of the canal.

B. 1) AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Pool Level)
   2) Initiate makeup to the refueling cavity with any water source.

C. 1) AP/1/A/5500/025 (Damaged Spent Fuel)
   2) Notify reactor building fuel handling bridge operator to ensure air is isolated to the fuel handling bridge and any robotic tools.

D. 1) AP/1/A/5500/025 (Damaged Spent Fuel)
   2) Complete the transfer of the fuel assembly to the upender and lower it fully down.

Q34 Parent Question (2006 CNS NRC Q92 (Bank 4821 MODIFIED))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4821 CNS A

General Discussion

92

Answer A Discussion

Symptoms are correct for entry into AP/26 Case I Loss of Refueling Cavity Level and action taken is correct per the AP

Answer B Discussion

AP/26 is the correct procedure to be used in this situation and makeup to the refueling cavity is a correct action, but per OP/1/A/6200/13 (Filling, Draining and Purification of the Refueling Cavity) which only uses borated water sources.

Answer C Discussion

RAD-3, D/2 "1EMF 17 REACTOR BLDG REFUEL BRIDGE" is an entry symptom for AP/25 Case I Damaged Fuel in Reactor Building and the action taken is correct for AP/25 but AP/25 is not the correct procedure to use in this situation.

Answer D Discussion

1RAD-3, D/2 "1EMF 17 REACTOR BLDG REFUEL BRIDGE" is an entry symptom for AP/25 Case I Damaged Fuel in Reactor Building and completing the transfer to the upender and lowering it fully down is a logical, though incorrect action.

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2006 NRC Q92 (Bank 698)

Development References

References:
1. AP/25, AP/26, 1RAD-3 D/2
2. OP-CN-FH-FHS-02

Student References Provided

KA	KA_desc
SYS034 A1.02	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: (CFR: 41.5 / 45.5)Water level in the refueling canal ....

SYS001 A4.06 - Control Rod Drive System

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

Control rod drive disconnect/connect ....

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- While performing the RCCA movement test, Control Rod H-8 slips into the core to 200 steps withdrawn
- All other Control Bank D control rods are at 216 steps withdrawn as indicated on DRPI and step demand counters
- The crew is performing AP-14 (CONTROL ROD MALFUNCTION)

Based on the conditions above,

1) the MAXIMUM time allowed to restore Control Rod H-8 to within limits per Tech. Spec. 3.1.4 (ROD GROUP ALIGNMENT LIMITS) is ________.

2) in accordance with AP-14, the lift coil disconnect switch(s) for________ will be placed in the disconnect position when <u>initially</u> attempting to withdraw Control Rod H-8.

Which ONE (1) of the following completes the statements above?

A. 1. 1 hour
   2. ONLY rod H-8

B. 1. 1 hour
   2. all rods in the affected bank <u>except</u> H-8

C. 1. 30 minutes
   2. ONLY rod H-8

D. 1. 30 minutes
   2. all rods in the affected bank <u>except</u> H-8

General Discussion

In accordance with AP-14, when initially attempting to recover the misaligned rod by withdrawing the misaligned rod to the position of the other rods in the bank, the unaffected rods will have their lift coils disconnected.

Per TS 3.1.4, one hour is allowed to realign a misaligned rod to within group limits. 30 minutes is the AFD spec which is often utilized with misaligned rods.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible in that only the rod to be retrieved (H-8) will have its lift coil disconnected while the other rods in the affected bank remain connected during recovery. It is an option in AP-14 to move the bank to the position of the misaligned rod.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because AFD TS 3.2.3 action is 30 minutes.

Second part is plausible in that only the rod to be retrieved (H-8) will have its lift coil disconnected while the other rods in the affected bank remain connected during recovery. It is an option in AP-14 to move the bank to the position of the misaligned rod.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because AFD TS 3.2.3 action is 30 minutes.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant must demonstrate the ability to operate the correct lift coil disconnect switches when aligning a misaligned rod to the rest of its bank.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2008 CNS RO NRC Retake Q19 (Bank 1719)

Development References

REFERENCES:
AP-14 (Control Rod Malfunction) Rev 16
TS 3.1.4 (Rod Group Alignment Limits) Rev 184/166
TS 3.2.3 (AFD) Rev. 261/241
Lesson Plan OP-MC-IC-IRE (Rod Control System) Rev. 26

LEARNING OBJECTIVES:
OP-MC-IC-IRE Objective 15

Student References Provided

SYS001 A4.06 - Control Rod Drive System
Ability to manually operate and/or monitor in the control room: (CFR: 41.7/45.5 to 45.8)
Control rod drive disconnect/connect ....

401-9 Comments:	Remarks/Status

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION	PAGE NO. 2 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

1. **Dropped/Misaligned Rod**

- "RPI AT BOTTOM ROD DROP" alarm (1AD-2, D-9)
- "RPI AT BOTTOM > 1 ROD DROPPED" alarm (1AD-2, E-9)
- Individual rod "RB" indication on DRPI monitor (yellow or green rod with orange background)
- "DEVIATION > 12 STEPS" DRPI monitor alarm
- DRPI indicates misaligned rod(s)
- Demand step counters indicate misaligned group of rods
- "P/R CHANNEL DEVIATION" alarm (1AD-2, B-3)
- "P/R LOWER DET HI FLUX DEV OR AUTO DEFEAT" alarm (1AD-2, B-1)
- "P/R UPPER DET HI FLUX DEV OR AUTO DEFEAT" alarm (1AD-2, B-2)
- Nuclear Instrument indication of flux tilt
- Unanticipated rod withdrawal
- Sudden drop in T-Avg
- "T-REF/T-AVG ABNORMAL" alarm (1AD-6, B-10)
- Turbine load deceasing
- "PZR LO PRESS CONTROL" alarm (1AD-6, C-6)

2. **Failure of Rods to Move on Demand**

- No automatic rod motion occurring when expected
- No manual rod motion occurring when expected
- "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10)
- "T-AVG/T-REF FAILURE ROD STOP" alarm (1AD-2, B-7)

3. **Continuous Rod Movement**

- Unwarranted rod insertion or withdrawal
- "T-REF/T-AVG ABNORMAL" alarm (1AD-6, B-10)

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION	PAGE NO. 3 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
1. **IF two or more rods are either dropped OR misaligned by greater than 24 steps, THEN perform the following:** __ a. Trip reactor. __ b. GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
__ 2. **Place control rods in manual.**	
__ 3. **Check rod movement - STOPPED.**	**IF rod movement continues, THEN perform the following:** __ a. Trip reactor. __ b. GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
__ 4. **Check all rods - ALIGNED WITH ASSOCIATED BANK.**	**Perform the following:** **NOTE** DRPI problems are not addressed by this AP. __ a. IF misaligned rod(s) due to DRPI indication failure only, THEN exit this procedure. __ b. IF T-Avg has gone down, THEN lower Turbine load as necessary to restore T-Avg to T-Ref. __ c. GO TO Enclosure 1 (Response To Dropped or Misaligned Rod).
__ 5. **Check "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10) - DARK.**	__ **GO TO Enclosure 2 (Failure Of Rods To Move On Demand).**
__ 6. **Check "T-AVG/T-REF FAILURE ROD STOP" alarm (1AD-2, B-7) - DARK.**	__ **GO TO Enclosure 2 (Failure Of Rods To Move On Demand).**

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 1 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 5 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ **1. Announce occurrence on paging system.**	
2. Dispatch rod control system qualified IAE to perform the following: __ • Correct cause of misaligned rod. __ • Notify Control Room operators when auto or manual rod motion is available for reactivity control.	
__ **3. Do not move rods until IAE determines rod movement is available.**	
4. <u>IF AT ANY TIME</u> a runback occurs while in this procedure, <u>THEN</u> observe the following guidance: __ a. <u>**IF**</u> IAE has determined that it is permissible to move rods, <u>**THEN**</u> respond to the runback <u>**PER**</u> AP/1/A/5500/03 (Load Rejection). b. For all other circumstances, assume rod control is not available and respond to the runback as follows: __ 1) Trip Reactor. __ 2) <u>**GO TO**</u> EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
__ **5. Check "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10) - DARK.**	**Perform the following:** __ a. Do not move control rods while the "ROD CONTROL URGENT FAILURE" alarm is lit, unless instructed by IAE. __ b. <u>**IF AT ANY TIME**</u> IAE desires to reset "ROD CONTROL URGENT FAILURE" alarm, <u>**THEN**</u> depress the "ROD CONTROL ALARM RESET" pushbutton.

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 2 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 6 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Use OAC point M1P1385 (Reactor Thermal Power, Best Estimate) to determine reactor power in subsequent steps.**	
__ 7. **Check AFD (Tech Spec 3.2.3) - WITHIN TECH SPEC LIMITS.**	**IF reactor power greater than 50%, THEN perform the following:** __ a. Trip reactor. __ b. **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).

NOTE If any control rod is misaligned more than 12 steps, Step 15 will provide guidance for performing any Tech Spec required power reduction.

8. **REFER TO the following Tech Specs while continuing in this enclosure:**
   - __ Tech Spec 3.1.4 (Rod Group Alignment Limits)
   - __ Tech Spec 3.1.5 (Shutdown Bank Insertion Limits)
   - __ Tech Spec 3.1.6 (Control Bank Insertion Limits)
   - __ Tech Spec 3.2.4 (QPTR)
   - __ Ensure shutdown margin calculation is performed within 1 hour.

__ 9. **Contact Reactor Engineer for instructions.**

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 3 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 7 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. IF Tech Specs permit continued operation in the current mode for an unlimited period of time with control rod(s) misaligned, THEN notify station management of the following administrative time limit for operating with misaligned rod(s): __ a. Complete troubleshooting activities and realign all control rods within 48 hours. b. IF it appears all control rods cannot be realigned within 48 hours, THEN perform one of the following: __ • Shutdown to Mode 3. OR __ • Obtain PORC approval to continue operation beyond 48 hour time limit. __ **11. IF AT ANY TIME IAE desires to operate the lift coil disconnect switches as part of troubleshooting activities, THEN REFER TO OP/1/A/6150/008 (Rod Control), Enclosure 4.9 (Operating Lift Coil Disconnect Switches for Maintenance Troubleshooting).**	

Q35 References

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 12. **Check reactor power - GREATER THAN OR EQUAL TO 5%.**	**Perform the following:** __ a. Do not move rods until IAE determines rod movement is available. __ b. **IF** in Mode 2, **THEN** shutdown to Mode 3 **PER** OP/1/A/6100/003 (Controlling Procedure For Unit Operation). __ c. **IF** affected rod is in shutdown bank, **THEN** consider inserting associated shutdown bank after control banks have been inserted. __ d. Consult station management to determine plan for repairing affected rod. __ e. Exit this procedure.
13. **Maintain T-Avg within 1°F of T-Ref as follows:** __ • Adjust Turbine load. OR __ • Borate/Dilute NC System.	

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 5 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 9 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
14. Determine if power reduction is required as follows:	
__ a. Check any misaligned rod - GREATER THAN 12 STEPS MISALIGNED.	a. Perform the following: 1) **IF** QPTR within Tech Spec limits, **THEN** perform the following __ a) Maintain stable plant conditions. __ b) **GO TO** Step 16. 2) **IF** QPTR outside Tech Spec limits, **THEN** reduce power as follows: __ a) Do not move rods until IAE determines rod movement is available. __ b) Borate as required during power reduction to maintain T-Avg at T-Ref. __ c) Monitor AFD during load reduction. d) **IF AT ANY TIME** AFD reaches Tech Spec limit **AND** reactor power is greater than 50%, **THEN** perform the following: __ (1) Trip Reactor. __ (2) **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection). e) Reduce reactor power as required by Tech Specs **PER** one of the following procedures: __ • OP/1/A/6100/003 (Controlling Procedure For Unit Operation), Enclosure 4.2 (Power Reduction) OR __ • AP/1/A/5500/04 (Rapid Downpower). __ f) **GO TO** Step 16.

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 7 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 11 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. **Reduce reactor power below 50% prior to rod realignment as follows:**	
__ a. Ensure reactor power is less than 75% within 2 hours of rod misalignment to comply with Tech Spec 3.1.4.	
__ b. Check QPTR (Tech Spec 3.2.4) - WITHIN TECH SPEC LIMITS.	__ b. Ensure reactor power is also reduced in subsequent steps as required **PER** Tech Spec 3.2.4 (QPTR).
__ c. Continue reducing load as directed in subsequent steps until reactor power is less than 50% to comply with Reactor Engineering requirements.	
d. Observe the following limitations during power reduction:	
__ 1) Do not move rods until IAE determines rod movement is available.	
__ 2) Borate as required during power reduction to maintain T-Avg at T-Ref.	
__ 3) Monitor AFD during load reduction.	
4) **IF AT ANY TIME** AFD reaches Tech Spec limit **AND** reactor power is greater than 50%, **THEN** perform the following:	
__ a) Trip Reactor.	
__ b) **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	

MNS AP/1/A/5500/14 UNIT 1	ROD CONTROL MALFUNCTION Enclosure 1 - Page 8 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 12 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. (Continued)	
e. Reduce reactor power to less than 50% **PER** one of the following procedures:	
__ • OP/1/A/6100/003 (Controlling Procedure For Unit Operation), Enclosure 4.2 (Power Reduction)	
OR	
__ • AP/1/A/5500/04 (Rapid Downpower).	
__ f. Check only one rod - MISALIGNED.	f. Perform the following: 1) Do not continue until the following conditions for rod realignment are satisfied: __ • Reactor power is stable less than 50%. __ • Any additional requirements as specified by Reactor Engineering. __ 2) **GO TO** Step 16.
g. Do not continue until the following conditions for rod realignment are satisfied: __ • Reactor power is stable less than 50%. __ • 15 hours have elapsed from the time of rod misalignment.	
__ 16. **Do not continue in this enclosure until troubleshooting is complete and IAE determines rod realignment is permissible (either by moving misaligned rod(s) or by moving other rods in bank).**	
__ 17. **Check misaligned rod(s) - HIGH WITH RESPECT TO ITS ASSOCIATED BANK.**	__ **GO TO Step 26.**

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 14 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 18 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
25. (Continued)	
__ h. Check rods - REALIGNED WITHIN ±12 STEPS.	h. IF rods cannot be realigned to within ±12 steps, **THEN** perform the following: __ 1) Notify station management of status of rod coil disconnect switches. __ 2) Contact station management for further guidance. __ 3) Do not continue until guidance obtained.
__ i. **GO TO** Step 47.	
__ 26. **Check misaligned rod(s) - LOW WITH RESPECT TO ITS ASSOCIATED BANK.**	__ **RETURN TO Step 17.**
27. **Check DRPI indication for misaligned rod:** __ • AT ZERO STEPS OR __ • AT SIX STEPS.	__ **GO TO Step 39.**
28. **Record the following in the Reactor Operator Logbook:**	
__ a. Record step counter readings for all rod groups in affected bank.	
__ b. Check affected rod location - IN CONTROL BANK.	__ b. **GO TO** Step 29.
__ c. Dispatch IAE to obtain Bank Overlap Display in Logic Cabinet (Rod Control Cabinets approximately 5 ft from floor).	
__ d. Record bank overlap display.	

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 17 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 21 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
36. (Continued)	
	__ e. Dispatch IAE to ensure master cycler counter (card A105) in Logic Cabinet indicates correctly.
	__ f. Dispatch Reactor Engineer to reset OAC bank position to indicate actual bank position per the OAC (turn on code "RODS").
	__ g. **REFER TO** Tech Spec 3.1.4 (Rod Group Alignment Limits).
	__ h. **RETURN TO** Step 16 of this enclosure.
__ 37. **Do not continue until dropped rod is withdrawn to its recorded bank position.**	
__ 38. **GO TO Step 47.**	
39. **Select method to realign rod(s) as follows:**	
__ • To withdraw the misaligned rod(s) until aligned with rest of associated bank, **GO TO** Step 40.	
OR	
__ • To leave the misaligned rod(s) at present location and insert rest of associated bank, **GO TO** Step 46.	

Q35 References

MNS AP/1/A/5500/14 **UNIT 1**	ROD CONTROL MALFUNCTION Enclosure 1 - Page 18 of 26 **Response To Dropped or Misaligned Rod**	PAGE NO. 22 of 39 Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
40. Record the following in the Reactor Operator Logbook:	
__ a. Record step counter readings for all rod groups in affected bank.	
__ b. Check affected rod location - IN CONTROL BANK.	__ b. **GO TO** Step 41.
__ c. Dispatch IAE to obtain Bank Overlap Display in Logic Cabinet (Rod Control Cabinets approximately 5 ft from floor).	
__ d. Record bank overlap display.	
__ **41. Open coil disconnect switches on all lift coils in affected bank except for misaligned rod(s).**	

CAUTION **Failure to pause between each bank selected may result in dropping rods.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ **42. Transfer rod control to affected bank using "CRD BANK SELECTOR", pausing at least one second between each position selected.**	
__ **43. Check "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10) - DARK.**	**Perform the following:** __ a. Dispatch IAE to investigate alarm. __ b. Do not continue until alarm reset.

Q35 References

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Rod Group Alignment Limits

LCO 3.1.4 All shutdown and control rods shall be OPERABLE, with all individual indicated rod positions within 12 steps of their group step counter demand position.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rod(s) untrippable.	A.1.1 Verify SDM is within the limit specified in the COLR. OR A.1.2 Initiate boration to restore SDM to within limit. AND A.2 Be in MODE 3.	1 hour 1 hour 6 hours
		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One rod not within alignment limits.	B.1 Restore rod to within alignment limits.	1 hour
	OR	
	B.2.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	OR	
	B.2.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.2.2 Reduce THERMAL POWER to ≤ 75% RTP.	2 hours
	AND	
	B.2.3 Verify SDM is within the limit specified in the COLR.	Once per 12 hours
	AND	
	B.2.4 Perform SR 3.2.1.1.	72 hours
	AND	
	B.2.5 Perform SR 3.2.2.1.	72 hours
	AND	
	B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.	5 days

(continued)

Q35 References

3.2 POWER DISTRIBUTION LIMITS

3.2.3 AXIAL FLUX DIFFERENCE (AFD)

LCO 3.2.3 The AFD in % flux difference units shall be maintained within the limits specified in the COLR.

---NOTE---
The AFD shall be considered outside limits when two or more OPERABLE excore channels indicate AFD to be outside limits.

APPLICABILITY: MODE 1 with THERMAL POWER ≥ 50% RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. AFD not within limits.	A.1 Reduce THERMAL POWER to < 50% RTP.	30 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.3.1 Verify AFD within limits for each OPERABLE excore channel.	In accordance with the Surveillance Frequency Control Program <u>AND</u> Once within 1 hour and every 1 hour thereafter with the AFD monitor alarm inoperable

EXAM BANK QUESTION: 1719 CNS **D**

Unit 1 is operating at 100% power. Given the following:

- While performing the RCCA movement test, control rod H-8 slips into the core to 200 steps withdrawn
- All other Bank D control rods are at 216 steps withdrawn as indicated on DRPI and step demand counters
- The crew is performing AP/1/A/5500/014 (Control Rod Misalignment) and currently referring to OP/1/A/6150/008 (Rod Control)

1. What is the maximum time allowed to restore rod H-8 to within limits per Technical Specification 3.1.4 (Rod Group Alignment Limits)?
2. Which control rod lift coil(s) will be disconnected per OP/1/A/6150/008 (Rod Control), when initially attempting to recover control rod H-8?

A. 1. 30 minutes
   2. Rod H-8

B. 1. 30 minutes
   2. All rods in the affected bank except H-8

C. 1. 1 hour
   2. Rod H-8

D. 1. 1 hour
   2. All rods in the affected bank except H-8

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 1719 CNS D

General Discussion

When initially attempting to recover the misaligned rod, the unaffected rods will have their lift coils disconnected per OP/1/A/6150/008, enclosure 4.6, step 2.11.

Per TS 3.1.4, one hour is allowed to realign a misaligned rod to within group limits. 30 minutes is the AFD spec which is often utilized with misaligned rods.

Answer A Discussion

Plausible because AFD TS 3.2.3 action is 30 minutes. Plausible that only the rod to be retrieved (H-8) will have its lift coil disconnected while the other rods in the affected bank remain connected during recovery

Answer B Discussion

Plausible because AFD TS 3.2.3 action is 30 minutes. Second part is correct; the unaffected rods will have their lift coils disconnected.

Answer C Discussion

TS 3.1.4 action time is correct. Plausible that only the rod to be retrieved (H-8) will have its lift coil disconnected while the other rods in the affected bank remain connected during recovery

Answer D Discussion

Correct: TS 3.1.4 action time is correct. The unaffected rods will have their lift coils disconnected when initially attempting to recover the misaligned rod.

Basis for meeting the KA

Question deals with an inoperable and possibly stuck control rod and asks about rod disconnect switches for attempting retrieval (which will also determine if the rod is indeed stuck).

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

Development References
AP/14 OP/1/A/6150/008 TS 3.1.4 TS 3.2.3

Student References Provided

KA	KA_desc
APE005 AK2.02	Knowledge of the interrelations between the Inoperable / Stuck Control Rod and the following: (CFR 41.7 / 45.7)Breakers, relays, disconnects, and control room switches ....

SYS072 K4.01 - Area Radiation Monitoring (ARM) System
Knowledge of ARM system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)
Containment ventilation isolation ....

Given the following initial conditions on Unit 2:

- Unit is in Mode 6
- Fuel loading in progress

Subsequently,

- 2EMF-39(L) (CONTAINMENT GAS-LO RANGE) Trip 2 alarm is received
- 2EMF-3 (CONTAINMENT REFUELING BRIDGE) Trip 2 alarm is received

Based on the conditions above,

1) the Containment Evacuation alarm ________ automatically actuate.

2) VP ________ be automatically secured.

Which ONE (1) of the following completes the statements above?

A. 1. will
   2. will

B. 1. will
   2. will NOT

C. 1. will NOT
   2. will

D. 1. will NOT
   2. will NOT

General Discussion

Entry conditions for AP-25 are:
Containment evacuation alarm is activated by a Trip 2 on 1EMF-16/2EMF-3 (CONTAINMENT REFUELING BRDG) and/or Trip 2 on 1(2) EMF-39L (Containment Gas) unless both SR high flux trips are blocked.

A trip 2 on EMF-38, 39 or 40 will generate an Sh signal which will secure VQ and VP

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible if the applicant concludes that VP will be left in service under these conditions to take advantage of the charcoal filtration.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may conclude that the SR Hi Flux Trips are blocked due to fuel loading. However these are blocked on Reactor startup after proper overlap with the intermediate range is observed.

Second part is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may conclude that the SR Hi Flux Trips are blocked due to fuel loading. However these are blocked on Reactor startup after proper overlap with the intermediate range is observed.

Second part is plausible if the applicant concludes that VP will be left in service under these conditions to take advantage of the charcoal filtration.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the design features that actuate the containment evacuation alarm and provide for containment ventilation isolation.

Basis for Hi Cog

This is a high cognitive question because the applicant is required to perform an analysis of the conditions given to determine whether the Containment Evacuation alarm will be activated.

Then, the applicant must recall from memory the compensatory actions provided by an Sh signal.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-WE-EMF (Radiation Monitoring) Rev 38 Section 2.1.5. & 2.2.1

LEARNING OBJECTIVES:
AP25001
OP-MC-WE-EMF Objective 3

Student References Provided

SYS072 K4.01 - Area Radiation Monitoring (ARM) System

Knowledge of ARM system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

Containment ventilation isolation ....

401-9 Comments:	Remarks/Status

Q36 References

Stopping the unfiltered exhaust fans should terminate a release originating from the unfiltered exhaust.

WG discharges are normally monitored and if release rate limits are exceeded, terminated by 0EMF50. 1EMF36 will duplicate 0EMF50 actions.

Operator Fundamental Focus; Monitoring and Teamwork
Reinforce *the fundamental attribute for the CRS to track degraded and inoperable technical specification equipment.* ***Relate*** *this fundamental behavior to the fact that it is preferable to not make a release with either 1EMF-36 or 0EMF-50 inoperable. Controlling EMF operability (1EMF-36 or 0EMF-50), and any necessary inoperable actions, is a responsibility of the entire crew and communicating problems to the CRS, so that the appropriate Tech Spec actions can be taken, support the Operator Fundamental Teamwork.*

EMF35, 36, 37 use a particulate-iodine-gas assembly. The Gas channel has a high and low range. The low range uses a plastic Scint detector while the high range uses a GM detector. The iodine portion uses a NaI Scint.

There are Loss of Sample Flow annunciators associated with both the EMF vacuum pump and the RP Composite Sampler. However, the actions required by SLC 16.11-7 are different for each. Loss of the Unit Vent Composite Sampler requires RP to estimate flow once per four hours. (Ref. PIP 1-M96-2953)

2.1.5 Containment Airborne Monitor

The containment air is sampled by the following channels:

- 1(2) EMF 38 (L) - Unit 1 (2) Containment Particulate (Low Range)
- 1(2) EMF 39 (L) - Unit 1(2) Containment Gas (Low Range)
- 1(2) EMF 39 (H) - Unit 1(2) Containment Gas (High Range)
- 1(2) EMF 40 - Unit 1(2) Containment Iodine

Objective # 2

The above channels monitor the particulate, iodine and gaseous activity levels in the:

- Containment atmosphere during normal unit operation.
- Containment purge exhaust flow during containment purge operations.

These channels monitor containment to warn personnel if containment atmospheric activity exceeds preset limits and to secure liquid and atmospheric releases from containment.

Q36 References

Objective # 4

Three sample points, selected from the control console, provide coverage of the containment. Sample points are located in:

- Upper Containment
- Lower Containment
- Incore Instrumentation Room

The three sample points are monitored by a single Particulate-Iodine-Gas detector assembly. Selection of the point to be sampled is made using the toggle switches on the sample flow select module on the control cabinet (refer to Drawing 7.1). To prevent damage to the sample pump, at least one flow path must be opened. The sample air is returned to the containment.

According to the basis of T.S. 3.4.15 (RCS Leakage Detection Instrumentation), a sample from the lower containment region is required for NC leakage detection. The reason is that the NC system is physically located within the lower containment region. The incore area and lower containment samples are both obtained from the lower containment region. Applicable RP and Operations procedures reflect this requirement. For example, the Semi-Daily PT has a note to alert the operators that EMF-38 is inoperable if the sample pump is selected to Upper Containment only for greater than 15 minutes.

Objective # 3

A Trip 2 high radiation alarm on EMF-38(L), EMF-40(L), or EMF-39(L) channels will stop the CFAES pumps and the Incore Sump pump. Also, trip 2 will initiate a Containment Ventilation isolation signal (S_H) through the Solid State Protection System. This S_H signal will:

- Secure VQ
- Secure VP

A high alarm on the EMF-39(L) (gaseous) channel will also sound the Containment Evacuation Alarm unless both source range high flux trips are blocked.

The purpose of the auto actions are to:

- terminate a release originating in containment which is discharging to the Unit Vent if the release limits are exceeded.
- Stop the containment sump pumps to prevent pumping potentially highly contaminated water into the Aux. Building (i.e., FDT or WEFT).
- Sound the containment evacuation alarm to inform personnel to leave the containment due to the potential for high airborne concentration existing in containment.

The Gas channel has a high and low range. The low range uses a plastic Scint detector while the high range uses a GM detector. The iodine portion uses a NaI Scint.

Q36 References

an accident or post-accident condition. This EMF utilizes a sample probe located within the Unit Vent.

Objective #3

A high radiation alarm (Trip I) on 1EMF-36 (HH) will shut off the 1EMF 35/36/37 sample pump. A high alarm on 2EMF 36 (HH) will shut off the 2EMF 35/36/37 sample pump.

Note that the automatic action occurs on Trip I instead of Trip II.

EMF 36(HH) uses an Ionization chamber detector. The instrument range is 1 to 10^8 R/hr.

2.2 Area Monitors Functional Description

2.2.1 Area Radiation Monitors - Low Range

Objective #2

Detectors are situated to monitor the following areas for radiation hazards to personnel.

- Auxiliary Building Corridors: 1EMF 1, 2, 3, 4, 6, 7, 8, 10, 23; 2EMF 9
- Sample Rooms: 1EMF 5; 2EMF 1
- Control Room: 1EMF 12
- Hot Machine Shop: 1EMF 15
- Laboratory (RP Shift Office) 1EMF 13
- Waste Drumming and Shipping Area: 1EMF 11 & 14
- Rx Bldg and SFP Refueling Bridge: 1EMF 16 and 17; 2EMF 3 and 4
- Incore Instrumentation Rooms: 1EMF 9; 2EMF 2
- New Fuel Buildings: 1EMF 20 & 21; 2EMF 7 & 8
- Diesel Generator Rooms: 1EMF 28; 2EMF 14
- Technical Support Center: EMF 22
- QA Radiographic Shooting Vault: EMF 29

Objective #3

No control actions are performed by these channels with the exception of 1EMF-16 and 2EMF-3 (Containment Refueling Bridge). On a Trip 2 High Radiation Alarm, the respective EMF (1EMF-16 and 2EMF-3) will actuate the Containment Evacuation alarm. This alarm is blocked when both Source Range high flux trips are blocked.

These channels use a Geiger-Mueller detector. The instrument range is 0.1 to 10^4 mr/hr.

SYS011 K3.03 - Pressurizer Level Control System (PZR LCS)
Knowledge of the effect that a loss or malfunction of the PZR LCS will have on the following: (CFR: 41.7 / 45.6)
PZR PCS ....

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- All Pressurizer heaters are energized in MANUAL
- The SLIM for 1NV-238 (CHARGING FLOW CONTROL) has been placed in MANUAL due to a malfunction of the Pressurizer Level Master Controller
- The OATC reduces the 1NV-238 SLIM output to reduce Pressurizer level
- Charging Line Flow is inadvertently reduced to 18 GPM

If the 1NV-238 controller output remains constant, after 5 minutes Pressurizer level will be ___(1)___ AND the Pressurizer heaters will be ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. INCREASING
2. OFF

B. 1. INCREASING
2. ON

C. 1. DECREASING
2. OFF

D. 1. DECREASING
2. ON

General Discussion

Letdown will isolate and pressurizer heaters will de-energize if charging flow remains <20 gpm for > 20 seconds.

With this question, the changing flow is lowered to 18 GPM which would result in a L/D isolation. Approximately 12 GPM will still be leaving the NC system via NCP seal leakoff so with 18 GPM total charging, PZR level will be increasing and PZR heaters will be off.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is correct and therefore plausible.

Part (2) is plausible if the applicant does not recall that in addition to the letdown isolation when charging flow decreases to less than 20 GPM for 20 seconds the Pressurizer heaters are de-energized as well.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is plausible if the applicant fails to realize that letdown is isolated or concludes that NCP seal leakoff is greater than the current charging flow.

Part (2) is correct and therefore plausible.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is plausible if the applicant fails to realize that letdown is isolated or concludes that NCP seal leakoff is greater than the current charging flow.

Part (2) is plausible because the heaters do not de-energize due to PZR low level until level reaches 17%. If the applicant fails to recall that heaters will be off due to the low flow condition associated with charging this answer is plausible.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of how a malfunction on the Pzr Level Control system (and subsequent operator action to correct) can effect the Pzr Pressure Control system (Pzr heater operation).

Basis for Hi Cog

This is a higher cognitive level question because it require more than one mental step. First the applicant must analyze the given condition to determine the status of the LCS and the potential consequences of the initial conditions. The applicant must then recall from memory the protective features which can be affected by operating the level control system in the configuration given and determine which protective actions are going to occur and in what order.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2010 MNS RO NRC Q30 (Bank 2730)

Development References

REFERENCES:
OP-MC-PS-ILE-DCS (Pressurizer Level Control) Sections 2.4.1 & 2.5.1 Rev. 4D

LEARNING OBJECTIVES:
OP-MC-PS-ILE-DCS Objectives 6 & 8

Learning Objective:
1) PS-ILE-DCS #17

Student References Provided

SYS011 K3.03 - Pressurizer Level Control System (PZR LCS)

Knowledge of the effect that a loss or malfunction of the PZR LCS will have on the following: (CFR: 41.7 / 45.6)

PZR PCS ....

401-9 Comments:	Remarks/Status

Q37 References

Level to Actual level and develops a demand signal. The demand varies as the error varies in the automatic mode. It also allows manual control of the output. The output is sent to the Controller for NV-238.

When the "Soft Control" or the SLIMs for NV-238 is placed in "Manual" or the SLIMs is taken to "L-MANUAL" the Pressurizer Level Master Controller is swapped to "Manual" also by DCS. However, when the "Soft Control" or the SLIMs for NV-238 is returned to "AUTO" the operator must place the Pressurizer Level Master Controller back in "AUTO".

Objective #6

On the Pressurizer Level Master Controller, located on the NV - CHARGING FLOW CONTROL Graphic in DCS, the LI (Limit Increase) and LD (Limit Decrease) buttons are used to set a minimum limit "LM" for automatic charging flow to ensure seal injection flow to the NC Pumps is maintained. There is an "LM" setpoint window and also an "LM" bargraph displayed on the Level Master controller. The limit is set in gallons per minute. The normal setting is 47 gpm. This function is bypassed when the Pressurizer Level Master Controller or the SLIMs for NV-238 is placed in "MANUAL". This function is also bypassed when the SLIMs for NV-238 is placed in "L-MANUAL". This limit value is set up per OP/1(2)/A/6200/001A (Chemical and Volume Control System Letdown) Enc. 4.1.

Objective #7

When in "MANUAL", the output of the controller sets a fixed demand (gpm) for NV-238. Increasing the output causes NV-238 to open if NV-238 is in Auto, while decreasing the output causes NV-238 to close.

Objective #3

2.4.2 NV-238 SLIMs Station

This SLIMs station is used to control the position of NV-238. In AUTO, it compares the output of the Level Master to Selected Charging Flow (which is developed using a Median Select Algorithm with three charging flow inputs) to position the valve for needed charging flow. In "MANUAL or L-MANUAL", UP/DOWN push-button arrowheads are used to position the valve.

When the "Soft Control" or the SLIMs is taken to "MANUAL" or the SLIMs is taken to "L-MANUAL" the Pressurizer Master Level Controller is swapped to "MANUAL" also by DCS. However, when the "Soft Control" or the SLIMs for NV-238 is returned to "AUTO" the operator must place the Pressurizer Level Master Controller back in "AUTO".

Q37 References

Objective #3

2.4.3 PD Pump SLIMs Station

This station is used to control the speed of the PD Pump. The Controller will be a MANUAL only controller. The UP/DOWN arrowhead push-buttons are used to adjust speed.

If the AUTO pushbutton is depressed the "LED" on the AUTO pushbutton will illuminate and immediately return to the MANUAL pushbutton "LED" illuminating.

2.5 Control Functions

2.5.1 PZR Low Level

Objective #8

In the event PZR Level decreases to 17%, valves NV1A, NV2A, NV457A, NV458A and NV35A are automatically closed. This isolates letdown to prevent further loss of inventory and minimize the possibility of uncovering the heaters. At the same time all PZR Heater groups are de-energized to protect them from overheating should they become uncovered. An Annunciator Alarm, PZR LO LEVEL / LO CHGING FLOW HTRS OFF & L/D SECURED, alerts the operator of the low level condition. Another feature which will isolate letdown and de-energize the pressurizer heaters is charging flow lowering to <20 gpm for > 20 seconds. The Selected Charging flow signal is developed with a Median Select algorithm with input from three (3) transmitters measuring charging flow. The low charging flow signal is maintained for 15 seconds and then clears, therefore if Pressurizer Level is >17% the Pressurizer Heaters can be placed back into service even though charging flow may not have been restored.

Objective #10

Once level has increased to greater than 17% all heater groups must be manually re-energized and letdown can be re-established. This is accomplished by selecting "MAN" on "A", "B", and "D" Heater MAN/AUTO Selector Switch. This allows closing the 600V supply breaker from their control switches on MC-5. "C" Heater supply breaker is closed via the switch on MC-10. There is no "MAN/AUTO" switch for "C" Heater.

NOTE: If a Safety Injection has occurred, the Safety Injection signal and the sequencers must be reset in order to close the A & B heater breakers.

Operator Fundamental Focus; Control

***Reinforce** that operators must use know which steps result in undesirable consequences if they are not performed correctly. In this case the operators must be aware of all actions necessary to reenergize the heaters based on plant status.*

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2010 MNS SRO NRC Examination QUESTION 30 2530

SYS011 K3.02 - Pressurizer Level Control System (PZR LCS)
Knowledge of the effect that a loss or malfunction of the PZR LCS will have on the following: (CFR: 41.7 / 45.6)
RCS ....

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- All Pressurizer heaters are energized in MANUAL
- The SLIM for 1NV-238 (Charging Flow Control) has been placed in MANUAL due to a malfunction of the Pressurizer Level Master Controller
- The OATC reduces the 1NV-238 SLIM output to reduce Pressurizer level
- Charging Line Flow is inadvertently reduced to 18 GPM

If the 1NV-238 controller output remains constant, after 5 minutes Pressurizer level will be __(1)__ AND the Pressurizer heaters will be __(2)__.

Which ONE (1) of the following completes the statement above?

A. 1. DECREASING
2. OFF

B. 1. DECREASING
2. ON

C. 1. INCREASING
2. OFF

D. 1. INCREASING
2. ON

2010 MNS SRO NRC Examination QUESTION 30 2530 **C**

General Discussion

On the Pressurizer Level Master Controller, located on the NV - CHARGING FLOW CONTROL Graphic in DCS, the LI (Limit Increase) and LD (Limit Decrease) buttons are used to set a minimum limit "LM" for automatic charging flow to ensure seal injection flow to the NC Pumps is maintained. There is an "LM" setpoint window and also an "LM" bargraph displayed on the Level Master controller. The limit is set in gallons per minute. The normal setting is 35 gpm. This function is bypassed when the Pressurizer Level Master Controller or the SLIMs for NV-238 is placed in "MANUAL". This function is also bypassed when the SLIMs for NV-238 is placed in "L-MANUAL". This limit value is set up per OP/1(2)/A/6200/001A (Chemical and Volume Control System Letdown) Enc. 4.1.

In the event PZR Level decreases to 17%, valves NV1A, NV2A, NV457A, NV458A and NV35A are automatically closed. This isolates letdown to prevent further loss of inventory and minimize the possibility of uncovering the heaters. At the same time all PZR Heater groups are de-energized to protect them from overheating should they become uncovered. An Annunciator Alarm, PZR LO LEVEL HTRS OFF & LETDN SECURED, alerts the operator of the low level condition. Another feature which will isolate letdown and de-energize the pressurizer heaters is charging flow lowering to <20 gpm for > 20 seconds.
With this question, the changing flow is lowered to 18 GPM which would result in a L/D isolation. Approximately 12 GPM will still be leaving the NC system via NCP seal leakoff so with 18 GPM total charging, PZR level will be increasing and PZR heaters will be off.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is plausible if the applicant fails to realize that letdown is isolated or concludes that NCP seal leakoff is greater than the current charging flow.

Part (2) is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is plausible if the applicant fails to realize that letdown is isolated or concludes that NCP seal leakoff is greater than the current charging flow.

Part (2) is plausible because the heaters do not de-energize due to PZR low level until level reaches 17%. If the applicant fails to recall that heaters will be off due to the low flow condition associated with charging this answer is plausible.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part (1) is correct and therefore plausible.

Part (2) is This answer is plausible if the applicant does not recall that in addition to the letdown isolation when charging flow decreases to less than 20 GPM for 20 seconds the Pressurizer heaters are de-energized as well.

Basis for meeting the KA

The Pressurizer is part of the RCS. Any malfunction that effects Pressuirzer level effects RCS inventory and any malfunction that effects Pressurizer pressure effects RCS pressure. Since these malfunctions/operations affect both Pressurizer pressure and level, RCS pressure and inventory are both effected. Therefore, the KA is matched.

Basis for Hi Cog

This is a higher cognitive level question because it require more than one mental step. First the applicant must analyze the given condition to determine the status of the LCS and the potential consequences of the initial conditions. The applicant must then recall from memory the protective features which can be affected by operating the level control system in the configuration given and determine which protective actions are going to occur and in what order.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Q37 Parent Question (2010 MNS NRC Exam Q30 (Bank 2730))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2010 MNS SRO NRC Examination QUESTION 30 2530

Development References
Learning Objective: 1) PS-ILE-DCS #17 References: 1) Lesson Plan OP-MC-PS-ILE-DCS Sections 2.4.1 & 2.5.1

Student References Provided

SYS011 K3.02 - Pressurizer Level Control System (PZR LCS)
Knowledge of the effect that a loss or malfunction of the PZR LCS will have on the following: (CFR: 41.7 / 45.6)
RCS ....

401-9 Comments:

Remarks/Status
Consider Modifing Q to a fill in the blank. It will read better. Pressurizer level is ____ and pressurizer heaters are ___. Is there enough information for the applicant to calc whether or not heaters are on or off? Facility re-confirm. 05/20/101 Re-wrote question to be fill in the blank. The applicant does not need to calculate whether the heaters are on or off. With charging flow reduced to less than 20 GPM for 20 sec., letdown is automatically isolated and the heaters are automatically secured. 05/31/10 Removed "Assume no other operator actions have been taken" from stem. Revised question approved. RFA 06/07/10 Revisited question due to high miss rate. Changed 8 GPM to 18 GPM to be more operationally valid. Approved revised question. RFA 07/06/10

SYS086 K5.04 - Fire Protection System (FPS)

Knowledge of the operational implication of the following concepts as they apply to the Fire Protection System: (CFR: 41.5 / 45.7)

Hazards to personnel as a result of fire type and methods of protection ...

Given the following conditions on Unit 1:

- 1AD-13 / E3 (FIRE DET SYS ALERT) is in alarm
- An electrical fire inside the auxiliary building cable spreading room has been reported
- AP-45 (PLANT FIRE) has been implemented

Fire suppression for the affected area will be accomplished by ___(1)___.

Hazards to personnel due to this type of suppression would be ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. automatic sprinkler actuation
   2. electrical shock

B. 1. automatic halon actuation
   2. displacement of oxygen

C. 1. actuating a manual Cardox system
   2. displacement of oxygen

D. 1. opening a manual isolation valve
   2. electrical shock

General Discussion

OP-MC-SS-RFY lesson plan states that manually operated Mulsifyre systems are provided for the Unit 1 and Unit 2 cable rooms and ETA HVAC equipment rooms. These systems are further described as "Consisting of a number of open spray nozzles with locked closed manual isolation valves."

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since extensive use of Automatic sprinkler deluge systems is employed at MNS, typically protecting systems containing oil, or other class B fuels, as well as ventilation systems and this type of suppression system would create an electrical shock hazard.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since Halon 1301 Total Flooding systems are used in the DG Rooms, the CA Pump rooms and the Computer Room in the Admin Building and Halon does provide protection against electrical fires by removing oxygen.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since a manual cardox pressure system is used to initiate halon fire suppression for the D/G rooms at MNS and Halon does provide protection against electrical fires by removing oxygen.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched since the applicant is required to have knowledge of the operational implications and personnel hazards associated with the Fire Protection system suppression method required to address the given conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2015 MNS NRC Q62 Bank #5967

Development References

REFERENCES:
OP-MC-SS-RFY (Fire Protection) Rev. 30 Section 2.9

LEARNING OBJECTIVES:
NONE

Student References Provided

SYS086 K5.04 - Fire Protection System (FPS)

Knowledge of the operational implication of the following concepts as they apply to the Fire Protection System: (CFR: 41.5 / 45.7)

Hazards to personnel as a result of fire type and methods of protection ...

401-9 Comments:

Remarks/Status

Q38 References

- **KC Pumps (750, 733 elev)**
- **695 elev. corridor**
- **Equipment decon room**
- **NC Pumps 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D**
- **Lower Containment Filter Units 1A, 1B, 2A, 2B**
- **Pipe corridor Units 1 & 2**
- **Annulus Units 1 & 2**

2.9 Components/Areas Protected by Mulsifyre System

Objective #11

The Automatic deluge (Mulsifyre) systems, which provide fixed spray patterns of water similar to a sprinkler system, are provided for:

- **Main and station oil filled power transformers (1A, 1B, 2A & 2B)**
- **Auxiliary transformers(1ATA, 1ATB, 2ATA, & 2ATB)**
- **Auxiliary Electric Boiler oil filled transformers (1ATE, 2ATE)**
- **Turbine oil reservoirs, oil piping, and bearings in Unit 1 & 2 as follows:**
  - **Main Turbine piping and bearings**
  - **MTOT**
  - **FWPT lube oil reservoir**
  - **Hydrogen seal oil unit**
  - **D/G lube oil transfer storage tanks(clean and dirty)**
  - **Main Turbine lube oil transfer tanks**
  - **Oil Purifier areas**
  - **Lube Oil house in service building**
- **Acetylene and oxygen storage in the yard**

Manually operated mulsifyre systems are provided for the unit 1 & 2 cable rooms and for the 1(2)ETA HVAC equipment rooms. These systems consist of a number of open spray nozzles with locked closed manual isolation valves. When the valve is opened, water discharges from all the nozzles in the system.

The following HVAC filters contain built in deluge systems:

- **VE filters (1A, 1B, 2A, 2B)**
- **Fuel Pool area filters Unit 1 & 2**
- **Auxiliary Building exhaust filters (1A, 1B, 2A, 2B)**
- **Reactor Building Purge Exhaust filters (1A, 1B, 2A, 2B)**
- **Control Room Ventilation Unit 1 & 2**
- **Counting Room supply unit**
- **Incore Instrumentation room purge exhaust filter Unit 1 & 2**
- **Onsite TSC filter unit**

C

ILT-31 MNS SRO NRC Examination QUESTION 62 62

APE067 AA2.03 - Plant Fire On Site
Ability to determine and interpret the following as they apply to the Plant Fire on Site: (CFR: 43.5 / 45.13)
Fire alarm ....

Given the following conditions on Unit 1:

- Unit 1 is at 100% RTP
- 1AD-13 / E3 (FIRE DET SYS ALERT) is in alarm
- An electrical fire inside the auxiliary building cable spreading room has been reported
- AP-45 (PLANT FIRE) has been implemented

Fire suppression for the affected area will be accomplished by ________.

Which ONE (1) of the following completes the statements above?

A. automatic halon actuation

B. automatic sprinkler actuation

C. an AO dispatched to open a MANUAL deluge valve

D. an AO dispatched to actuate a manual Cardox system

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 62 | 62 | **C**

General Discussion

OP-MC-SS-RFY lesson plan states that manually operated Mulsifyre systems are provided for the Unit 1 and Unit 2 cable rooms and ETA HVAC equipment rooms. These systems are further described as "Consisting of a number of open spray nozzles with locked closed manual isolation valves."

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible since Halon 1301 Total Flooding systems are used in the DG Rooms, the CA Pump rooms and the Computer Room in the Admin Building and Halon does provide protection against electrical fires by removing oxygen

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible since extensive use of Automatic sprinkler deluge systems is employed at MNS, typically protecting systems containing oil, or other class B fuels, as well as ventilation systems.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible since a manual cardox pressure system is used to initiate halon fire suppression for the D/G rooms at MNS.

Basis for meeting the KA

The K/A is matched since the applicant is required to respond to the Fire Detection system alert annunciator and then determine the appropriate action required to ensure fire suppression actuation occurs.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2009 MNS RO Retake Q61 (Bank 2261)

Development References

REFERENCES:
OP-MC-SS-RFY Section 2.9

LEARNING OBJECTIVES:
NONE

Student References Provided

APE067 AA2.03 - Plant Fire On Site

Ability to determine and interpret the following as they apply to the Plant Fire on Site: (CFR: 43.5 / 45.13)

Fire alarm ....

401-9 Comments:

Remarks/Status

401-9 Comment from Chief Examiner: UNSAT

Question does not meet the K/A. There is a fire detection system. See OP/0A/6400 002C.

Question is Unsatisfactory due to not meeting the K/A.

C

Facility Response: The facility has had this specific K/A selected on at least one other NRC examination in the past. It is the facilities' belief (as it has always been with this specific K/A), that the intent of this K/A to test knowledge of a Plant Fire alarm (i.e. Site-Wide Fire alarm) and not alarms on the fire protection/detection/suppression system panels (as these are "zone" alarms and not plant-wide alarms). That belief is based on the fact that there are many plants which have a unique plant alarm just for fires (and a unique Fire Alarm All Clear alarm). Additionally, there is are other K/As under which we would normally test fire protection / detection /suppression system alarms (e.g. SYS086 A3.02, A3.03, and APE067 AA1.09).

Since McGuire does not have a unique Plant Fire Alarm, we have, to this point, tested this specific K/A related to how McGuire identifies the existence of a fire to plant personnel. At plants with unique Plant Fire alarms, they alert plant personnel and Fire Brigade members by sounding the Plant Fire alarm followed by an announcement and sound the Fire Alarm All Clear alarm when personnel can return to normal activities. Since McGuire does not have a unique Plant Fire Alarm and can only alert personnel to the existence of a fire by the methods listed in RP-25, we may need a new K/A. Need to discuss with Chief Examiner. HCF 03/26/15

Facility Response:

After further discussion with chief examiner, question was replaced. SLM 04/10/15

After discussion with the Chief Examiner, determine that the second question was not needed (since the first question was different answers). Removed the second question. HCF 04-23-15

EPE007 EK1.05 - Reactor Trip

Knowledge of the operational implications of the following concepts as they apply to the reactor trip: (CFR 41.8 / 41.10 / 45.3)

Decay power as a function of time ....

Given the following sequence of events on Unit 1:

- 0210 – reactor tripped due to a LOCA
- 0300 – crew enters ECA-1.2, (LOCA Outside Containment)
- 0330 – crew enters ECA-1.1, (Loss of Emergency Coolant Recirc)
- 0350 – The crew is at step 18.b of ECA-1.1

Current conditions at time 0350:

- 1A NI pump is running, indicating 145 GPM
- 1B NI pump is running, indicating 185 GPM
- Both NV pumps are running, indicating 340 GPM (Consider that the NV pumps have equal capacity)
- Subcooling is +35°F

Based on the conditions above, at time 0350:

1) the MINIMUM flow from the ECCS pumps which will match the decay heat removal requirements of ECA-1.1 is ________.

AND

2) to meet the ECCS requirements of ECA-1.1, the crew will ________.

Which ONE (1) of the following completes the statements above?

REFERENCE PROVIDED

A. 1. 310 GPM
   2. stop both NI pumps

B. 1. 310 GPM
   2. stop the 1B NI pump AND one NV pump

C. 1. 330 GPM
   2. stop both NV pumps

D. 1. 330 GPM
   2. stop the 1A NI pump AND one NV pump

General Discussion

Time after trip is 100 minutes, which makes the required flow 310 GPM.

Since the minimum flow required is 310 gpm per Enclosure 9 of ECA-1.1.

If both NI pumps are stopped, the ECCS flow would be 340 GPM which meets the minimum 310 GPM required for decay heat removal.

If the 1A NI pump and ONE NV pump (either pump) is stopped, the ECCS flow would be 315 GPM. This also meets the minumum 310 GPM required for decay heat removal.

However, Step 18.b RNO requires the crew to minimize S/I flow by stopping pumps while maintaining flow greater than that required by Enclosure 9 for decay heat removal. Therefore, the correct action is to stop the 1B NI pump and one NV pump

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is correct.

Part 2 is plausible in that stopping the NI pumps would still meet the flow requirements of Enclosure 9. Additionally, since ECA-1.1 directs stopping S/I pumps to minimize ECCS flow, the applicant could conclude that only the NI pumps could be stopped and not the NV pumps.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is plausible if the applicant determines uses time from the trip to ECA-1.1 entry for determining the required decay heat removal flow. If so, 330 GPM would be correct.

Part 2 is plausible because stopping both NV pumps would minimize S/I flow and still meet the 330 GPM minimum flow that they determined in Part 1.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is plausible if the applicant determines uses time from the trip to ECA-1.1 entry for determining the required decay heat removal flow. If so, 330 GPM would be correct.

Part 2 is plausible because stopping the 1A NI pump and one of the NV pumps would meet the 330 GPM minimum flow that they determined in Part 1.

Basis for meeting the K

The KA is matched because the applicant must determine that the reason for the pump combination chosen is based on both maintaining the minimum required flow required by Enclosure 9 of ECA-1.1 (calculation and reading of graph) while at the same time minimizing S/I flow (following the requirements of the procedure step).

Basis for Hi Cog

This is an analysis question as the applicant must interpret the graph from Enclosure 9 and then determine the correct combination of pumps based on maintaining the minimum required flow while minimizing S/I flow.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2012 MNS NRC Exam Q44 (Bank 5737) MODIFIED

Development References
REFERENCES: ECA-1.1 Rev 16, Step 18 and Encl 9 - PROVIDED LEARNING OBJECTIVES: OP-MC-EP-EP2 Objective 29

Student References Provided
ECA-1.1 (Step 18) ECA-1.1 (Enclosure 9)

EPE007 EK1.05 - Reactor Trip

Knowledge of the operational implications of the following concepts as they apply to the reactor trip: (CFR 41.8 / 41.10 / 45.3)

Decay power as a function of time ....

401-9 Comments:

Remarks/Status

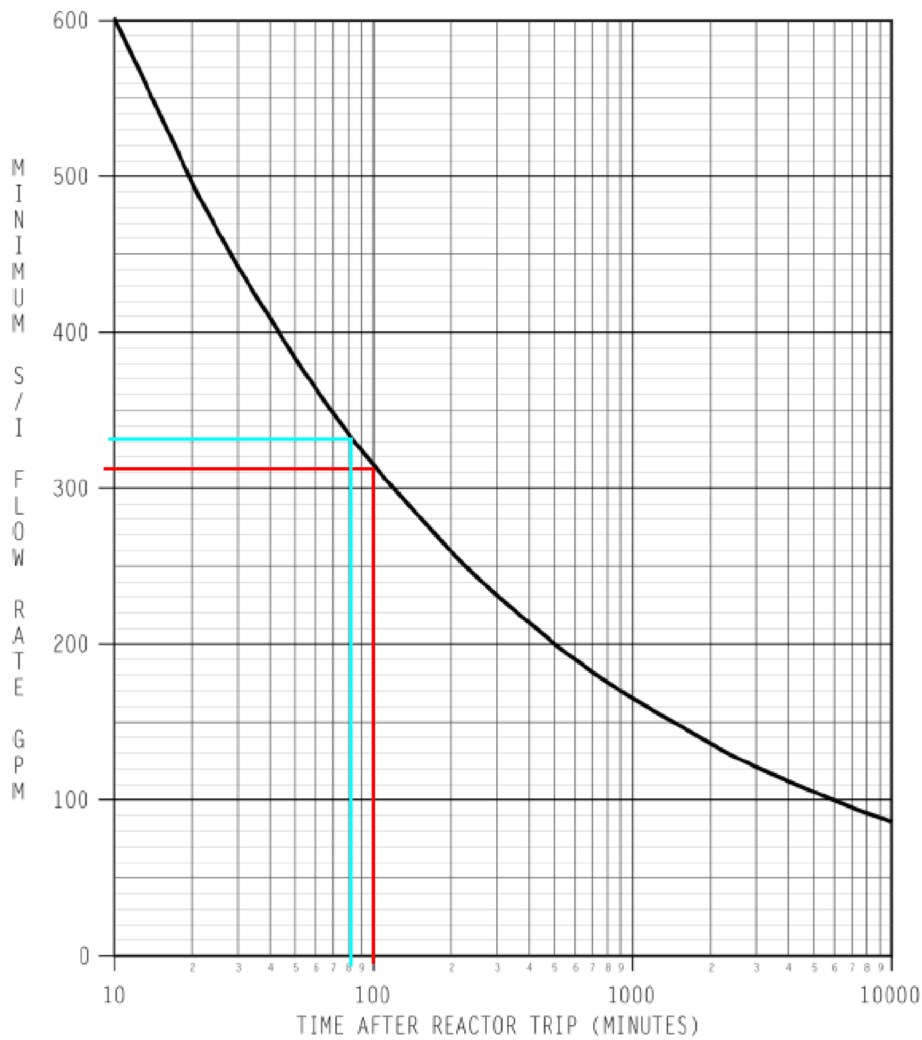
Q39 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC	PAGE NO. **21 of 109** Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
18. **Check if S/I can be terminated:**	
a. Check RVLIS indication: __ • **IF** all NC pumps off, **THEN** check "REACTOR VESSEL LR LEVEL" - GREATER THAN 60%. OR __ • **IF** at least one NC pump on, **THEN** check "REACTOR VESSEL D/P" - GREATER THAN REQUIRED DELTA P FROM Enclosure 7 (Minimum Dynamic RVLIS Indication).	__ a. Observe Caution prior to Step 24 and **GO TO** Step 24.
__ b. NC subcooling based on core exit T/Cs - GREATER THAN 50°F.	b. Perform the following: __ 1) Determine minimum S/I flow required **PER** Enclosure 9 (Flow Required to Match Decay Heat). __ 2) Minimize S/I flow by stopping one or more S/I pumps while maintaining greater than or equal to flow required by Enclosure 9 (Flow Required to Match Decay Heat). __ 3) Observe Caution prior to Step 24 and **GO TO** Step 24.
19. **Reset the following:** __ • Phase A Isolation __ • Phase B Isolation.	

Q39 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC **Enclosure 9 - Page 1 of 1** **Flow Required to Match Decay Heat**	PAGE NO. **85 of 109** Rev. 16



Q39 Parent Question (2012 MNS NRC Exam Q44 (Bank 5737) MODIFIED)

C

WE11 EK3.2 - Loss of Emergency Coolant Recirculation

Knowledge of the reasons for the following responses as they apply to the (Loss of Emergency Coolant Recirculation)
(CFR: 41.5 / 41.10, 45.6, 45.13)

Normal, abnormal and emergency operating procedures associated with (Loss of Emergency Coolant Recirculation).

Unit 1 was operating at 100%. Given the following events and conditions:

- 0210 – reactor tripped due to a LOCA
- 0300 – crew enters ECA-1.2, (LOCA Outside Containment)
- 0320 – crew enters ECA-1.1, (Loss of Emergency Coolant Recirc)
- 0330 – The crew is at step 18.b of ECA-1.1
- Current conditions:
  - 1A NI pump is running, indicating 185 GPM
  - 1B NI pump is running, indicating 165 GPM
  - Both NV pumps are running, indicating 340 GPM (Consider that the NV pumps have equal capacity)
  - Subcooling is +35°F

Based on the conditions above, at time 0330:

1) Which ONE (1) of the following describes the actions that will meet ALL requirements of ECA-1.1?

AND

2) Flow from the remaining ECCS pumps will be greater than the MINIMUM required flow rate of ________.

REFERENCE PROVIDED

A. 1. Stop both NV pumps.
 2. 345 GPM

B. 1. Stop the 1B NI pump AND one NV pump.
 2. 345 GPM

C. 1. Stop the 1A NI pump AND one NV pump.
 2. 330 GPM

D. 1. Stop both NI pumps.
 2. 330 GPM

Q39 Parent Question (2012 MNS NRC Exam Q44 (Bank 5737) MODIFIED)

2012 MNS SRO NRC Examination QUESTION **44** 44 **C**

General Discussion

Time after trip is 80 minutes, which makes the required flow 330 GPM.

Since the minimum flow required is 330 gpm, there are two possible answers that will meet the minimum flow of 330 GPM. The remaining flow after stopping the 1A NI pump and on NV pump would be 335 GPM. The remaining flow after stopping both NI pumps would be 340 GPM. Since the crew is directed to "Minimize S/I flow while maintaining greater than or equal to the flow required by Enclosure 9", the correct answer would be to stop the 1A NI pump and one NV pump.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is plausible if the applicant determines that the minimum flow is 345 GPM. If so, the correct action would be to stop both NV pumps.

Part 2 - The minimum flow of 345 GPM is plausible if the applicant uses the time from the reactor trip to entry into ECA-1.1 as opposed to the time to reach step 18.b (70 min vs. 80 min) as this would be the correct minimum flow.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is plausible if the applicant determines that the minimimum required flow is 345 GPM. It is plausible for the applicant to determine that stopping the 1B NI and one NV pump would be correct as this would meet the minimum required flow.

Part 2 - The minimum flow of 345 GPM is plausible if the applicant uses the time from the reactor trip to entry into ECA-1.1 as opposed to the time to reach step 18.b (70 min vs. 80 min) as this would be the correct minimum flow.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part 1 is correct if the applicant determines 330 GPM and sees from the initial conditions that the flow from both NV pumps meets the required minimum flow. It is plausible that they will immediately pick stopping both NI pumps as the correct answer without calculating the effect of stopping 1A NI pump and one NV pump.

Part 2 - The minimum flow of 330 GPM is correct.

Basis for meeting the KA

The KA is matched because the applicant must determine that the reason for the pump combination chosen is based on both maintaining the minimum required flow required by Enclosure 9 of ECA-1.1 (calculation and reading of graph) while at the same time minimizing S/I flow (following the requirements of the procedure step).

Basis for Hi Cog

This is an analysis question as the applicant must interpret the graph from Enclosure 9 and then determine the correct combination of pumps based on maintaining the minimum required flow while minimizing S/I flow.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2009 MNS NRC RO Retake Q54 MODIFIED (Bank 2254)

Development References

References:
ECA-1.1 step 18 and Encl 9 - PROVIDED

Student References Provided

EP/1/A/5000/ECA-1.1 (Step 18)
EP/1/A/5000/ECA-1.1 (Enclosure 9)

Q39 Parent Question (2012 MNS NRC Exam Q44 (Bank 5737) MODIFIED)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2012 MNS SRO NRC Examination QUESTION 44 44

Learning Objective:
OP-MC-EP-EP2 Objective 29

WE11 EK3.2 - Loss of Emergency Coolant Recirculation
Knowledge of the reasons for the following responses as they apply to the (Loss of Emergency Coolant Recirculation)
(CFR: 41.5 / 41.10, 45.6, 45.13)
Normal, abnormal and emergency operating procedures associated with (Loss of Emergency Coolant Recirculation).

401-9 Comments:	Remarks/Status

EPE009 EK3.11 - Small Break LOCA

Knowledge of the reasons for the following responses as the apply to the small break LOCA: (CFR 41.5 / 41.10 / 45.6 / 45.13)

Dangers associated with inadequate core cooling ....

Given the following conditions on Unit 2:

- A Small Break LOCA results in a Reactor Trip and Safety Injection
- The crew has implemented E-1 (LOSS OF REACTOR OR SECONDARY COOLANT)
- Subcooling is -2°F
- Pressurizer level is 2%
- Containment pressure is 2.5 PSIG and STABLE
- CETs are 650°F and slowly increasing

In accordance with E-1, the NCPs should ___(1)___ to ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. be stopped
   2. minimize NC system inventory loss

B. 1. remain running
   2. provide forced cooling flow through the core

C. 1. be stopped
   2. prevent pump damage due to loss of support systems

D. 1. remain running
   2. aid in refilling the pressurizer to satisfy SI termination criteria

---

General Discussion

In accordance with the E-1 (Loss of Reactor or Secondary Coolant) Background Document, the NCPs should be stopped when subcooling is lost and at least 1 NV or NI pump is running.

This timing of stopping the NC pumps during a Small Break LOCA is important in that if stopping the NC pumps is delayed, sufficient NC system inventory loss could result in water level in the Reactor Vessel settling below the top of the fuel when NCPs are eventually stopped.

Delaying the stopping of the NC pumps and the resultant inventory loss could result in an inadequate core cooling condition and the melting of fuel.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
It is plausible that the applicant could conclude based on increasing CET temperatures that an inadequate core cooling condition already exists and that NC pumps should remain running to improve core cooling.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because continued operation of the NC pumps under the given conditions would most likely result in damage to the NC pumps. However, the primary reason for stopping the NC pumps under these conditions is to minimize NC system inventory loss.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Maintaining the NC pumps running in combination with sustained makeup flow from the NV and NI pumps would aid in sweeping the loops of any voids and thus aid in increasing overall NC system inventory. Additionally, steps in E-1 very early on check to see if SI Termination criteria is met. Consequently, it would be easy for an applicant to conclude that any steps which could be taken to help meet SI Termination criteria would be desirable. Therefore, this answer is plausible.

Basis for meeting the K

For this question, the applicant must have knowledge of the reasons for performing actions in E-1 during mitigation of a Small Break LOCA. Since not performing those actions or delaying performing those actions could cause an inadequate core cooling condition, the K/A is matched.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must analyze the conditions given to determine that the Foldout Page criteria of E-1 for stopping the NCPs is met.

Second the applicant must recall from memory the reason for stopping the NC pumps when these conditions are met.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS ILT Bank 30850 (Not Previously Used on NRC Exam)

Development References

REFERENCES:
E-1 (Loss or Reactor or Secondary Coolant) Rev. 13
Lesson Plan OP-MC-EP-E1 (Loss of Reactor or Secondary Coolant) Rev. 28B

LEARNING OBJECTIVES:

Student References Provided

EPE009 EK3.11 - Small Break LOCA

ILT-16-1 MNS SRO NRC Examination **QUESTION 40** 40 **A**

Knowledge of the reasons for the following responses as the apply to the small break LOCA: (CFR 41.5 / 41.10 / 45.6 / 45.13)
Dangers associated with inadequate core cooling ....

401-9 Comments:	Remarks/Status
	401-9 Early submittal comments: 009EK3.11 K/A is met. Drl 11/9/15

Q40 References

MNS EP/2/A/5000/E-1 **UNIT 2**	LOSS OF REACTOR OR SECONDARY COOLANT **Enclosure 1 - Page 1 of 1** **Foldout**	PAGE NO. **21 of 25** **Rev. 13**

1. NC Pump Trip Criteria:
   - IF the following conditions are satisfied, THEN trip all NC pumps while maintaining seal injection flow:
     - At least one NV or NI pump - ON
     - NC subcooling based on core exit T/Cs- LESS THAN OR EQUAL TO 0°F.

2. S/I Reinitiation Criteria:
   - IF NC subcooling based on core exit T/Cs is less than 0°F OR Pzr level cannot be maintained greater than 11% (29% ACC), THEN perform the following as necessary to restore subcooling and level:
     - Start one or more S/I pumps.
     - Realign NV S/I flow path PER EP/2/A/5000/G-1 (Generic Enclosures) Enclosure 29 (NV Alignment to S/I Mode).

3. Secondary Integrity Criteria:
   - IF any unisolated S/G pressure is going down in an uncontrolled manner OR has completely depressurized, THEN GO TO EP/2/A/5000-E-2 (Faulted Steam Generator Isolation).

4. SGTR Transition Criteria:
   - IF any S/G level goes up in an uncontrolled manner OR any S/G has abnormal radiation, THEN perform the following:
     a. IF NC subcooling based on core exit T/Cs is less than 0°F OR Pzr level cannot be maintained greater than 11% (29% ACC), THEN perform the following as necessary to restore subcooling and level:
        - Start one or more S/I pumps.
        - Realign NV S/I flow path PER EP/2/A/5000/G-1 (Generic Enclosures) Enclosure 29 (NV Alignment to S/I Mode).

     b. GO TO EP/2/A/5000/E-3 (Steam Generator Tube Rupture).

5. FWST Level Pre-Lo Alarm Actions:
   - IF FWST level reaches 135 inches ("FWST LEVEL PRE-LO" alarm), THEN perform Enclosure 4 (FWST Level Pre-Lo Alarm Actions).

6. Cold Leg Switchover Criteria:
   - IF FWST level reaches 95 inches ("FWST LEVEL LO" alarm), THEN GO TO EP/2/A/5000/ES-1.3 (Transfer To Cold Leg Recirculation).

7. CA Suction Sources:
   - IF CA Storage Tank (water tower) goes below 1.5 ft, THEN perform EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 20 (CA Suction Source Realignment).

8. Position Criteria for 2NV-150B and 2NV-151A (NV Pumps Recirculation):
   - IF NV S/I flowpath is aligned, AND NC pressure is less than 1500 PSIG, THEN CLOSE 2NV-150B and 2NV-151A.
   - IF NC pressure is greater than 2000 PSIG, THEN OPEN 2NV-150B and 2NV-151A.

Q40 References

- When attempting to restore the secondary heat sink in FR-H.1 (Loss of Secondary Heat Sink), after secondary heat sink has been reestablished and all Pzr PORVs are closed.

3.3. Major Actions

The recovery/restoration technique of E-1 includes the following three major action categories:

1. Monitor plant equipment for optimal mode of operation.
2. Check for subsequent failures
3. Determine optimal method of long-term plant recovery.

The following subsections provide a more detailed discussion of each major action category.

3.3.1 Monitor Plant Equipment for Optimal Mode of Operation

Plant equipment is monitored to ensure it is in the proper mode of operation. This check is made by continuous monitoring of the foldout page while following the steps in E-1.

3.3.2 Check for Subsequent Failure

A check is made for other major failures that could alter plant recovery actions. Examples are steam generator tube ruptures, stuck open PORVs, or secondary side breaks. If a SGTR is found, a transition to E-3 is made. A secondary side break would result in a transition to E-2.

3.3.3 Determine Optimal Method of Long-Term Plant Recovery

The optimal method for long-term recovery is determined. If S/I termination criteria are not satisfied, then a determination is made whether to use ES-1.2, Post LOCA Cooldown and Depressurization, or to continue in E-1 and eventually use ES-1.3, Transfer to Cold Leg Recirculation, as the long-term recovery action for the plant.

3.4. Detailed Description of Procedural Steps

STEP 1 Monitor Foldout page.

PURPOSE: To remind the operator that the foldout page should be open.

BASIS: The foldout page, included as Enclosure 1, provides a list of important items that should be continuously monitored. If any of the parameters match the conditions in the foldout, appropriate operations are initiated.

STEP 2 Check NC Subcooling based on Core Exit T/Cs - GREATER THAN 0˚F.

PURPOSE: To trip NC pumps if required conditions are satisfied.

BASIS: This step is a redundant check of the NC pump trip criteria found on the Foldout page.

Q40 References

Tripping the NC pumps, when the trip criteria is reached during accident conditions, is done to prevent excessive depletion of NC System water inventory through a small break in the NC System which might lead to severe core uncovery if the NC pumps were tripped for some reason later in the accident.

> ***Operator Fundamental Focus; Knowledge***
> *Explain how this step is a redundant check of the NC pump trip criteria found on the Foldout page. Explain that tripping the NC pumps, when the trip criteria is reached during accident conditions, is done to prevent excessive depletion of NC System water inventory through a small break in the NC System which might lead to severe core uncovery if the NC pumps were tripped for some reason later in the accident.*

The effectiveness of the NC Pump #1 seal is not affected by pump rotation. To ensure continued performance of the seal, cool filtered water should be continuously supplied. The operator should not isolate the seal injection lines unless directed to in the procedures.

STEP 3 Check if main steamlines intact:

PURPOSE: To identify any faulted S/Gs (failure in the secondary pressure boundary) and to ensure proper isolation.

BASIS: An uncontrolled S/G pressure decrease or a S/G with pressure near containment or atmospheric pressure indicates a failure of the secondary pressure boundary. If it cannot be verified that all faulted S/G(s) steamlines and feedlines are isolated, the operator is instructed to leave E-1 and transfer to E-2, Faulted Steam Generator Isolation, to perform the isolation actions. Therefore, this step alerts the operator to a possible misdiagnosis or subsequent failure.

In this step, the word "uncontrolled" means "not under the control of the operator, and incapable of being controlled by the operator using available equipment".

STEP 4 Control intact S/G levels (CONTINUOUS ACTION)

PURPOSE: To first ensure adequate feed flow or S/G inventory to ensure a secondary heat sink for small and intermediate size LOCAs and secondary break accidents, and secondly to provide a positive static head of water to prevent primary to secondary leakage.

BASIS: Ensuring that narrow range level is reestablished in all (intact) S/Gs maintains symmetric cooling of the NC. If level cannot be controlled and increases above the NR level, then a transition to E-3, Steam Generator Tube Rupture, is made to control and isolate the ruptured S/G.

Even though a secondary heat sink is not required for large LOCAs, it is beneficial to maintain S/G narrow range levels on span to ensure a positive static head of water between the secondary and primary sides of the tubes since these S/Gs will eventually be depressurized (either later in this procedure or by natural heat losses). Water level in the S/Gs will prevent or minimize leakage from the primary to the secondary, which are within the limits of the Technical Specifications (and therefore are not classified as SGTR).

STEP 19 WHEN 4 hours after event initiation have elapsed, THEN align valve power supplies for Hot Leg Recirc

PURPOSE: To verify that required equipment is available for switchover from cold leg recirculation to hot leg recirculation.

BASIS: Typically, the valves needed to initiate the hot leg recirculation mode are locked out at their respective motor control centers so that spurious operation will be avoided during cold leg injection and recirculation modes. Since the motor control centers are located at various locations in the auxiliary building, the operator must re-energize these breakers prior to the time that hot leg recirculation is needed.

STEP 20 WHEN 6 hours after event initiation have elapsed, THEN GO TO EP/1/A/5000/ES-1.4 (Transfer to Hot Leg Recirc).

PURPOSE: To direct the operator to ES-1.4 to for transfer to hot leg recirculation.

BASIS: After six hours after event has initiated, boric acid concentrations could approach the solubility limit in the reactor vessel/core region following a double-ended cold leg guillotine break. The time established by this analysis would preclude boron precipitation from the boric acid solution that could potentially hinder core cooling.

STEP 21 Consult plant management to evaluate long term plant status

PURPOSE: To determine long term plant status and future recovery actions.

BASIS: The equipment needed to function following a LOCA has been designed so that operation for extremely long times is possible. This allows the plant engineering staff time to evaluate the event and develop recovery procedures so that the plant can be repaired and brought back to service.

3.5. E-1 Enclosures

Enclosure 1, Foldout

1. NC Pump Trip Criteria

IF the following conditions are satisfied, **THEN** trip all NC pumps while maintaining seal injection flow:

- At least one NV or NI pump on
- NC subcooling based on core exit T/Cs less than or equal to 0°F.

BASIS: Tripping the NC pumps, when the trip criteria is reached during accident conditions, is done to prevent excessive depletion of NC System water inventory through a small break in the NC System which might lead to severe core uncovery if the NC pumps were tripped for some reason later in the accident.

The effectiveness of the NC Pump #1 seal is not affected by pump rotation. To ensure continued performance of the seal, cool filtered water should be continuously supplied. The operator should not isolate the seal injection lines unless directed to in the procedures.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 5819 MNS

B

Given the following conditions on Unit 2:

- The unit is initially at 100% RTP
- A Small Break LOCA results in a Reactor trip and Safety Injection
- The crew has transitioned from E-0 (REACTOR TRIP OR SAFETY INJECTION) to E-1 (LOSS OF REACTOR OR SECONDARY COOLANT)
- Subcooling is 0°F
- Pressurizer level is 2%
- Containment pressure is 2.5 PSIG

Based on the conditions above, which ONE (1) of the following indicates the strategy for operation of the NC pumps?

A. The reactor coolant pumps should remain running to provide forced cooling through the core.

B. The reactor coolant pumps should be stopped to prevent excessive depletion of the NC system water inventory.

C. The reactor coolant pumps should remain running to refill the pressurizer to satisfy SI termination criteria.

D. The reactor coolant pumps should be stopped to prevent pump damage due to loss of pump support systems.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 5819 MNS **B**

General Discussion

Answer A Discussion

Answer B Discussion

Answer C Discussion

Answer D Discussion

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Exam Bank Q30850

Development References
References: Lesson Plan OP-MC-EP-E1 Learning Objectives:

Student References Provided

KA	KA_desc
GEN2.4 2.4.6	Emergency Procedures / PlanKnowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)
KA	**KA_desc**
GEN2.1 2.1.23	Conduct of OperationsAbility to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)
KA	**KA_desc**
GEN2.1 2.1.20	Conduct of OperationsAbility to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)
KA	**KA_desc**
EPE009 EK3.13	Knowledge of the reasons for the following responses as the apply to the small break LOCA: (CFR 41.5 / 41.10 / 45.6 / 45.13)Stopping the affected RCP ....

APE015/017 2.1.32 - Reactor Coolant Pump (RCP) Malfunctions
APE015/017 GENERIC
Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- The following trends are observed on the 1A NCP:

Time	0200	0205	0210	0215
Pump #1 Seal D/P (PSID)	215	210	205	195
Lower pump bearing temp (°F)	221	224	228	231
#1 seal outlet temp (°F)	222	237	246	253
Motor winding temp (°F)	303	310	316	323

At what time is 1A NCP trip criteria **FIRST** exceeded?

A. 0200

B. 0205

C. 0210

D. 0215

General Discussion

NCP Trip criteria:
Any motor bearing temperature > 195°F
Seal Outlet temperature > 235°F
Motor winding temperature > 311°F
Lower pump bearing temperature > 225°F

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant confuses the motor bearing temperature limit with the pump bearing temperature limit.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since the NCP trip criteria has been met for lower bearing temperature and motor winding temperature. However, they were not the first trip criteria met.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible since the NCP trip criteria has been met for all the parameters listed. However, they were not the first trip criteria met.

Basis for meeting the K

The KA is matched because a malfunction of the 1A NCP has occurred and the applicant must determine when the NCP must be secured based on comparing the given data to the Limits and Precautions.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step. The applicant must first recall from memory the NCP operating limits from the limits and precautions. The applicant must then analyze the given data to determine when the NCP operating limits are exceeded.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	CNS 2013 SRO Examination AUDIT Q42 (Bank 4972)

Development References

REFERENCES:
Lesson Plan OP-MC-PS-NCP (Reactor Coolant Pump) Rev 30

LEARNING OBJECTIVES:
OP-MC-PS-NCP Objective 15

Student References Provided

APE015/017 2.1.32 - Reactor Coolant Pump (RCP) Malfunctions
APE015/017 GENERIC
Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)

401-9 Comments:

Remarks/Status

Q41 References

- **IF** three NC Pump starts or attempted starts made within a two (2) hour period, the NC Pump Motor must be allowed to cool by standing idle for at least one (1) hour prior to restart.
- A total of six (6) NC Pump starts over a 24 hour period shall NOT be exceeded.

  BASIS: These limitations ensure the motor windings and rotor core have cooled sufficiently prior to attempting another start. Frequent starting of the NCP may result in damage to the NCP motor windings due to excessive heat generated during starting.
- 2A NC Pump should **NOT** be started with NC system pressure greater than 1800 psig without prior station management evaluation of oil lift tube concerns. Under urgent circumstances, the 2A NC Pump should be started without an evaluation. {PIP 07-1163}
- **WHEN** reactor power greater than 25%, starting an NC Pump is prohibited.

  BASIS: The concern here is a power excursion which could result in a reactor trip and possible core damage. The idle loop temperature is at Tc for the system and the higher the reactor power the larger the core ΔT.
- **IF** in Mode 3 capable of rod withdrawal, 3 NC loops must be operable and in operation.

  BASIS: To ensure compliance with the conditions assumed in the FSAR accident analysis.
- **IF** in Mode 3 **NOT** capable of rod withdrawal, 3 NC loops must be operable and at least 1 loop in operation.

  BASIS: To ensure compliance with the conditions assumed in the FSAR accident analysis.
- **IF** NC Pump is to be run for less than 10 min. in Mode 5, 6 or No Mode, KC is **NOT** required to Motor Bearing Coolers or Thermal Barrier HXs.

  BASIS: Cooling from KC is not required for short term pump runs when NC System temperatures are less than 200 degrees F.
- Cooling water to the motor bearing oil coolers should be maintained for at least 30 minutes after NC Pump shutdown. This is **NOT** applicable if NC Pump will be run for less than 10 minutes in Mode 5 and below.

  BASIS: To dissipate residual heat to prevent overheating after shutdown of the NCP.

- NC Pump trip criteria are:
  - Any motor bearing temperature exceeds 195°F.

Q41 References

- Any motor winding temperature exceeds 311°F.
- Lower pump bearing temperature exceeds 225°F.
- Motor frame vibration exceeds 5 mils.
- Pump shaft vibration exceeds 20 mils.
- Motor shaft vibration exceeds 20 mils.
- Flywheel vibration exceeds 20 mils.
- Flywheel axial vibration exceeds 20 mils.
- No. 1 seal outlet temperature exceeds 235°F.
- ICCM indicates NC System is nearing saturation conditions (loss of subcooling)
- No. 1 Seal ΔP is less than 200 psi.
- High or Low oil level alarm with an adverse trend in level either the upper or lower motor oil reservoirs.

- **WHEN** NC Pump uncoupled, trip criteria are:
  - Any motor bearing temperature exceeds 195°F.
  - Any motor winding temperature exceeds 311°F.
  - Motor frame vibration exceeds 5 mils.
  - Motor shaft vibration exceeds 20 mils.
  - Flywheel vibration exceeds 20 mils.
  - Flywheel axial vibration exceeds 20 mils.
  - High or Low oil level alarm with an adverse trend in level either the upper or lower motor oil reservoirs.

BASIS: Stopping a pump when any of these parameters is exceeded should reduce the possibility of any further degradation of the pump or motor.

Bases for NCP Trip Criteria

1. **Motor Bearing Temperature Limit -195°F**

   The 195°F shutdown limit for the motor bearing temperature was established to minimize the risk of bearing damage. Temperatures above 195°F can result in damage (melting) of the babbitted surfaces of the bearing shoes. Damaged shoes will adversely affect the operation of the motor and could impair the NCP coastdown, which is used for residual core cooling during plant shutdown. Also, operation of damaged bearings will result in increased bearing friction, which may result in rapidly rising bearing temperatures, which is not predictable or controllable.

2. **Pump Bearing Temperature Limit - 225°F**

EXAM BANK QUESTION: 4972 MNS **A**

With Unit 1 at 100% power, the following trends are given on the 1A NCP:

Time	0200	0205	0210	0215
Pump #1 Seal D/P (PSID)	215	210	205	195
Lower pump bearing temp (°F)	221	225	228	231
#1 seal outlet temp (°F)	205	227	235	251
Motor winding temp (°F)	312	314	316	323

When is 1A NCP trip criteria FIRST exceeded?

A. 0200

B. 0205

C. 0210

D. 0215

Q41 Parent Question (2013 CNS Audit Q42 (Bank 4972) MODIFIED)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4972 MNS **A**

General Discussion

NCP Trip criteria:
Any motor bearing temperature > 195°F
Seal Outlet temperature > 235°F
Motor winding temperature > 311°F
(Any bearing water exit temperature > 225°F)

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible if the applicant does not recall the NCP operating limits from the Limits and Precautions.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible if the applicant does not recall the NCP operating limits from the Limits and Precautions.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible if the applicant does not recall the NCP operating limits from the Limits and Precautions.

Basis for meeting the KA

The K/A IS matched because a malfunction of the 1A NCP has occurred and the applicant must determine based on comparing the given data to the Limits and Precautions for the NCPs when the pump must be stopped.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step. The applicant must first recall from memory the NCP operating limits from the limits and precautions. The applicant must then analyze the given data to determine when the NCP operating limits are exceeded.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2003 CNS NRC Q45

Development References
Lesson Plan OP-MC-PS-NCP Lesson Plan Objective 15

Student References Provided

KA	KA_desc
APE015/017 2.1.32	APE015/017 GENERICAbility to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)

APE022 2.4.6 - Loss of Reactor Coolant Makeup
APE022 GENERIC
Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)

In accordance with AP-12 (LOSS OF LETDOWN, CHARGING, or SEAL INJECTION),

After stabilizing the plant, what is the proper order of the major mitigation actions?

A. Restore Letdown, Charging, and Seal Injection

B. Restore Letdown, Seal Injection, and Charging

C. Restore Charging, Seal Injection, and Letdown

D. Restore Charging, Letdown, and Seal Injection

General Discussion

In accordance with the AP-12 Background Document there are four major action categories to AP-12:

1. Plant Stabilization
2. Restore Charging
3. Restore Seal Injection
4. Restore Letdown

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because there is an early step in AP-12 to "skip ahead" to letdown restoration if this AP was entered for loss of letdown only. This step occurs before restoring NV pumps.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because seal injection is required to be restored in a timely manner to prevent damage to the NC pump seals and this can be accomplished through gravity charging.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because after charging flow is restored, Pressurizer level will be increasing and it is therefore important to restore letdown to stop an uncontrolled increase in Pressurizer level.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of AOP mitigation strategy related to Loss of Reactor Coolant Makeup.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
AP-12 (Loss of Letdown, Charging, or Seal Injection) Rev. 24
AP-12 Background Document Rev. 13

LEARNING OBJECTIVES:
AP12002

Student References Provided

APE022 2.4.6 - Loss of Reactor Coolant Makeup
APE022 GENERIC
Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
022G2.4.6
K/A is not really met.
The distractors are kind of weak in that charging temperature

really is never a concern.
A simpler way to meet the K/A and a stronger question might be to ask the prioritization of the mitigation strategies:
… IAW AP-12, after stabilizing the plant, what is the proper order of the major mitigating actions?
Then list the remaining 3 strategies in various orders. Drl 11/9/15

Facility Response:
Facility agrees with chief examiner and question was changed based on chief examiners comments. SLM 11/17/15

Q42 References

MNS AP/2/A/5500/12 **UNIT 2**	LOSS OF LETDOWN, CHARGING OR SEAL INJECTION	PAGE NO. 2 of 49 Rev. 24

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Letdown flow going down**
- **Charging flow going down**
- **All charging pumps off**
- **"PZR LO LVL / LO CHGING FLOW HTRS OFF & L/D SECURED" alarm**
- **"LETDN RELIEF HI TEMP" alarm**
- **"REGEN HX LETDN HI TEMP" alarm**
- **"CHARGING LINE ABNORMAL FLOW" alarm**
- **"SEAL WATER INJ FILTER HI D/P" alarm**
- **"NC PUMP SEAL INJ LO FLOW" alarm**
- **"LETDN HX OUTLET HI TEMP" alarm**
- **"LETDN-HX OUTLET HI PRESS" alarm**
- **"NC PMP NO. 1 SEAL OTLT HI TEMP" alarm**
- **"2A(2B, 2C, 2D) NC PUMP L/B TEMP" going up**
- **"NC PUMP LWR BRG HI TEMP" alarm**
- **Pzr level going down**
- **"VCT ABNORMAL LEVEL" alarm**
- **VCT level going down.**

Q42 References

AP/1 and 2/A/5500/012 (Loss of Letdown, Charging, or Seal Injection)

INTRODUCTION

This procedure checks proper response in the event of a loss of letdown, charging, or seal injection, to assess plant conditions, and identify the appropriate steps of these events.

OVERVIEW OF AP-12

There are four basic parts, or major action categories, to AP-12:

1. Plant Stabilization
2. Restore Charging
3. Restore Seal Injection
4. Restore Letdown

ENTRY CONDITIONS

This procedure can be entered any time the listed symptoms are encountered

APE025 AK2.03 - Loss of Residual Heat Removal System (RHRS)
Knowledge of the interrelations between the Loss of Residual Heat Removal System and the following: (CFR 41.7 / 45.7)
Service water or closed cooling water pumps ....

Given the following initial conditions on Unit 1:

- Unit is in MODE 5
- 'A' Train of ND, KC and RN are in service
- The standby KC train is NOT available to start
- NC system temperature is being maintained at 140°F

Subsequently,

- 1A2 KC pump trips on overcurrent

In accordance with AP-21 (LOSS OF KC OR KC SYSTEM LEAKAGE), the action which would maintain or restore the NC system to its INITIAL temperature is to throttle ___(1)___ OR throttle ___(2)___.

Which ONE (1) of the following completes the statement above?

(ASSUME THE ACTIONS LISTED DO NOT RESULT IN EXCEEDING ANY FLOW OR TEMPERATURE LIMITATIONS)

COMPONENT LEGEND:

- 1ND-34 (1A & 1B ND HX BYPASS)
- 1NV-459 (U1 VARIABLE L/D ORIFICE OUTLET FLOW CONTROL)
- 1KC-149 (1A KF HX OUTLET FLOW)
- 1RN-89A (RN TO A KC HX CONTROL)

A. 1. CLOSED 1NV-459
2. OPEN 1RN-89A

B. 1. CLOSED 1KC-149
2. OPEN 1ND-34

C. 1. OPEN 1ND-34
2. OPEN 1RN-89A

D. 1. OPEN 1KC-149
2. CLOSED 1NV-459

General Discussion

Based on the conditions given, the crew will implement AP-21 (Loss of KC or KC System Leakage).

The loss of the KC pump has caused a reduction in ND cooling capacity (loss) and thus NC system temperature increases. To maintain or restore NC system temperature (until the standby KC train is available for start), the crew must somehow increase the cooling capability of the ND system.

AP-21 offers several options to "maintain cooling water to critical loads" including:

- Throttling KC to ND Hx
- Throttling KC to KF Hx
- Raising RN flow to KC Hx
- Reducing NV letdown

Based on the above, the following actions would result in an increase in cooling availble for the ND system:

- Throttling CLOSED 1ND-34
- Throttling CLOSED 1NV-459
- Throttling CLOSED 1KC-149
- Throttling OPEN 1RN-89A

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Throttling closed 1KC-149 would reduce the KC flow through the KF Hx and would thus increase the KC flow through the ND Hx increasing its cooling capacity and is thus a correct answer.

Throttling open 1ND-34 is plausible if the applicant does not understand the cause effect relationship when operating flow control valves in the ND system. If so, the applicant could conclude that throttling open 1ND-34 would increase the flow through the ND Hx and thus increasing cooling when in fact it does the opposite. This relationship is a common point of confusion and misunderstanding among both Licensed Operators and Operator License candidates.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Throttling open 1ND-34 is plausible if the applicant does not understand the cause effect relationship when operating flow control valves in the ND system. If so, the applicant could conclude that throttling open 1ND-34 would increase the flow through the ND Hx and thus increasing cooling when in fact it does the opposite. This relationship is a common point of confusion and misunderstanding among both Licensed Operators and Operator License candidates.

Throttling open 1RN-89A would increase cooling to the KC Hx which in turn would increase cooling to the ND Hx and is thus a correct answer.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Throttling open 1KC-149 is plausible if the applicant does not understand the cause-effect relationship related to throttling valves in the KC system. If so, the applicant could conclude that throttling 1KC-149 in the open direction would increase the amount of KC flow available through the ND Hx.

Closing 1NV-459 would reduce decrease letdown flow and thus decrease the heat load on the KC system. This in turn would result in an increasing in cooling to the ND Hx and is therefore a correct answer.

Basis for meeting the K

The K/A is matched because a loss (reduction) of RHR Cooling has occurred as the result of a loss of a KC (Closed Cooling Water) pump. To determine a way to mitigate this event (restore NC system temperature to its original value), the applicant must demonstrate a knowledge of the interrelationship between RHR and the plant's cooling water systems (RN and KC).

Basis for Hi Cog

This is a higher cognitive level question because the applicant must analyze the conditions given to determine the consequences of the malfuntion, and then analyze each potential action to determine if that specific action either aids or hinders restoring NC system temperature to its original value.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
AP-21 (Loss of KC or KC System Leakage) Rev. 10
Lesson Plan OP-MC-PSS-KC Rev 29B, Section 2.6
Lesson Plan OP-MC-PSS-RN Rev 51, Section 2.6
Lesson Plan OP-MC-PS-ND Rev. 49, Section 2.3
Lesson Plan OP-MC-PS-NV-DCS Rev 10, Section 2.2

LEARNING OBJECTIVES:

Student References Provided

APE025 AK2.03 - Loss of Residual Heat Removal System (RHRS)

Knowledge of the interrelations between the Loss of Residual Heat Removal System and the following: (CFR 41.7 / 45.7)

Service water or closed cooling water pumps ....

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
025AK2.03
K/A is met. Drl 11/9/15

Q43 References

MNS AP/1/A/5500/21 **UNIT 1**	LOSS OF KC OR KC SYSTEM LEAKAGE	PAGE NO. 4 of 80 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Start standby KC Train as follows:**	
__ a. Check standby KC Train - AVAILABLE TO START.	a. Perform the following: 1) <u>**IF**</u> any KC Pump running, <u>**THEN**</u> perform the following as necessary to maintain KC flow less than 4000 GPM per operating KC Pump: __ a) Maintain cooling water to critical heat loads. <u>**CAUTION**</u> **If ND in RHR and NC temperature is greater than 200°F, then KC flow must be maintained greater than 2000 GPM to operating ND train.** __ b) Evaluate THROTTLING KC to ND Hx. __ c) Evaluate THROTTLING KC to KF Hx. __ d) Evaluate raising RN flow to KC Hx to lower KC temperature. __ e) Evaluate reducing NV letdown to 45 GPM. __ f) <u>**IF**</u> necessary to reduce KC flow, <u>**THEN**</u> notify Radwaste to ensure NB evaporator is shutdown. g) <u>**IF AT ANY TIME**</u> it is desired to restart tripped KC Pump, <u>**THEN**</u> perform the following: __ (1) Start desired KC Pump. __ (2) Exit this procedure. __ 2) Do not continue until KC Train available to start.

the train swapped, then KC flow will be adjusted as necessary based on system requirements.

Objective #9

These valves automatically close to isolate the thermal barrier on high flow, which is indicative of a ruptured thermal barrier.

Operator Fundamental Focus; Knowledge and Control
The Operator Fundamental principles for monitoring and control both require that an Operator understand the impact of his/her actions before taking them and also take measures to prevent undesired consequences from occurring when taking actions.

***Emphasize** that these principles are important to consider when discussing swapping KC pumps since the NCP Thermal Barrier Isolation Valves would often close on high flow conditions during KC pump starts or train swaps. **Reinforce** that, in order to keep this from occurring, the Operator needs to increase flow to 6,000-7,000 gpm through either the KF HX or KC to the ND HX. Once the pumps have been started or the train swapped, then KC flow will be adjusted as necessary based on system requirements.*

2.6.17. KF Heat Exchanger Control Valves (KC-149 & 156).

Controls KC flow through KF Heat Exchanger. Controlled by manual loader in Control Room. Fails in the open position.

2.6.18. KC Heat Exchanger RN Cooling Water Auto/Manual Valve Control

Controls RN Cooling flow to KC heat Exchanger. A manual loader is located in Control Room to adjust flow. A mini-flow circuit available to maintain flow ≥ 2700 gpm.

2.6.19. In 1996, a severe pressure transient occurred on the Unit 1 KC system that caused excessive cycling of several control valves. The valve controlling cooling flow to the 1A NC Pump upper bearing oil cooler eventually closed and would not re-open. This soon led to manual tripping of the reactor and the 1A NC Pump.

The transient occurred during slave relay testing and procedures were promptly revised to prevent recurrence. However, a similar transient could still occur if the inlet isolation to either of the ND HX's were to be opened without a return path to the operating pumps. Operators should ensure that whenever possible, close the Aux Building non-essential header supply valve <u>before</u> closing the associated Aux Building non-essential header return valve.

Q43 References

Operator Fundamental Focus; Control and Monitoring
The modulating reset circuitry has a mechanical latching relay which will maintain the valves in their safe position after the safety injection signal is reset. ***Emphasize*** *that, to gain control of these valves, the safety injection signal and DG sequencer must be reset* ***and*** *the operator must depress the train related modulating valve reset pushbutton. The indicating light is labeled "RESET" and is normally illuminated. Upon receipt of a Safety Injection Signal, the light will be off. Following reset of the latching relay, the light will illuminate.* ***Explain*** *that a failure of the fuse in the pushbutton circuit renders all modulating valves* ***inoperable***. *PIP 0-M96-2018 in section 5.2 covers an operating experience associated with these fuses.*

The modulating reset circuitry has a mechanical latching relay which will maintain the valves in their safe position after the safety injection signal is reset. To gain control of these valves, the safety injection signal and DG sequencer must be reset and the operator must depress the train related modulating valve reset pushbutton. The indicating light is labeled "RESET" and is normally illuminated. Upon receipt of a Safety Injection Signal, the light will be off. Following reset of the latching relay, the light will illuminate. Failure of the fuse in the pushbutton circuit renders all modulating valves inoperable. PIP 0-M96-2018 in section 5.2 covers an operating experience associated with these fuses.

The following are the Train A modulating valves:

		Safe Position
• RN-89A	(RN to A KC HX Control)	Open*
• ND-29	(A ND HX Outlet)	Open
• KC-57A	(A ND HX Return)	Open

The following are the Train B modulating valves:

		Safe Position
• RN-190B	(RN to B KC HX Control)	Open*
• ND-14	(B ND HX Outlet)	Open
• KC-82B	(B ND HX Return)	Open

* Theses valves open to their travel stop position.

Q43 References

2.3.4 NI-173A (Train A ND to A & B CL) and NI-178B (Train B ND to C & D CL)

These valves can be operated from the ND section of MC11. These valves have throttle capability but no automatic control. When aligned for standby readiness, these valves are fully open with power removed.

2.3.5 ND-17 (B ND HX to Letdown HX), ND-32 (A ND HX to Letdown HX), ND-18 (B ND HX Bypass) and ND-33 (A ND HX Bypass)

Operator Fundamental Focus; Knowledge and Control *The Operator Fundamentals Knowledge and Control require that operators understand component operation and anticipate the impact of operating that component prior to its operation.*

These non-safety related MOVs are controlled from MC11. Using their open/closed pushbuttons, ND-18 and ND-33 can be throttled in the open direction only (the closing contacts "seal in" on the closed direction). ND-17 and ND-32 can be throttled in both directions using their open /close pushbuttons. These four valves have no automatic control features.

ND-18 and ND-33 are used during residual heat removal mode of operation to control bypass flow around ND Heat Exchanger B and A respectively. Opening ND-18 and ND-33 would allow the respective train's ND heat exchanger to be bypassed during the ECCS recirculation mode if a loss of instrument air were to occur (since bypass valve ND-34 fails open upon a loss of instrument air). Therefore, these valves are required to remain closed during Modes 1 - 3, when the ECCS system is required. If opened during Mode 4 for residual heat removal temperature control, they shall be capable of manual closing upon ECCS actuation. If opened for residual heat removal mode, these valves shall be closed prior to swap over to sump recirculation mode of ECCS operation, for the respective ND train to be operable. Valve status is also provided to the OAC.

2.3.6 ND-34 (A & B ND HX Bypass)

This valve can be operated from MC11 or the ASP by a manual loader. This valve is used in conjunction with ND-14 and ND-29 to control NCS cooldown rate and temperature. ND-34 will fail open on a loss of Instrument Air (VI). ND-34 is regulated to maintain a constant return flow to the NCS. A constant flow rate allows the ND pumps to continuously operate on a more efficient part of their performance curve. Flow through this return line is higher during the initial stages of NCS cooldown to limit the ND System heatup rate, and thus thermal shock to the ND heat exchangers. This valve is not required for the unit to achieve cooldown and is therefore not safety related.

2.3.7 ND-15B (Train B ND to Hot Leg Isol), ND-30A (Train A ND to Hot Leg Isol)

These motor operated valves are controlled from the ND section of MC11 in the Control Room by open/close pushbuttons. These "fail as is" valves provide cross tie isolations for the ND Trains. These valves have no auto open/close control features. These valves are opened in standby readiness, but closed in cold leg recirc.

Q43 References

2.2 Regenerative Heat Exchanger

Objective # 4

The regenerative heat exchanger is designed to recover heat from letdown by reheating the charging flow. This eliminates the reactivity effects of introducing cold charging flow and reduces the thermal shock on the charging line penetration to the NC system. In addition, the heat exchanger cools the letdown flow to ≅ 290°F prior to depressurization, to prevent flashing of water to steam across the letdown orifices. The letdown water flows through the shell side of the heat exchanger.

2.3 Letdown Orifice / Letdown Throttle Valves

Objective # 4

The letdown orifice / letdown throttle valves are designed to reduce the NC system pressure by ≅ 1900 psig and to control the letdown flow. The orifice reduces flow to 45 gpm and is isolated by NV-457A. One letdown throttle valve, NV-454, is manually set at 75 gpm via the Valve Checklist OP. It is isolated by NV-458A. In addition, there is a flow control valve, NV-459, that is controlled by a manual loader on the control board or on the Auxiliary Shutdown Panel (ASP).

The flow control valve, NV-459, allows the operator to control flow when heating up the letdown path to avoid thermal shock (water hammer, etc.) and provides for increased letdown flow during low-pressure operation. **NV-459 is also the preferred flow path during normal operation.**

The letdown orifice isolation valves (NV 457A, NV-458A, NV-35A) are each controlled by a three position switch (Open-Automatic-Close) from the Control Room or the ASP. The ASP has a Remote-Local switch. They function as containment isolation valves in addition to providing a means to isolate the orifice / letdown throttle valves. NV-457A, NV-458A and NV-35A have the following interlocks:

- Auto close on Low PZR Level (17%) or Low Charging Flow (<20gpm for >20 seconds) the Low Charging Flow signal will clear after 15 seconds.
- Auto close if NV-1A or NV-2A closes. Cannot manually close NV-1A or NV-2A if orifice isolation valves are open.
- Auto close on Phase "A" isolation (S_t).

Operator Fundamental Focus; Knowledge and Teamwork

In a Loss of Letdown event (AP-12) with the orifice isolation valves going closed, it may become necessary to locally pressurize the letdown header from the charging header, in order to prevent water hammer. NV-106 (a manual valve in the pipe chase) will allow the re-pressurization of the letdown line from the charging header.

***Reinforce** that the operator must understand plant conditions and know the appropriate action to take during abnormal conditions.*

***Emphasize** the need to coordinate field and control room activities to achieve the intended results; in this case, re-pressurizing the letdown line from the charging header.*

APE026 AA2.02 - Loss of Component Cooling Water (CCW)

Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: (CFR: 43.5 / 45.13)

The cause of possible CCW loss ....

Given the following conditions on Unit 2:

- KC Surge Tank level is lowering slowly
- The crew has implemented AP-21 (LOSS OF KC OR KC SYSTEM LEAKAGE)

Based on the conditions above, a possible location of the KC system leakage is into the ___(1)___ heat exchanger.

The assured supply of makeup water to the KC Surge tank is ___(2)___ .

Which ONE (1) of the following completes the statements above?

A. 1. Letdown
   2. YM

B. 1. Letdown
   2. RN

C. 1. Seal Water Return
   2. YM

D. 1. Seal Water Return
   2. RN

General Discussion

KC system leakage into the seal water return heat exchanger is a possible leak location due to KC system pressure being maintained at 100-110 psig and the seal water return header being maintained at VCT pressure of 25-30 psig.

Normal makeup water supply to the KC Surge Tank is YM. The assured water supply is from RN.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since KC cools the letdown Hx and is letdown pressure is relatively low, however normal letdown pressure is greater than KC system pressure.

Second part is plausible because YM is the source of normal makeup for the KC Surge Tank..

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since KC cools the letdown Hx and is letdown pressure is relatively low, however normal letdown pressure is greater than KC system pressure.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because YM is the source of normal makeup for the KC Surge tank.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to determine from the information and choices given the cause of the KC system leakage.

Basis for Hi Cog

This is a high cog question because the applicant is required to analyze the data given and perform a calculation to determine the KC surge tank level rate of decrease and then recall from memory whether or not YM is capable of keeping up with the leakage.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-PSS-KC (Component Cooling Water System) Rev 29B

LEARNING OBJECTIVES:
OP-MC-PSS-KC Objective 12

Student References Provided

APE026 AA2.02 - Loss of Component Cooling Water (CCW)
Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: (CFR: 43.5 / 45.13)
The cause of possible CCW loss ....

401-9 Comments:

Remarks/Status

Q44 References

2.3. Component Cooling Surge Tank

There is one component cooling surge tank per unit. It is divided by a baffle plate into two separate compartments for train separation. The tank is located at the high point in the system to facilitate filling and venting of the system and provide NPSH for the KC Pumps. Maximum water volume of the KC Surge Tank is 6600gallons with normal level maintained at approximately 5800 gallons. Level indications for each compartment of the KC Surge Tanks is available in the Control Room (0-9 ft.). An annunciator "KC Surge Tk LVL Abnormal" is provided to indicate high (7 ft. 2 in.) and low (4.0 ft.) level conditions.

Objective #6

Make up supply to surge tank is normally from the YM System, with a backup supply from the RN System.

The KC Surge Tank serves the following purposes.

- Accommodates for thermal expansion and contraction.
- Provides time for the operator to respond in the event of in-leakage or out-leakage.
- Provides NPSH for KC Pumps
- Provides the ability to recirculate through the surge tank to ensure uniform chemistry concentrations.

2.4. Component Cooling Drain Tank and Pump

2.4.1. KC Drain Tank

To minimize makeup and waste handling of treated water, system drains are piped to the KC drain tank. One drain tank is shared by both units. The tank is constructed primarily of stainless steel due to potential exposure to the atmosphere. The tank is then pumped back to the KC surge tank. Local level indication is available near the tank (0-100%).

2.4.2. KC Drain Tank Pump

The pump/motor is powered from SMXA Cmpt. R1I (600 VAC).

Objective #7

The pump discharge can be aligned to either units KC surge tank. Pump controls are located in the Control Room. In automatic, the pump automatically starts on high drain tank level and automatically stops on tank low level. In manual the pump is started and stopped at the operators discretion.

2.4.3. KC Standby Drain Tank Pump

A standby drain pump was installed as a backup to the permanently installed pump. The pump/motor power supply is 120 VAC from a local wall outlet. The pump is connected to the system by red rubber hoses (not normally installed). The pump is started (plugged in) when the drain tank high level alarm is received

Q44 References

1.0 INTRODUCTION

Objective #1

1.1. Purpose

The Component Cooling Water System (KC) supplies cooling water to various essential and non-essential heat exchangers within the Auxiliary and Reactor Buildings and serves as a boundary (buffer) between the Reactor Coolant and Nuclear Service Water Systems.

1.2. General Description

The KC System consists of four pumps (2 per train), two heat exchangers (1 per train), one surge tank (shared by two trains) and associated valves, piping and instrumentation.

A drain tank, drain tank pump and standby drain tank pump are shared by the two units.

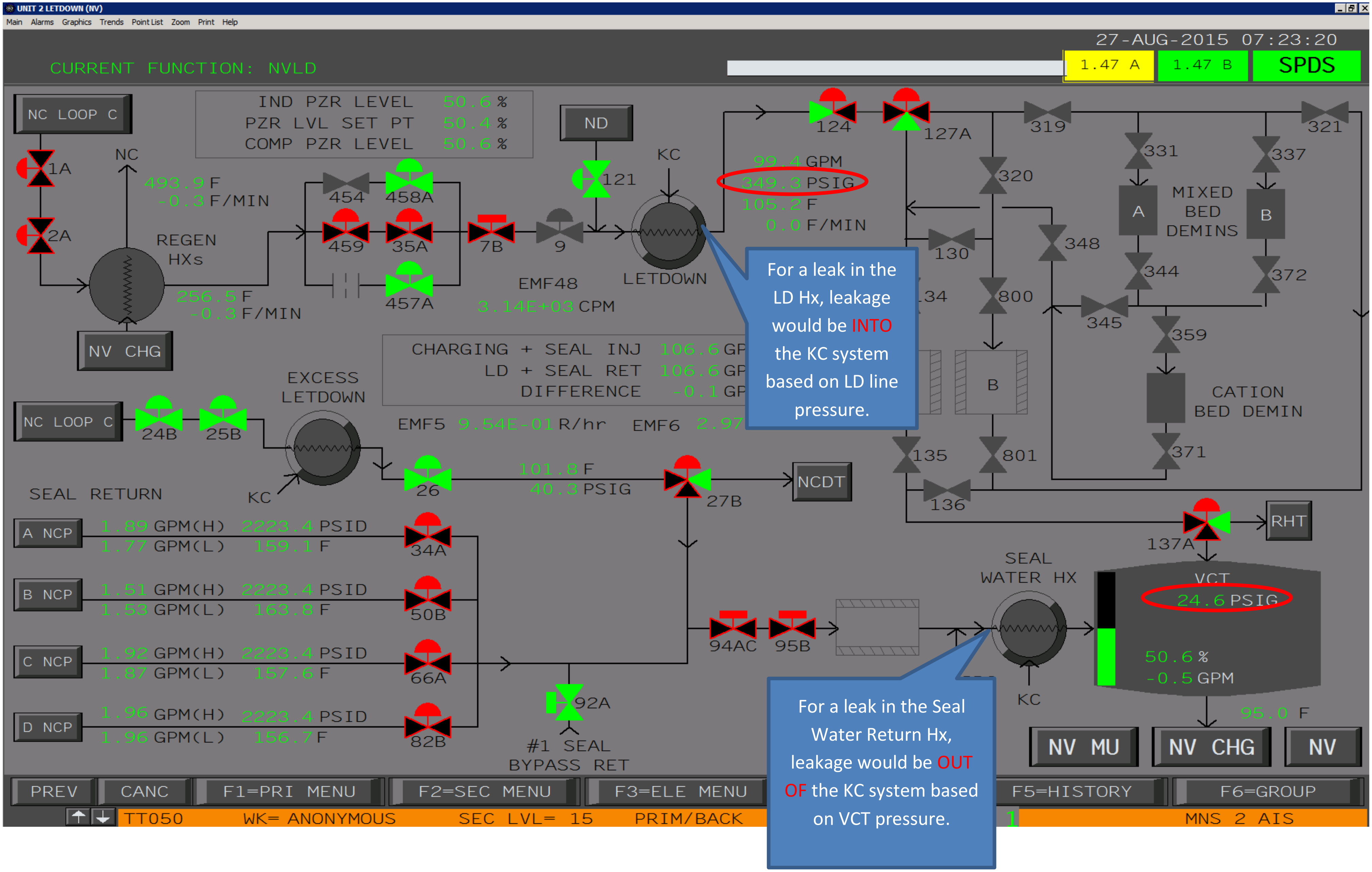
Objective #3

1.2.1. Each train is always aligned to supply its own Engineered Safeguards Header which includes the ND Heat Exchanger (normally isolated unless ND is in service) and ND Pump Mechanical Seal Heat Exchanger. Along with its safeguards header, one of the two trains will supply the non-essential headers.

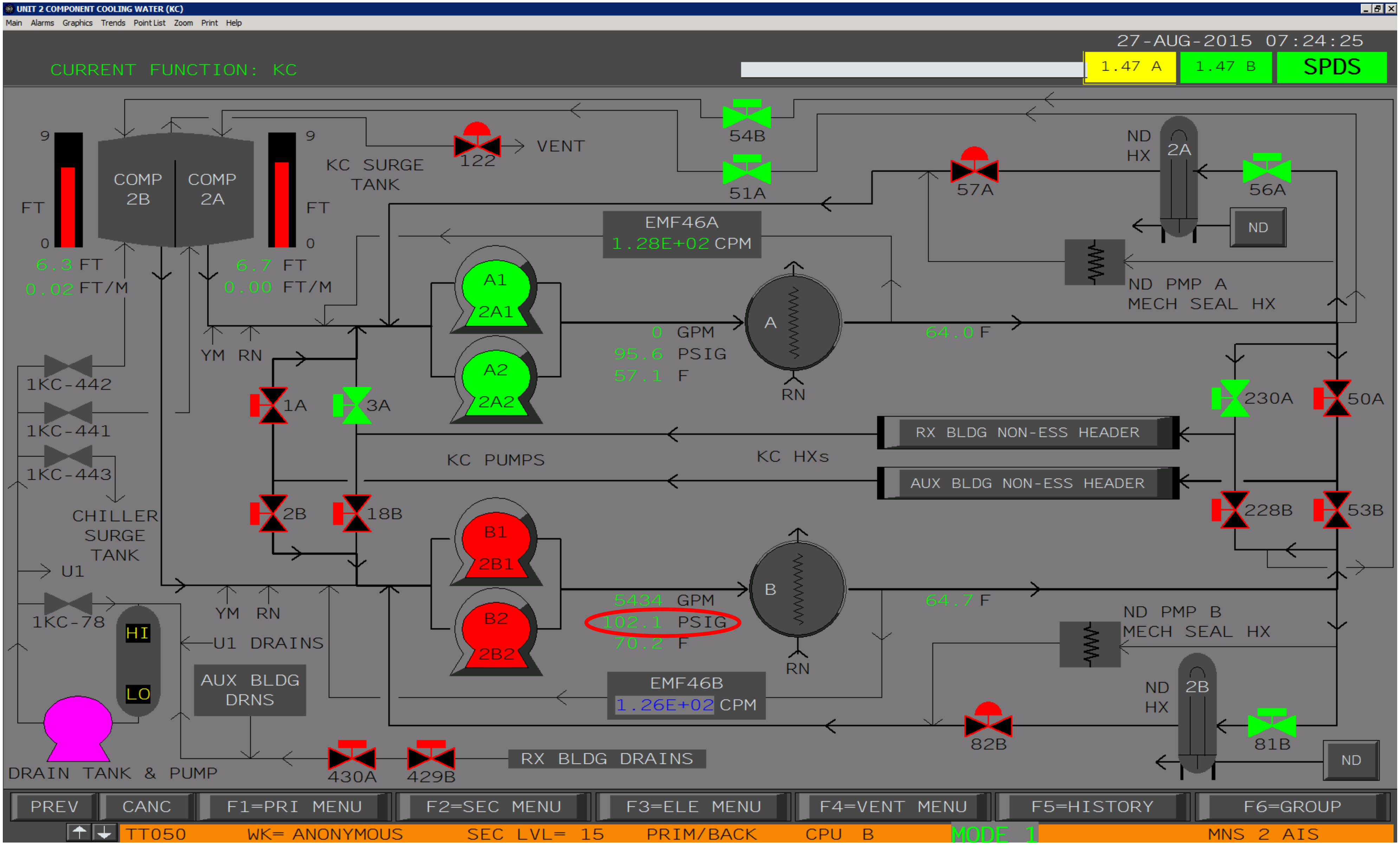
Auxiliary Building Header

- **H_2 Recombiners**
- **Waste Gas Compressors**
- **Recycle Evaporator Packages**
- **S/G Blowdown Sample Heat Exchangers**
- **ND Sample Heat Exchanger**
- **Pressurizer Sample Heat Exchanger**
- **NC Loop Sample Heat Exchanger**
- **Letdown Heat Exchanger**
- **Seal Water Heat Exchanger**
- **Fuel Pool Cooling Heat Exchangers**

Q44 References



Q44 References



EPE055 EK1.02 - Loss of Offsite and Onsite Power (Station Blackout)

Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : (CFR 41.8 / 41.10 / 45.3)

Natural circulation cooling ....

Given the following initial conditions:

- Both units have experienced a Loss of Offsite Power
- BOTH Diesel VI compressors are NOT available
- ECA-0.0 (LOSS OF ALL AC POWER) was implemented on Unit 1 and the crew has just transitioned to ECA-0.1 (LOSS OF ALL AC POWER RECOVERY WITHOUT S/I REQUIRED)

Current conditions:

- NC T_{hots} are STABLE
- S/G pressures are STABLE at 725 PSIG
- S/G levels are decreasing and approaching 11% NR
- NC T_{colds} are 490°F and STABLE
- VI header pressure is 0 PSIG

Based on the conditions above,

1) Natural Circulation flow ________ been established.

2) in accordance with ECA-0.1, the Operators will ________.

Which ONE (1) of the following completes the statements above?

REFERENCE PROVIDED

A. 1. HAS
2. increase CA flow using flow controllers in the control room

B. 1. HAS
2. increase CA flow by notifying AO to throttle CA valves locally

C. 1. HAS NOT
2. increase dumping steam using SM PORV controller on main control board AND increase CA flow using flow controllers in the control room

D. 1. HAS NOT
2. dispatch an operator to locally increase flow from the SM PORV AND increase CA flow by notifying AO to throttle CA valves locally

---

General Discussion

In the scenario given, the station has experienced a complete loss of offsite power as well as the loss of both vital AC buses on U-1. Additionally, the backup diesel powered VI compressors are not available therefore; instrument air has been lost as well. The applicant is asked to evaluate actions required by ECA 0.1 (Loss of AC Power Recovery Without S/I Required) to address given indications that Natural circulation cooling is effective and that S/G levels need to be increased.

In the first part of the answers, the applicant is asked to determine if conditions for natural circulation have been established. Generic Enclosure (Natural circulation parameters) is provided as a reference. With the conditions given, the crew would NOT be required to raise dumping steam because S/G conditions are within the limits of the graph provided in the reference. Additionally, the required actions have been affected by the loss of VI (Instrument Air) and the loss of AC power making them unique to a loss of all AC scenario.

CA (Aux Feedwater) control also would not be available from the C/R. Normally, if VI is lost, CA flow is controlled by motor driven valves from the C/R. However in this case power is not available so local manual operation would be required.

Due to the given indication that Natural Circ is adequate but S/G levels are approaching the minimum level allowed, local operations would be required to establish CA flow to the S/G's to recover level.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is correct.

Part (2) is plausible because under normal conditions CA flow would be controlled via operation of the manual loaders for the associated motor operator valves from the control room.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is plausible if the applicant misreads the graph in Enclosure 33 OR concludes that Natural Circulation conditions are not met because NC Tcolds are not at saturation for given S/G pressure (i.e. does not read the qualifier in Enclosure 33 that states "Within the limits of the graph below").

Part (2) is plausible because if the applicant concludes that Natural Circulation is not adequate the increasing steam dump would be the required action. Since the SM PORV is normally controlled from the C/R, if the applicant failed to realize that the loss of VI would prevent this capability it would be reasonable to select this answer.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is plausible if the applicant misreads the graph in Enclosure 33 OR concludes that Natural Circulation conditions are not met because NC Tcolds are not at saturation for given S/G pressure (i.e. does not read the qualifier in Enclosure 33 that states "Within the limits of the graph below").

Part (2) is plausible because if the applicant concludes that Natural Circulation is not adequate the increasing steam dump would be the required action. With the loss of VI if the applicant concludes that increasing steam dump is appropriate, dispatch an operator to locally throttle open the SM PORV would be correct. Having a NEO locally increase CA flow is correct.

Basis for meeting the K

The K/A is matched because the in the scenario given in the stem of the question, a station blackout has occurred and applicant must demonstrate the ability to verify that adequate natural circulation cooling has been established by evaluating a set of plant indications. He must then demonstrate knowledge of how to increase dumping steam (operational implications) with the degraded plant control capabilities associated with the loss of power.

Basis for Hi Cog

This question is Hi Cog because the applicant must evaluate a given set of conditions and through a multipart mental process, determine the required actions based on these conditions.

Basis for SRO only

ILT-16-1 MNS SRO NRC Examination **QUESTION 45** 45 **B**

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2014 MNS Audit Exam Q47 (Bank 5269)

Development References
REFERENCES: Generic Enclosure 33 (Natural Circulation Parameters) Rev. 38 ECA-0.1 (Loss of All AC Power Recovery Without S/I Required) Rev. 14 LEARNING OBJECTIVES: NONE

Student References Provided
Generic Enclosure 33

EPE055 EK1.02 - Loss of Offsite and Onsite Power (Station Blackout)

Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : (CFR 41.8 / 41.10 / 45.3)

Natural circulation cooling ....

401-9 Comments:

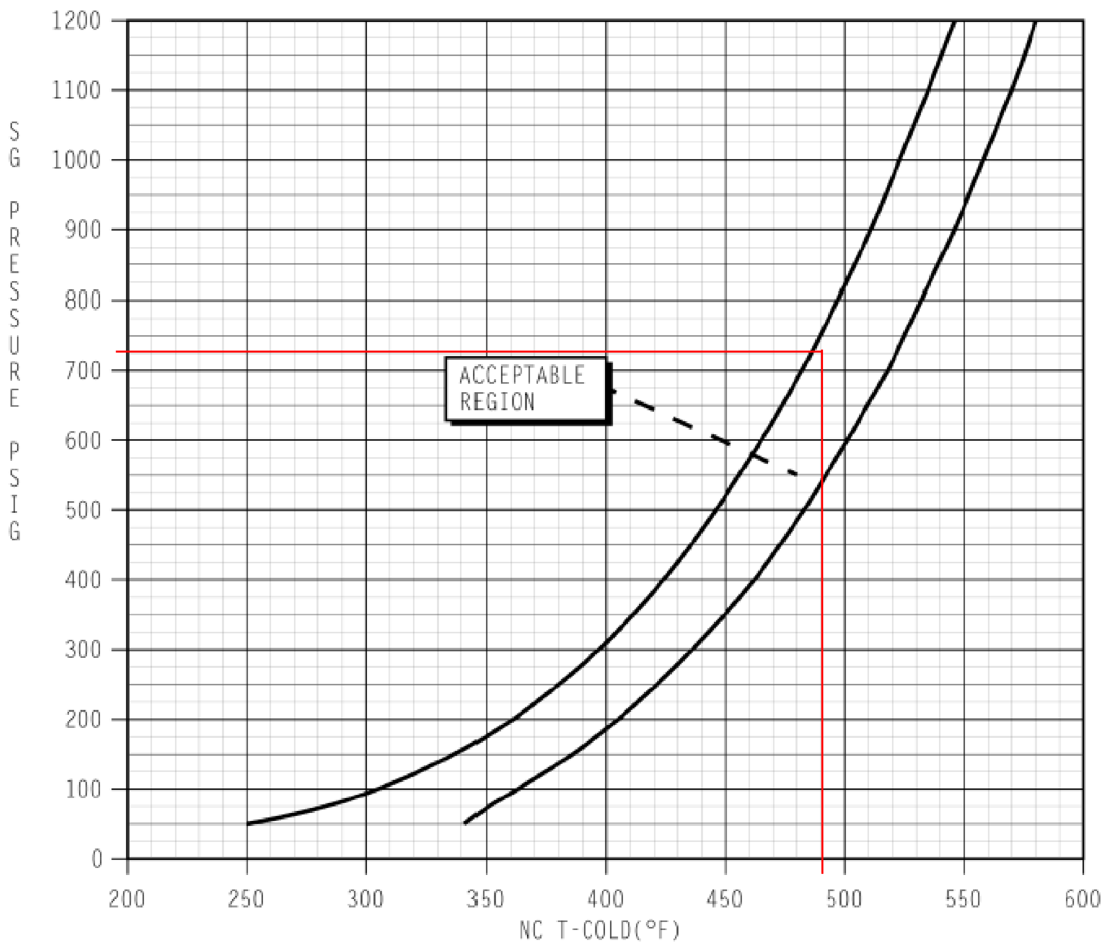
Remarks/Status

Q45 References

1. The following conditions support or indicate natural circulation flow:

- NC subcooling - GREATER THAN 0°F
- S/G pressures - STABLE OR GOING DOWN
- NC T-Hots - STABLE OR GOING DOWN
- Core exit T/Cs - STABLE OR GOING DOWN
- NC T-Colds - AT SATURATION TEMPERATURE FOR S/G PRESSURE (WITHIN THE LIMITS OF THE GRAPH BELOW).

2. IF Natural Circulation flow is not established, THEN raise dumping steam to establish Natural Circulation flow.



Q45 References

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Establish VI to containment as follows:**	
a. OPEN the following valves:	
__ 1) 1VI-129B (VI Supply to A Cont Ess VI Hdr Outside Isol).	__ 1) Align N_2 to A Train PORV by OPENING 1NI-430A (Emerg N2 From CLA To 1NC-34A).
__ 2) 1VI-160B (VI Supply to B Cont Ess VI Hdr Outside Isol).	__ 2) Align N_2 to B Train PORVs by OPENING 1NI-431B (Emerg N2 From CLA To 1NC-32B & 36B).
__ 3) 1VI-150B (Lwr Cont Non-Ess Cont Outside Isol).	
__ b. Check VI header pressure - GREATER THAN 85 PSIG.	b. Perform the following: 1) Align N_2 to all PORVs by OPENING the following valves: __ • 1NI-430A (Emerg N2 From CLA To 1NC-34A) __ • 1NI-431B (Emerg N2 From CLA To 1NC-32B & 36B). __ 2) **IF** CA control valves cannot be throttled in subsequent steps, **THEN** control flow **PER** EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 16 (CA Flow Control With Loss Of VI). __ 3) Restore VI **PER** AP/1/A/5500/22 (Loss Of VI).

CAUTION **The loads placed on the energized AC emergency bus should not exceed the capacity of the power source.**

__ 6. **Start KC pumps PER Enclosure 1 (KC System Operation).**

MNS EP/1/A/5000/G-1 **UNIT 1**	GENERIC ENCLOSURES Enclosure 16 - Page 1 of 9 **CA Flow Control With Loss Of VI**	PAGE NO. 110 of 208 Rev. 38

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Continue to use any normal CA flow control valve that works instead of associated S/G motor operator isolation valve.**	
__ 2. **Check TD CA pump - ON.**	__ **<u>GO</u> <u>TO</u> Step 4.**
3. **Control TD CA pump flow by operating the following TD CA pump to S/G motor operated isolation valves as required:** __ • 1CA-66AC (U1 TD CA Pump Disch To 1A S/G Isol) __ • 1CA-54AC (U1 TD CA Pump Disch To 1B S/G Isol) __ • 1CA-50B (U1 TD CA Pump Disch To 1C S/G Isol) __ • 1CA-38B (U1 TD CA Pump Disch To 1D S/G Isol).	**Control TD CA flow as follows:** **<u>CAUTION</u>** **Failure to control CA flow to B and C S/Gs may result in loss of TD CA pump due to S/G overfill.** __ a. <u>IF</u> <u>any</u> of the TD CA pump to S/G motor operator isolation valves **<u>OR</u>** air operated control valves work, **<u>THEN</u>** continue to control those S/G levels from the Control Room. (RNO continued on next page)

Q45 References

MNS EP/1/A/5000/G-1 **UNIT 1**	GENERIC ENCLOSURES Enclosure 16 - Page 4 of 9 **CA Flow Control With Loss Of VI**	PAGE NO. 113 of 208 Rev. 38

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. **Control MD CA pump flow by operating the following CA to S/G motor operated isolation valves as required:** • 1A CA pump: __ • 1CA-62A (1A CA Pump Disch To 1A S/G Isol) __ • 1CA-58A (1A CA Pump Disch To 1B S/G Isol). • 1B CA pump: __ • 1CA-46B (1B CA Pump Disch To 1C S/G Isol) __ • 1CA-42B (1B CA Pump Disch To 1D S/G Isol).	**Control MD CA pump flow as follows:** __ a. **<u>IF</u>** any of the CA to S/G motor operator isolation valves **<u>OR</u>** air operated control valves work, **<u>THEN</u>** continue to control that S/G level from the Control Room. **<u>NOTE</u>** Full closed to full open requires 20-22 turns for the following valves. Most of the throttling occurs in the first 20% from closed seat. b. Dispatch operator to unlock and THROTTLE the following valve(s) on just the S/G(s) that flow cannot be controlled from the Control Room: __ • 1A S/G: 1CA-59 (1A CA Pump Disch To 1A S/G Control Inlet Isol) (Unit 1 CA pump rm, 716+10, CC-50, above 1B CA Pump) __ • 1B S/G: 1CA-55 (1A CA Pump Disch To 1B S/G Control Inlet Isol) (Unit 1 CA pump rm, 716+10, above CA Pumps 1A and 1B control panels) __ • 1C S/G: 1CA-43 (1B CA Pump Disch To 1C S/G Control Inlet Isol) (Unit 1 CA pump rm, 716+11, CC-51, 5 ft north of 1B CA Pump near reactor bldg wall) __ • 1D S/G: 1CA-39 (1B CA Pump Disch To 1D S/G Control Inlet Isol) (Unit 1 CA pump rm, 716+12, CC-50, 6 ft north of 1B CA Pump near reactor bldg wall).
__ 7. **Check any CA to S/G motor operated isolation valve - ENERGIZED.**	__ **<u>GO</u> <u>TO</u> Step 9.**

FOR REVIEW ONLY - DO NOT DISTRIBUTE

B

ILT-30 MNS SRO Audit Examinatio QUESTION 47 | 47

EPE055 EK1.02 - Loss of Offsite and Onsite Power (Station Blackout)
Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : (CFR 41.8 / 41.10 / 45.3)
Natural circulation cooling ....

Given the following initial conditions:

- Both units have experienced a Loss of Offsite Power
- BOTH Diesel VI compressors are unavailable
- ECA-0.0 (LOSS OF ALL AC POWER) was implemented on Unit 1 and the crew has just transitioned to ECA-0.1 (LOSS OF ALL AC POWER RECOVERY WITHOUT S/I REQUIRED)

Current conditions:

- NC T_{hots} are STABLE
- S/G pressures are STABLE at 725 PSIG
- S/G levels are decreasing and approaching 11% NR
- NC T_{colds} are 490°F and STABLE
- VI header pressure is 0 PSIG

Based on the indications above:

Natural Circulation flow ___(1)___ been established.

In accordance with ECA-0.1, the Operators will ___(2)___.

Which ONE (1) of the following completes the statements above?

REFERENCE PROVIDED

A. 1. HAS
2. increase CA flow using flow controllers in the control room

B. 1. HAS
2. increase CA flow by notifying NEO to throttle CA valves locally

C. 1. HAS NOT
2. increase dumping steam using SM PORV controller on main control board AND increase CA flow using flow controllers in the control room

D. 1. HAS NOT
2. dispatch an operator to locally increase flow from the SM PORV AND increase CA flow by notifying NEO to throttle CA valves locally

---

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO Audit Examinatio QUESTION 47 47 **B**

General Discussion

In the scenario given, the station has experienced a complete loss of offsite power as well as the loss of both vital AC buses on U-1. Additionally, the backup diesel powered VI compressors are not available therefore; instrument air has been lost as well. The applicant is asked to evaluate actions required by ECA 0.1 (Loss of AC Power Recovery Without S/I Required) to address given indications that Natural circulation cooling is effective and that S/G levels need to be increased.

In the first part of the answers, the applicant is asked to determine if conditions for natural circulation have been established. Generic Enclosure (Natural circulation parameters) is provided as a reference. With the conditions given, the crew would NOT be required to raise dumping steam because S/G conditions are within the limits of the graph provided in the reference. Additionally, the required actions have been affected by the loss of VI (Instrument Air) and the loss of AC power making them unique to a loss of all AC scenario.

CA (Aux Feedwater) control also would not be available from the C/R. Normally, if VI is lost, CA flow is controlled by motor driven valves from the C/R. However in this case power is not available so local manual operation would be required.

Due to the given indication that Natural Circ is adequate but S/G levels are approaching the minimum level allowed, local operations would be required to establish CA flow to the S/G's to recover level.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is correct.

Part (2) is plausible because if AC power was available, this would be correct because procedurally, CA flow would be controlled via operation of the associated motor operator valves from the control room.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is plausible if the applicant misreads the graph in Enclosure 33 OR concludes that Natural Circulation conditions are not met because NC Tcolds are not at saturation for given S/G pressure (i.e. does not read the qualifier in Enclosure 33 that states "Within the limits of the graph below").

Part (2) is plausible because if the applicant concludes that Natural Circulation is not adequate the increasing steam dump would be the required action. Since the SM PORV is normally controlled from the C/R, if the applicant failed to realize that the loss of VI would prevent this capability it would be reasonable to select this answer.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part (1) is plausible if the applicant misreads the graph in Enclosure 33 OR concludes that Natural Circulation conditions are not met because NC Tcolds are not at saturation for given S/G pressure (i.e. does not read the qualifier in Enclosure 33 that states "Within the limits of the graph below").

Part (2) is plausible because if the applicant concludes that Natural Circulation is not adequate the increasing steam dump would be the required action. With the loss of VI if the applicant concludes that increasing steam dump is appropriate, dispatch an operator to locally throttle open the SM PORV would be correct. Having a NEO locally increase CA flow is correct.

Basis for meeting the K

The K/A is matched because the in the scenario given in the stem of the question, a station blackout has occurred and applicant must demonstrate the ability to verify that adequate natural circulation cooling has been established by evaluating a set of plant indications. He must then demonstrate knowledge of how to increase dumping steam (operational implications) with the degraded plant control capabilities associated with the loss of power.

Basis for Hi Cog

This question is Hi Cog because the applicant must evaluate a given set of conditions and through a multipart mental process, determine the required actions based on these conditions.

Basis for SRO only

Q45 Parent Question (2014 MNS Audit Q47 (Bank 5269))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

B

ILT-30 MNS SRO Audit Examinatio QUESTION 47 | 47

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2011 MNS NRC Exam Q51 MODIFIED (Bank 4404)

Development References
References: Generic Enclosure 33 ECA-0.1, Loss of All AC Power Recovery Without S/I Required Learning Objectives:

Student References Provided
Generic Enclosure 33

EPE055 EK1.02 - Loss of Offsite and Onsite Power (Station Blackout)
Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : (CFR 41.8 / 41.10 / 45.3)
Natural circulation cooling ....

401-9 Comments:

Remarks/Status
401-9 Comment: UNSAT 055EK1.02 Question kind of matches the K/A. Not sure it is operationally valid. If the unit has lost all AC for 10 hours, plant conditions would have degraded more. I doubt a transition to ECA 0.1 could be made. Furthermore, One items in the in your description of the question states that power is not available, however if you have transitioned out of ECA0.0, then power is available. I know this was used before; however I do not think these plant conditions can be achieved. While reviewing McGuire's ECA 0.0 I believe the S/Gs would have been depressurized to 290 psig if a loss of all AC lasted 10 hours. Will discuss. 2011 MNS NRC Exam Q5110/23/2013 The 10 hour Loss of Offsite Power in the first bullet was a carryover from the previous version of the question and was not needed. Revised first bullet to simply say that a loss of offsite power has occurred on both units. HCF 10/30/13 Q47 approved as SAT by Chief Examiner. HCF 11/18/13

APE025 2.4.35 - Loss of Residual Heat Removal System (RHRS)

APE025 GENERIC

Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)

Given the following initial conditions on Unit 1:

- Unit is in Mode 6
- NC System WR level is at +2 inches and lowering
- AP-19 (LOSS OF ND OR ND SYSTEM LEAKAGE) has been implemented
- The CRS has decided to makeup to the NC system using gravity feed through 1ND-35 (UNIT 1 ND to FWST ISOL) and 1NI-173A (1A ND to A & B COLD LEGS CONT OUTSIDE ISOL)

In accordance with AP-19,

1) flow to the NC system will be established by throttling 1ND-35 _______.

2) ND pump operation is not allowed with 1ND-35 OPEN because _______ will occur.

Which ONE (1) of the following completes the statements above?

A. 1. from the Control Room
2. a loss of NC system inventory outside containment

B. 1. from the Control Room
2. ND pump runout conditions

C. 1. locally
2. a loss of NC system inventory outside containment

D. 1. locally
2. ND pump runout conditions

General Discussion

AP-19 enclosure 8 states, since ND-35 is locally throttled to the necessary makeup flow, it can't be performed solely from the control room.

This enclosure ensures the ND pumps are off, consistent with the caution in enclosure 3. If ND pumps were allowed to run with ND-35 open, a loss of NC inventory outside containment (to the FWST) could occur.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because all other valves that would align NC system flow via ND to the cold legs are control room operated valves.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because all other valves that would align ND to the cold legs are control room operated valves.

Second part is plausible because having 1ND-35 and 1NI-173A open would provide multiple discharge flowpaths for the running ND pump.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because having 1ND-35 and 1NI-173A open would provide multiple discharge flowpaths for the running ND pump.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of a task that is performed locally during the implementation of AP-19 (Loss of ND) and the resultant operational effects of performing this task.

Basis for Hi Cog

This question is higher cognitive because the applicant must perform more than one mental step to correctly answer it. The applicant must first recall from memory where 1ND-35 can be operated from and then have a thorough understanding of system design and flowpath to be determine what undesired circumstances could arise from operating an ND pump with 1ND-35 open.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
AP-19 (Loss of ND or ND System Leakage) Rev 29
AP-19 (Loss of ND or ND System Leakage) Bckgd doc, pg 36 of 54 Rev 17

LEARNING OBJECTIVES:
NONE

Student References Provided

APE025 2.4.35 - Loss of Residual Heat Removal System (RHRS)
APE025 GENERIC
Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:	Remarks/Status

Q46 References

MNS AP/1/A/5500/19 UNIT 1	LOSS OF ND OR ND SYSTEM LEAKAGE Enclosure 9 - Page 1 of 2 **Makeup By Gravity Through 1ND-35 and 1NI-178B**	PAGE NO. 83 of 263 Rev. 29

NOTE NC makeup via this flowpath is required to be isolated prior to starting an ND pump. Enclosure 16 (Startup of ND Pumps) and Enclosure 20 (Startup of ND Pumps Without VI Available) contain steps to isolate this flowpath and realign valves as required just prior to starting ND pump.

__ 1. **Ensure NC System is vented.**

__ 2. **Dispatch operator to lift white tag, unlock, and stand by 1ND-35 (Unit 1 ND to FWST Isol) (aux bldg, 750+7, KK-52, just outside 1B ND/NS Hx room).**

__ 3. **OPEN from Control Room, or dispatch operator to OPEN, 1NI-178B (1B ND to C & D Cold Legs Cont Outside Isol) (aux bldg, 733+6, HH-52, room 730, BIT room 6 ft west of HH-52, 3 ft from reactor bldg wall).**

__ 4. **OPEN from Control Room, or dispatch operator to OPEN, 1ND-15B (1B ND To 1B & 1C NC Hot Legs Isol) (aux bldg, 733+8, LL-51, room 732, ND Hx room 1B).**

__ 5. **Ensure ND pumps off.**

__ 6. **Have operator THROTTLE OPEN 1ND-35 (Unit 1 ND to FWST Isol) for desired flow.**

NOTE Steps 7 through 9 prevent loss of NC inventory outside containment (to FWST through unchecked flowpath) if an ND pump inadvertently starts or if NC pressure goes above FWST head.

7. **IF power available to both valves, THEN CLOSE the following valves:**

   __ • 1ND-19A (1A ND Pump Suction From FWST or NC Isol)

   __ • 1ND-4B (1B ND Pump Suction From FWST or NC Isol).

Q46 References

MNS AP/1/A/5500/19 **UNIT 1**	LOSS OF ND OR ND SYSTEM LEAKAGE Enclosure 9 - Page 2 of 2 **Makeup By Gravity Through 1ND-35 and 1NI-178B**	PAGE NO. 84 of 263 Rev. 29

8. **IF 1ND-19A (1A ND Pump Suction From FWST or NC Isol) or 1ND-4B (1B ND Pump Suction From FWST or NC Isol) still open, THEN perform the following:**

CAUTION **Failure to monitor FWST level (and close 1ND-35 (Unit 1 ND to FWST Isol)) in next step may result in loss of NC inventory outside Containment.**

__ a. Monitor FWST level while 1ND-35 (Unit 1 ND to FWST Isol) is open.

b. IF AT ANY TIME either of the following occur, THEN have operator CLOSE, lock, and rehang white tag on 1ND-35:

__ • FWST empties

OR

__ • FWST level stabilizes or starts going up.

__ 9. **IF AT ANY TIME an ND pump inadvertently starts, THEN immediately stop ND pump.**

__ 10. **IF required to maintain NC temperature or level, THEN use different or multiple makeup options.**

Q46 References

makeup using NV Pumps through S/I flowpath cannot be used with normal charging aligned, since NV pump runout may occur.

SUMMARY FOR ENCLOSURE 8, MAKEUP BY GRAVITY THROUGH ND-35 AND ND-173A

The purpose of the note at the beginning of this enclosure is to inform operators of the compatibility issues that exist between this makeup option and the enclosures that start an ND pump. ND-35 must be closed prior to starting an ND pump to prevent pumping water from the NC system back to the FWST. In addition, other valves in this enclosure must be realigned out of their makeup alignment to support ND pump operation. The operator needs to be aware that if continuous makeup is required (e.g. if a leak exists), an additional makeup option may be needed, since the ND pump startup enclosure will isolate this flowpath just prior to starting an ND pump.

As noted in the table in the enclosure with the makeup options, the characteristics for this flow path are high volume, low pressure (NC System vented) and injects into cold legs ("A" & "B"). This enclosure may be best used for scenarios involving a loss of inventory in excess of normal charging capacity and with NC not pressurized above atmospheric, and without NC cold leg loss of inventory type events. The expected flow rate via this pathway may be in the neighborhood of 850 gpm with NC pressure 0 psig, and 670 gpm with NC pressure 10 psig (calc MCC-1223.11-00-0006, via the ND-35/NI-183 pathway) assuming a similar flowrate.

The flow path utilized is flow from the FWST, back through ND-35, forward flow through ND-30A, and forward flow through NI-173A, to "A" & "B" Cold leg.

This enclosure ensures the ND pumps are off, consistent with the caution in the enclosure 3. If ND pumps were allowed to run with ND-35 open, a loss of NC inventory outside containment (to the FWST) could occur. A cue is provided to immediately stop any ND pump that has inadvertently started.

One other consideration in the use of this enclosure is ND-35 is a manual local valve. Since ND-35 is locally throttled to the necessary makeup flow, it can't be performed solely from the control room.

SUMMARY FOR ENCLOSURE 9, MAKEUP BY GRAVITY THROUGH ND-35 AND ND-178B

The purpose of the note at the beginning of this enclosure is to inform operators of the compatibility issues that exist between this makeup option and the enclosures that start an ND pump. ND-35 must be closed prior to starting an ND pump to prevent pumping water from the NC system back to the FWST. In addition, other valves in this enclosure must be realigned out of their makeup alignment to support ND pump operation. The operator needs to be aware that if continuous makeup is required (e.g. if a leak exists), an additional makeup option may be

APE040 AA1.13 - Steam Line Rupture

Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: (CFR 41.7 / 45.5 / 45.6)

Steam line isolation valve indications ....

Given the following conditions on Unit 1:

- A steam line break has occurred downstream of the 1D S/G MSIV
- A Main Steam Isolation (MSI) has occurred

When verifying a MSI has occurred using indications on **1SI-3**,

1) individual Main Steam Isolation valve **status lights** are expected to be ________.

2) individual Main Steam Isolation Bypass valve **status lights** are expected to be ________.

Which ONE (1) of the following completes the statements above?

A. 1. illuminated
   2. illuminated

B. 1. illuminated
   2. dark

C. 1. dark
   2. illuminated

D. 1. dark
   2. dark

General Discussion

Individual status lights for the MSIVs will be illuminated upon MSIV closure and individual status lights for MSIV Bypass valves will be dark upon closure.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since the MSIV individual status lights will be illuminated upon closure.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the MSIV Bypass valve individual status lights will be dark upon valve closure

Second part is plausible since the MSIV individual status lights will be illuminated upon closure.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the MSIV Bypass valve individual status lights will be dark upon valve closure

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant must demonstrate the ability to monitor steam line isolation valve indications upon receipt of an MSI signal as a result of a steam line rupture.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-ECC-ISE (Engineered Safeguards Actuation System) Rev. 37
MNS Main Control Board Indications (Simulator) for specific event

LEARNING OBJECTIVES:
NONE

Student References Provided

APE040 AA1.13 - Steam Line Rupture
Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: (CFR 41.7 / 45.5 / 45.6)
Steam line isolation valve indications ....

401-9 Comments:

Remarks/Status

Q47 References

NOTE: Resetting the S_H signal will allow manual control of VQ valves. VQ valves do not have an auto function.

Annulus Ventilation System (VE) start maintains negative pressure in annulus. It is actuated automatically by a Hi Hi Containment pressure signal or manually by either depressing Phase "B" Containment Isolation Pushbutton or placing VE (Annulus Ventilation) to "ON".

To reset the start signal we must reset the Phase "B" isolation, then, place VE (Annulus Ventilation) fan switch to "Reset" and place back in "auto".

H_2 Skimmer and Air Return Fan (VX) starts on a Hi Hi Containment Pressure (S_P) with CPCS or Manually by Phase B pushbutton and CPCS after a 10 minute time delay.

Objective # 13

A Main Steam Isolation (MSI) signal closes the MSIV's, MSIV bypasses and the PORV's. It can be actuated by any one of the following signals:

Manually		**1/2 pushbuttons**	
Hi Hi Containment Pressure	**> 3.0 psig**	**2/4 channels**	
Low Steam Pressure	**< 775 psig**	**2/3 channels on 1/4 S/G**	**> P-11**
High steamline pressure negative rate	**(-)100 psig/sec**	**2/3 channels on 1/4 S/G**	**below P-11 if the Lo Press Stm Line Isol is blocked**

If a lower SM depressurization rate is maintained over time, eventually the Main Steam Isolation (MSI) can occur. The 100 psi/sec rate is somewhat of a misnomer. If SM press drops 100 psi in 1 sec, you will get an isolation, but lower rates can also give you an isolation. Here are some examples that will result in a Main Steam Isolation (MSI):

- 100 psi/sec for 1 sec
- 25 psi/sec for approximately 4 seconds
- 8.7 psi/sec for approximately 13 seconds
- 4.3 psi/sec for approximately 30 seconds
- 2.2 psi/sec for approximately 120 seconds
- 2.0 psi/sec for approximately 360 seconds

Q47 References

Main Steam Isolation (MSI)

- **Hi Hi Containment Pressure (S_P)**
- **Low Steamline Pressure**
- **High Steamline Pressure rate of decrease (below P-11 with Lo Press Stm Line Isol blocked)**
- **Manual**

Main Feedwater Isolation (FWI)

- **Safety Injection (S_S)**
- **Reactor Trip and Low T-avg**
- **High High S/G Level**
- **Manual**

VE (Annulus Ventilation) System Start

- **Hi Hi Containment Pressure (S_P)**
- **Manual**

H_2 Skimmer and Air Return Fan Start (VX)

Hi Hi Containment Pressure (S_P)

CPCS

10 minute time delay

2.2 POWER SUPPLIES

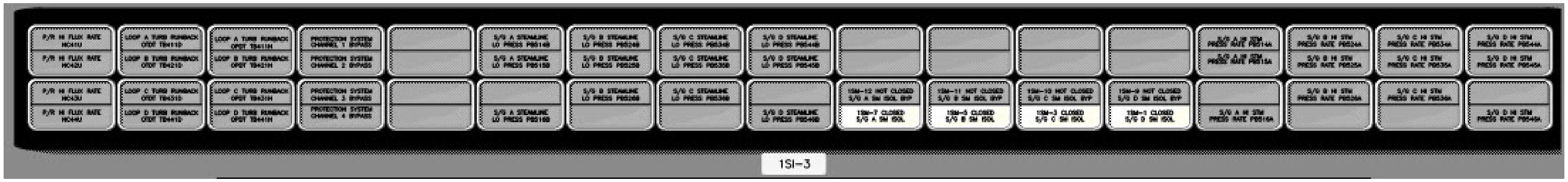
Protection Set I - 120 VAC Instrument and Control Power panelboard EKVA supplies power to the following:

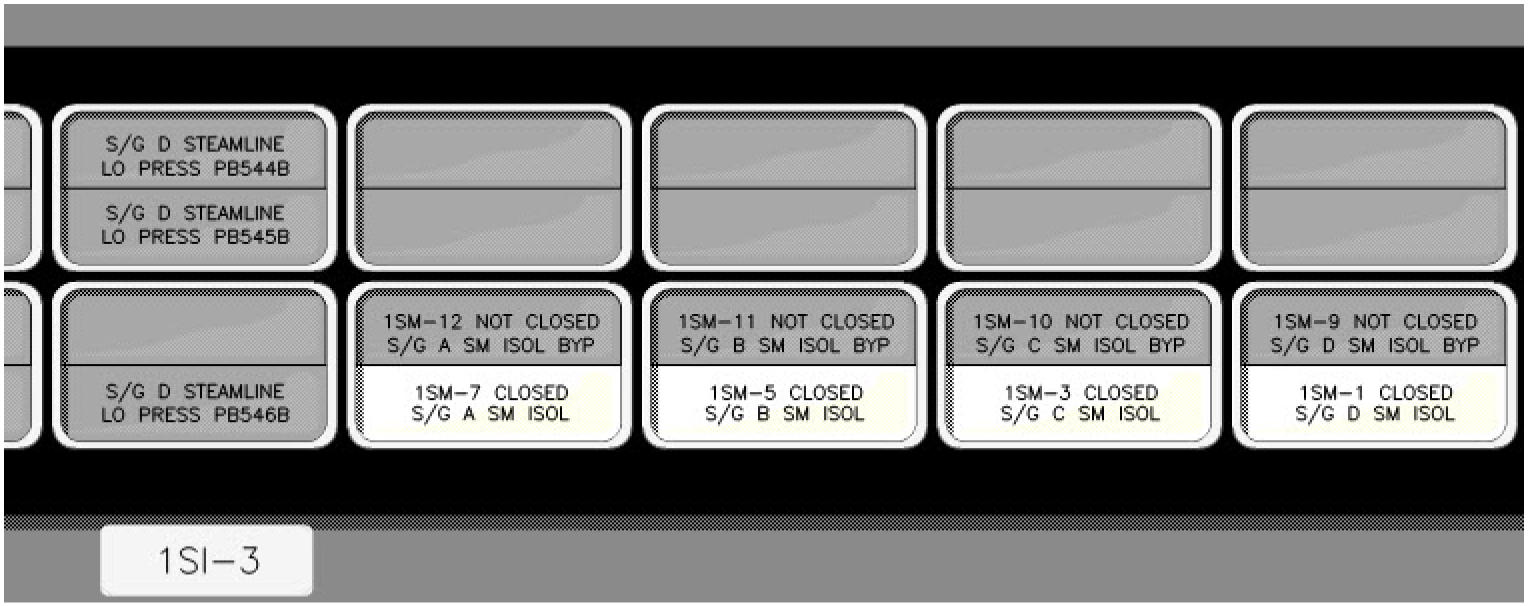
- Process Protection Channel I
- Safeguards Test Cabinet Train A
- Solid State Protection Channel I (Train A & B)
- Solid State Protection Train A Output Cabinet
- Auxiliary Safeguards Cabinet Train A

Protection Set II - 120 VAC Instrument and Control Power panelboard EKVB supplies power to the following:

- Process Protection Channel II
- Solid State Protection Channel II (Train A & B)

Q47 References





ILT-16-1 MNS SRO NRC Examination **QUESTION 48** 48 **D**

APE054 AK3.01 - Loss of Main Feedwater (MFW)
Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): (CFR 41.5,41.10 / 45.6 / 45.13)
Reactor and/or turbine trip, manual and automatic ....

Given the following initial conditions on Unit 1:

- The crew is performing a Unit Startup and Power increase
- Unit is holding at 2% RTP per OP/1/A/6100/003 (POWER INCREASE)
- 1A CF pump is out of service for emergent repairs

Subsequently,

- 1B CF pump trips on low lube oil pressure
- The crew enters AP/1/A/5500/006 (S/G FEEDWATER MALFUNCTION)

1) In accordance with AP-06, what is the MAXIMUM power level allowed, above which, a manual reactor trip is required?

2) What is the basis for manually tripping the reactor above that power level?

A. 1. 5%
   2. to prevent an inadvertent mode change

B. 1. 5%
   2. to ensure CA can maintain adequate S/G levels

C. 1. 3%
   2. to prevent an inadvertent mode change

D. 1. 3%
   2. to ensure CA can maintain adequate S/G levels

General Discussion

Per AP-06 background document, if the CF pumps are incapable of feeding the S/Gs with reactor power >3%, guidance is given to trip the reactor and go to E-0. If reactor power is higher than the feed capability of CA, then there is no need to wait on the low S/G water level reactor trip.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 5% is the point above which a mode change will occur and OP/1A/6100/003 gives specific guidance to not allow an unwarranted mode change to occur.

Second part is plausible since it is a reason for not allowing reactor power to increase above 5% and reactor power is inherently unstable at low powers.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 5% is the point above which a mode chan.ge will occur and OP/1A/6100/003 gives specific guidance to not allow an unwarranted mode change to occur.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since it is a reason for not allowing reactor power to increase above 5% and reactor power is inherently unstable at low powers.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the trip setpoint and the reason for tripping the reactor on a loss of main feedwater at low power conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
AP-06 (S/G Feedwater Malfunction) Rev 19
AP-06 background doc Rev 11

LEARNING OBJECTIVES:
OP-MC-AP-06 Objective 4

Student References Provided

APE054 AK3.01 - Loss of Main Feedwater (MFW)

Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): (CFR 41.5,41.10 / 45.6 / 45.13)
Reactor and/or turbine trip, manual and automatic ....

401-9 Comments:	Remarks/Status

Q48 References

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Check reactor power - GREATER THAN 3%.**	**IF S/G level(s) going down in an uncontrolled manner, OR any CA pump is on, THEN perform the following:** __ a. Start CA pump(s) as required to maintain S/G levels. __ b. Control flow to maintain S/G NR levels at 39%. __ c. **IF AT ANY TIME** CA Storage Tank (water tower) goes below 1.5 ft, **THEN** perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 20 (CA Suction Source Realignment). __ d. **IF AT ANY TIME** CA pump(s) run longer than 2 hours, **THEN** perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 21 (CA Storage Tank (Water Tower) Makeup). __ e. **IF** any EP in effect, **THEN GO TO** Step 7. f. **IF AT ANY TIME** all of the following met, **THEN GO TO** EP/1/A/5000/FR-H.1 (Response to Loss of Secondary Heat Sink): __ • N/R level in all S/Gs - LESS THAN 11% __ • Total feed flow - LESS THAN 450 GPM __ • ND pump suction - ALIGNED TO FWST.

Q48 References

MNS AP/1/A/5500/06 **UNIT 1**	S/G FEEDWATER MALFUNCTION	PAGE NO. **6 of 34** **Rev. 19**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 7. **Check CM/CF - PRESENTLY FEEDING S/Gs.**	**Perform the following:** a. **IF** CF pump(s) incapable of feeding S/Gs **AND** reactor power greater than 3%, **THEN** perform the following: __ 1) Trip reactor. __ 2) **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection). __ b. **IF** desired to establish CM/CF to S/Gs, **THEN GO TO** Enclosure 1 (Reestablishing CM/CF To S/Gs).

NOTE W/R S/G level indication will indicate changes in actual level trends before N/R level.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 8. **Check S/G levels - STABLE OR TRENDING TO PROGRAM LEVEL.**	**Perform the following:** a. Adjust any of the following as necessary to stabilize S/G levels: __ • CF pumps __ • CF control valves __ • CF control bypass valves. b. **IF** CF pump control problem, **THEN** perform the following: __ 1) **IF** CF pump flow is completely lost from only one pump, **AND** turbine inlet pressure is greater than 500 PSIG, **THEN** trip affected pump and **GO TO** AP/1/A/5500/03 (Load Rejection). __ 2) Reduce load **PER** AP/1/A/5500/04 (Rapid Downpower) as required to stabilize S/G levels at program level.

Q48 References

STEP 7:

PURPOSE:
Re-establish CM/CF flow to the S/Gs if desired.

DISCUSSION:
If the CF pumps are incapable of feeding the S/Gs with reactor power >3%, guidance is given to trip the reactor and go to E-0. If reactor power is higher than the feed capability of CA, then there is **no** need to wait on the low S/G water level reactor trip.

If low in power or shutdown with a FW isolation or CF pump problem, and it is desired to re-establish feedwater, then direction is given to use Enclosure 1 to re-establish CF flow. Enclosure 1 will recover from FW isolation. It will direct CF Pump startup per guidance similar to the OP except for those steps deemed unnecessary due to the CF Pump having been recently in operation.

REFERENCES:
OP/1&2/A/6250/001, Condensate and Feedwater System

STEP 8 NOTE:

PURPOSE:
Inform the operator that Wide Range S/G level will indicate changes in actual S/G level before Narrow Range S/G level will.

DISCUSSION:
Wide Range level more accurately displays actual S/G levels (Narrow range level responds after a delay of 1-2 minutes).

OE from 3/10/07 2A CFPT malfunction (PIP M-07-1917) "The BOP Operator closely monitored S/G levels from trip criteria through the transient. The BOP Operator advised the team of 2C S/G NR level decreasing and approaching 20% (17% Reactor Trip). The Shift Technical Advisor responded that W/R level indication, a leading indicator of level trends, had in fact turned and was indication an increase in level. S/G N/R level indications shortly thereafter began to increase with indicated level reaching its minimum value of approximately 21%."

REFERENCES:
PIP M-07-1917

APE057 AA1.05 - Loss of Vital AC Electrical Instrument Bus

Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: (CFR 41.7 / 45.5 / 45.6)

Backup instrument indications ....

Given the following initial conditions on Unit 2:

- A Reactor Trip has occurred
- The crew has completed E-0 (REACTOR TRIP OR SAFETY INJECTION) and transitioned to ES-0.1 (REACTOR TRIP RESPONSE)

Subsequently:

- EVDD output breaker to 2EVID inverter trips OPEN

Based on the conditions above,

1) which ONE (1) of the following indicates the impact on the CA system flow instrumentation?

2) what alternate indication can be used to determine the status of CA flow to the affected S/G?

A. 1. 2A S/G CA flow fails low
   2. 2A CA Pump amps and breaker indicating lights

B. 1. 2B S/G CA flow fails low
   2. 2B CA Pump amps and breaker indicating lights

C. 1. 2C S/G CA flow fails low
   2. 2A CA Pump amps and breaker indicating lights

D. 1. 2D S/G CA flow fails low
   2. 2B CA Pump amps and breaker indicating lights

General Discussion

Per AP-15 (Loss of Vital or Aux Control Power), a loss of Vital AC bus 2EKVA will cause 2CAP-5090 and 2CAP5100 (Aux Feedwater Flow to 2A and 2B S/G) to fail low.
Also per AP-15, a loss of Vital AC bus 2EKVD will cause 2CAFT-5121 and 2CAFT5110 (Aux Feedwater Flow to 2C and 2D S/G) to fail low.

Verification of CA pump operation (and therefore flow) can be done by using alternate indications such as, pump amps and breaker indicating lights.

Per OP-MC-CF-CA, MD CA pump A supplies steam generators A and B while MD CA pump B supplies steam generators C and D.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be correct had Vital AC bus 2EKVA de-energized. Applicant may confuse which loads are from each vital bus.

Second part is plausible since 2A CA pump feeds S/G's A and B and is true if 2A S/G CA flow had been lost due to loss of 2EKVA.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be correct had Vital AC bus 2EKVA de-energized. Also plausible since 6.9 kV and 4160 essential AC busses are aligned where 'A' bus/train feeds 'A' and 'C' loads and 'B' bus/train feeds 'B' and 'D' loads.

Second part is plausible if applicant concludes 2B MD CA pump feeds S/G's 2B and 2D.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible if applicant concludes 2A MD CA pump feeds S/G's 2A and 2C.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because it requires the applicant to determine the status of CA flow to A S/G by an alternate means (using backup indications to determine the status of the CA pumps) due to the loss of vital AC instrument bus 2EKVD.

Basis for Hi Cog

This question is high cognitive because the applicant must first analyze the conditions in the stem and determine that 2EKVD is de-energized since inverter 2EVID has no 'AUTO" swap to alternate power supply, then determine how the CA system will be affected on a loss of Vital bus and what alternate indications can be used to verify CA flow.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2015 MNS NRC Q51 Bank #5957

Development References

REFERENCES:
AP-15 (Loss of Vital or Aux Control Power) Rev. 21
Lesson plan OP-MC-CF-CA Rev 51
Lesson plan OP-MC-EL-EPL Rec 26C

LEARNING OBJECTIVES:
NONE

Student References Provided

APE057 AA1.05 - Loss of Vital AC Electrical Instrument Bus

Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: (CFR 41.7 / 45.5 / 45.6)

Backup instrument indications ....

401-9 Comments:	Remarks/Status

Q49 References

MNS AP/2/A/5500/15 UNIT 2	LOSS OF VITAL OR AUX CONTROL POWER Enclosure 16 - Page 2 of 4 **2EKVD Load List**	PAGE NO. 110 of 145 Rev. 21

4. **Annunciators:**

__ • 2AD-15 annunciator panel loses power.

5. **CA System:**

__ • 2CAFT5110 (Aux Feedwater flow 2C S/G) fails low

__ • 2CAFT5121 (Aux Feedwater flow 2D S/G) fails low

__ • 2B CA pump auto start defeat signal drops out. (If 2B CA pump is in auto start defeat and an auto start signal is present, 2B CA pump will start.)

6. **CF System:**

• The following valves cannot be operated using the manual pushbutton:

__ • 2CF-26AB (2D S/G CF Cont Outside Isol)

__ • 2CF-30AB (2B S/G CF Cont Outside Isol).

• The following valves lose position indication:

__ • 2CF-26AB (2D S/G CF Cont Outside Isol)

__ • 2CF-30AB (2B S/G CF Cont Outside Isol).

7. **Diesel Generator 2B:**

__ • 2B1 and 2B2 VG compressors run continuously due to VG tank pressure instrumentation failing low

__ • FD Transfer pump Auto control disabled (Manual control still available)

__ • 2LD-113B (LD Filter Bypass) fails open.

8. **FW System:**

__ • 2FWLT5000 (FWST Level Channel 4) inoperable. Channel 4 relays are incapable of energizing to support FWST low level auto-swapover to containment sump. Swapover logic is reduced to 2/2 from other channels.

Q49 References

MNS AP/2/A/5500/15 **UNIT 2**	LOSS OF VITAL OR AUX CONTROL POWER Enclosure 13 - Page 2 of 5 **2EKVA Load List**	PAGE NO. 103 of 145 Rev. 21

5. **CA System:**

   __ • 2CA-7A (U2 TD CA Pump Suction Isol) position indication lost

   __ • 2CAP5090 (Aux Feedwater flow 2A S/G) fails low

   __ • 2CAP5100 (Aux Feedwater flow 2B S/G) fails low

   __ • 2A CA pump auto start defeat signal drops out. (If 2A CA pump is in auto start defeat and an auto start signal is present, 2A CA pump will start.)

6. **CF System:**

   __ • 2CFCR5020 (2B S/G NR level, Steam Flow, Feed flow) inoperable

   __ • 2CFCR5040 (2C S/G NR level, Steam Flow, Feed flow) inoperable

   • The following valves cannot be operated using the manual pushbutton:

     __ • 2CF-28AB (2C S/G CF Cont Outside Isol)

     __ • 2CF-35AB (2A S/G CF Cont Outside Isol).

   • The following valves lose position indication:

     __ • 2CF-28AB (2C S/G CF Cont Outside Isol)

     __ • 2CF-35AB (2A S/G CF Cont Outside Isol).

7. **Diesel Generator 2A:**

   __ • 2A1 and 2A2 VG compressors run continuously due to VG tank pressure instrumentation failing low

   __ • FD Transfer pump Auto control disabled (Manual control still available)

   __ • 2LD-108A (LD Filter Bypass) fails open.

8. **FW System:**

   __ • 2FWLT5010 (FWST Level Channel 1) inoperable. Channel 1 relays are incapable of energizing to support FWST low level auto-swapover to containment sump. Swapover logic is reduced to 2/2 from other channels.

Q49 References

2.1.2 Assured Suction Source

Objective # 3, 5, 6

Nuclear Service Water (RN). RN is the safety related water source for the CA system. The "A" and "B" Train Assured Suction Sources are supplied from upstream of the DG (KD) Heat Exchanger inlet valves RN-70A ("A" Train KD Hx Inlet) and RN-171B ("B" Train KD Hx Inlet). The supply valves, RN-69A, CA-015A and CA-86A("A" Train) and RN-162B, CA-18B and CA-116B("B" Train), are NORMALLY CLOSED.

The RN suction source will align automatically on low CA pump suction pressure (7.0 psig for 3.5 ±.5 sec.) (8psig for 2A MD pump)

NOTE: Automatic cycling the RN supply to CA suction valves is considered an "ESF Actuation" and is reportable per RP-10 unless intentionally cycled for maintenance.

The Unit 1 RN supply to CA via 1CA-161C & 162B is from the 1A RN Essential Header Return to RC. The line taps off between 0RN-147AC & 0RN-148AC with both valves normally open (see Figure 7.1). 1CA-161C is normally open with power removed. Additionally, 1CA-162B is an air-operated valve.

The Unit 2 RN supply to CA via 2CA-162B (air operated) is from the 'B' Train RN Suction Supply from the RC Crossover. The line taps off between 0RN-4AC (normally OPEN) & 0RN-5B (normally CLOSED) (See Figure 7.2).

2.1.3 CA Assured Water Supply Air Entrainment

Objective # 3

Plant operating experience reveals the potential for air to accumulate in the RN piping that provides the Unit 1 FLEX and SSF water supply to the Unit 1 TD CA pump suctions. To eliminate this air entrainment concern, continuous vents have been installed on the RN header. These vents are normally Open and discharge to the WZ sumps. Loss of vent flow (solid water stream) with RN aligned to Lake Norman can affect Unit 1 FLEX and SSF functionality (SLC 16.9.7).

2.1.4 CA Assured Water Supply Flow Gauges

There are four local flow gauges (1 per S/G) that provide flow indication to the Steam Generator in a Loss of Offsite Power Event if the control room indication should be lost. These are located in the Interior and Exterior Doghouses. These gauges were added as part of the Unit 1 and 2 FLEX modifications.

2.2 Motor Driven CA Pumps

Objective # 7

Q49 References

The motor driven CA pumps are multi-stage centrifugal pumps to develop sufficient discharge pressure to pump water into the Steam Generators at full pressure. Each motor driven pump has a design flow rate of 450 gpm and is capable of supplying two steam generators. CA pump "A" supplies steam generators "A" and "B" while CA pump "B" supplies steam generators "C" and "D."

Objective # 8

The motor driven CA pumps are powered from essential power:

- 1(2) A CA Pump - 1(2) ETA
- 1(2) B CA Pump - 1(2) ETB

2.3 Turbine Driven CA Pump

Objective # 7

Each unit has one Steam Turbine Driven CA pump. Like the motor driven CA pumps, the Turbine Driven CA pump is a multi-stage centrifugal pump to develop sufficient discharge pressure to pump water into the Steam Generators at full pressure. The turbine receives steam from "B" and "C" steamlines through two redundant valves. The turbine driven pump has a design flow rate of 900 gpm and supplies all four steam generators.

Objective # 8

Steam is admitted to the turbine through two piston operated isolation valves, SA-48ABC and SA-49AB. See section 2.4 for additional information on these valves.

The bearing oil of the TD CA Pump is cooled utilizing a small heat exchanger at the pump. The cooling medium is the fluid moving through the pump (CA system water).

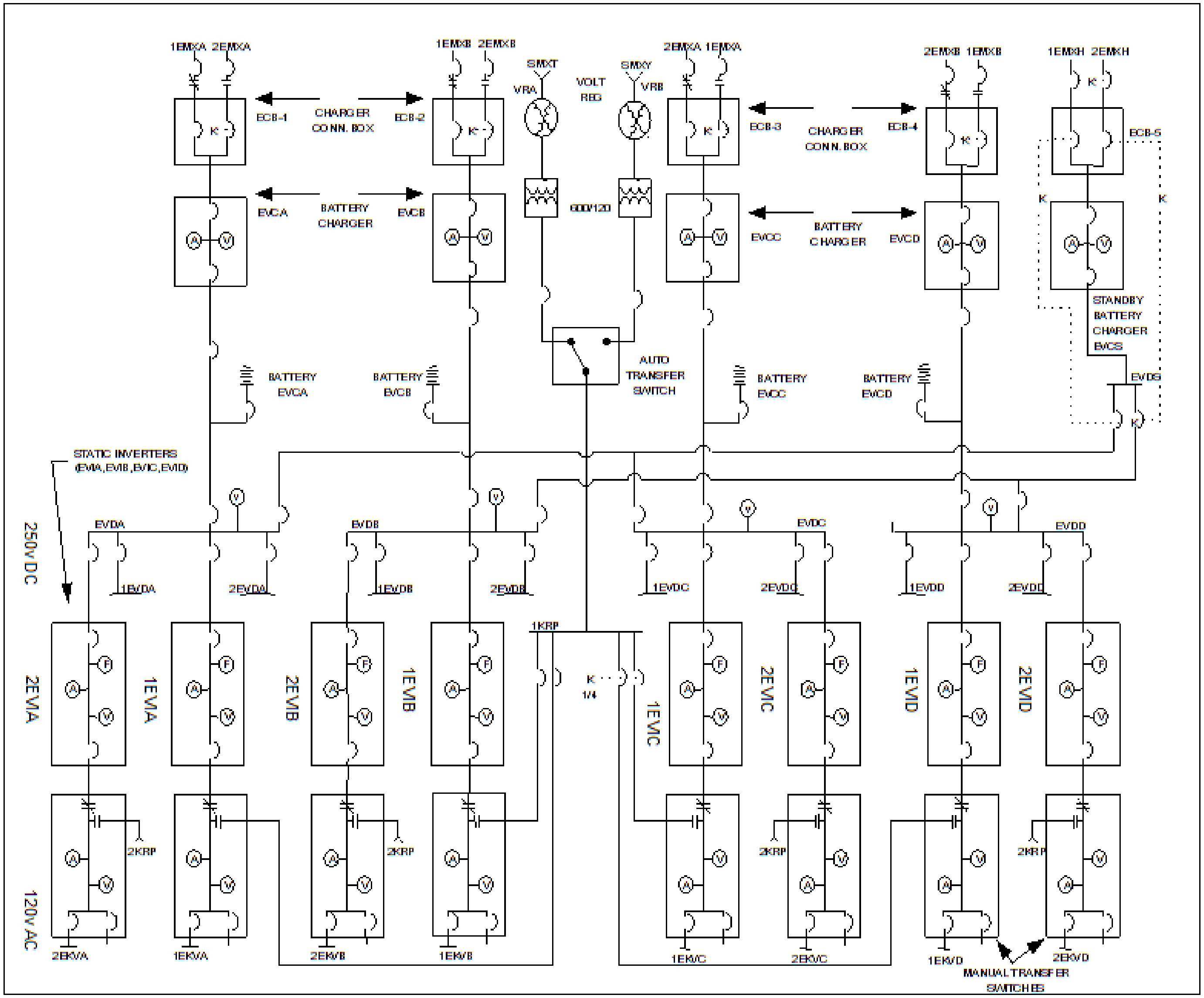
2.4 CA Turbine Steam Supply Valves

Objective # 8

The CA turbine is supplied steam from the B and C steam generators via SA-49AB and SA-48ABC respectively. These piston operated isolation valves fail OPEN on a loss of power to any one of the solenoids, admitting steam to the turbine. On a Manual Start, Low Low Level on 2 S/Gs or Blackout, solenoid valves (SASV-480, 481 and 483) or (SASV-490, 491 and 492) de-energize and block control air to the pilot valve and/or venting the existing air pressure, allowing the pilot valve to block gas pressure (N2 with VI backup) to the actuator and vents the actuator, which allows the actuator spring to open the steam valve which admits steam to the Turbine Driven CA Pump. See drawing 7.9.

Q49 References

7.1 125 VDC/120 VAC Vital I&C Power Composite Drawing (11-04-14)



FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 51 51 **A**

APE057 AA1.05 - Loss of Vital AC Electrical Instrument Bus
Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: (CFR 41.7 / 45.5 / 45.6)
Backup instrument indications ....

Given the following initial conditions on Unit 2:

- Both CFPT's tripped causing a Rx Trip 15 minutes ago
- The crew has completed E-0 (REACTOR TRIP OR SAFETY INJECTION) and transitioned to ES-0.1 (REACTOR TRIP RESPONSE)

Subsequently:

- EVDA output breaker to 2EVIA inverter trips OPEN

Based on the conditions above,

1) which ONE (1) of the following indicates the impact on the CA system flow instrumentation?

2) what alternate indication can be used to determine the status of CA flow to the affected S/G?

A. 1. 2A S/G CA flow fails low
2. 2A CA Pump amps and breaker indicating lights

B. 1. 2B S/G CA flow fails low
2. 2B CA Pump amps and breaker indicating lights

C. 1. 2C S/G CA flow fails low
2. 2A CA Pump amps and breaker indicating lights

D. 1. 2D S/G CA flow fails low
2. 2B CA Pump amps and breaker indicating lights

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 51 | 51 | **A**

General Discussion

Per AP-15 (Loss of Vital or Aux Control Power), a loss of Vital AC bus 2EKVA will cause 2CAP-5090 and 2CAP5100 (Aux Feedwater Flow to 2A and 2B S/G) to fail low.
Also per AP-15, a loss of Vital AC bus 2EKVD will cause 2CAFT-5121 and 2CAFT5110 (Aux Feedwater Flow to 2C and 2D S/G) to fail low.

Verification of CA pump operation (and therefore flow) can be done by using alternate indications such as, pump amps and breaker indicating lights.

Per OP-MC-CF-CA, MD CA pump A supplies steam generators A and B while MD CA pump B supplies steam generators C and D.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and is therefore plausible.

Second part is plausible if applicant concludes 2B MD CA pump feeds S/G's 2B and 2D.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be correct had Vital AC bus 2EKVD de-energized. Also plausible since 6.9 kV and 4160 essential AC busses are aligned where 'A' bus/train feeds 'A' and 'C' loads and 'B' bus/train feeds 'B' and 'D' loads.

Second part is plausible if applicant concludes 2A MD CA pump feeds S/G's 2A and 2C.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this would be correct had Vital AC bus 2EKVD de-energized. Applicant may confuse which loads are from each vital bus.

Second part is plausible since 2B CA pump feeds S/G's C and D and is true if 2D S/G CA flow had been lost due to loss of 2EKVD.

Basis for meeting the KA

The K/A is matched because it requires the applicant to determine the status of CA flow to A S/G by an alternate means (using backup indications to determine the status of the CA pumps) due to the loss of vital AC instrument bus 2EKVA.

Basis for Hi Cog

This question is high cognitive because the applicant must first analyze the conditions in the stem and determine that 2EKVA is de-energized since inverter 2EVIA has no 'AUTO" swap to alternate power supply, then determine how the CA system will be affected on a loss of Vital bus and what alternate indications can be used to verify CA flow.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
AP-15 (Loss of Vital or Aux Control Power)

LEARNING OBJECTIVES:
NONE

Student References Provided

APE057 AA1.05 - Loss of Vital AC Electrical Instrument Bus
Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: (CFR 41.7 / 45.5 / 45.6)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 51 51 **A**

Backup instrument indications ....

401-9 Comments:

Remarks/Status
401-9 Comments from Chief Examiner: UNSAT Choice D is not plausible. The S/G and pump do not match (2D and 2B). Choices A.2 and B.2 are not plausible. If the flow fails low, how could you use the flow computer points? Question is Unsatisfactory due to two non- plausible distractors. Facility Response: The reason the S/G and pump do not match is because MNS only has two MD CA pumps and the "B" pump feeds the "D" S/G. The facility concurs that choices A.2 and B.2 are not plausible. Question was re-written. SLM 03/26/15 After discussion with Chief Examiner, determined that question 2 needed to be revised to say "...to determine the status of CA flow to the affected S/G?" instead of "...to determine the status of the CA pumps?" HCF 04-10-15 Chief Examiner has determined that question is now satisfactory. HCF 04-10-15

APE058 AA2.03 - Loss of DC Power

Ability to determine and interpret the following as they apply to the Loss of DC Power: (CFR: 43.5 / 45.13)

DC loads lost; impact on ability to operate and monitor plant systems ....

Given the following conditions on Unit 1:

- The 125VDC/120VAC Auxiliary Control Power System is in normal alignment
- The supply breaker from DCA to Static Inverter KXA trips open

Based on the conditions above,

1) Bus KXA ________ automatically swap to its alternate power source.

2) the crew can verify power has been restored to KXA by observing that ________.

Which ONE (1) of the following completes the statements above?

COMPONENT LEGEND:

0RN-10AC (TRAIN 1B & 2B LLI SUPPLY)

A. 1. will
   2. NC pump vibration monitors are IN SERVICE

B. 1. will
   2. the indicating light (control power) to 0RN-10AC is LIT

C. 1. will NOT
   2. the NC pump vibration monitors are IN SERVICE

D. 1. will NOT
   2. the indicating light (control power) to 0RN-10AC is LIT

General Discussion

Static Inverter KXA is one of the DC loads supplied from DCA. If power is lost to Static Inverter KXA an ABT switch will automatically transfer Bus KXA to its alternate power source.

The operators can verify power is restored to KXA by verifying the NC pump vibration monitors are in service.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible if the applicant confuses vital and auxiliary control power loads.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the vital static inverters must be manually swapped to an alternate power supply.

Second part is correct and therefore plausible.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the vital static inverters must be manually swapped to an alternate power supply.

Second part is plausible if the applicant confuses vital and auxiliary control power loads.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of the effect of a loss of a DC load and how it affects the ability to monitor plant systems.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

The applicant must first recall from memory the arrangement of the 125VDC/120VAC Auxiliary Control Power system to determine Bus KXA has an auto bus transfer feature.

The applicant must then analyze the given condition to determine what indications are available to indicate that power has been restored to KXA.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2013 MNS NRC SRO Examination Q50 (Bank 3623)

Development References

REFERENCES:
Lesson Plan OP-MC-EL-EPK (125 VDC and 240/120 VAC Auxiliary Control Power) Rev 29A
AP-15 (Loss of Vital or Aux Control Power) Rev. 27

LEARNING OBJECTIVES:
ELEPK017

Student References Provided

APE058 AA2.03 - Loss of DC Power
Ability to determine and interpret the following as they apply to the Loss of DC Power: (CFR: 43.5 / 45.13)
DC loads lost; impact on ability to operate and monitor plant systems ....

401-9 Comments:	Remarks/Status

Objective # 14

125 VDC Auxiliary Control Power Distribution Centers, DCA and DCB, can be tied together through their respective bus tie breakers. The bus ties will normally be open but are manually closed during an "equalizing charge" on one of the associated batteries or when a battery is removed from service.

Whenever DCA and DCB are cross tied, both normal chargers (CXA & CXB) are connected to their respective bus, even though either charger can supply all of the normal baseline loads of both combined busses. In the event that one of these chargers should fail or trip, DC Loads will be supplied by the other charger without draindown of the "available" battery. In addition, the "available" battery is still there ready to provide the ultimate backup if needed.

If only one charger was connected and a loss occurred, then the "available" battery would be required to supply the DC loads until the other charger could be aligned. The resulting battery draindown can be avoided by merely aligning both chargers to their respective bus during such operations.

2.4 240/120VAC Auxiliary Control Power System

Objective # 15

The two 120 VAC auxiliary control power panelboards and the two 240/120 VAC operator aid computer power panelboards normally receive power from the 125 VDC Auxiliary Control Power System through the auxiliary control power static inverters (KXA, 1KU, KXB, and 2KU). Power from each inverter is directed through their respective automatic static transfer switch (in the "Inverter to Load" position), their manual bypass switch (in the "Normal" position), then through a Disconnect Switch to each power panelboard. Static Inverter KXA, KXB, and spare inverter SKX are of a newer design than 1KU and 2KU. In the following sections, any differences between the two types will be described.

Objective # 16

The automatic static transfer switch, associated with each auxiliary control power static inverter, provides automatic power transfer to an alternate power source (regulated power). The alternate power source is provided from 240/120 VAC Regulated Power Distribution Centers MKA (for 1KU and KXA) and MKB (for 2KU and KXB).

Objective # 16

This switch provides an automatic, uninterrupted power transfer during the following:

1. **Inverter over current (> 120%).**
2. **Inverter failure.**
3. **Inverter under voltage.**

The Static Switch will automatically return to the "Inverter Supplying Load" position, if the condition clears and remains stable for thirty (30) seconds. A manual transfer of the Static Switch is also possible using the "Alternate AC

Q50 References

MNS AP/1/A/5500/15 **UNIT 1**	LOSS OF VITAL OR AUX CONTROL POWER **Enclosure 23 - Page 6 of 11** **KXA Load List**	PAGE NO. **212 of 280** Rev. 27

10. **KF System:**

__ • 1KFP5120 (Spent Fuel Pool Level) is inoperable; however, 1KFP-5350 (SFP FLEX Strategy WR Radar Level) should be available.

__ • 1KFP5130 (Spent Fuel Pool Temp) is inoperable.

11. **LH System:**

__ • 1A and 1B LH pumps start on low oil pressure signal.

12. **NC System:**

__ • 1NC-27C (1A NC Loop PZR Spray Control) loses position indication only. Auto and manual control of valve still functional.

__ • 1NC-29C (1B NC Loop PZR Spray Control) loses position indication only. Auto and manual control of valve still functional.

__ • 1NCP-8470 (NC Ultrasonics A loop) fails low.

__ • 1NCP-5990 (NC System Level W/R) fails low.

__ • 1NCP-5991 (NC System Level N/R) fails low.

__ • NC Pump Vibration Monitor Panel loses power.

__ • Pzr Heaters will not trip on Low Pzr level.

13. **ND System:**

__ • Annunciator "A ND PUMP LO FLOW TO COLD LEGS" alarm (1AD-9, A-2) invalid

__ • Annunciator "B ND PUMP LO FLOW TO COLD LEGS" alarm (1AD-9, B-2) invalid.

14. **NF System:**

• The following valves fail closed:

__ • 1NF-228A (U1 Ice Cond AHUS Glycol Supply Hdr Cont Outside Isol)

__ • 1NF-234A (U1 Ice Cond AHUS Glycol Return Hdr Cont Outside Isol).

15. **NI System:**

__ • 1FWFT 5250 (NI Pumps Recirc Flow) fails low.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2013A MNS SRO NRC Examination QUESTION 50 | 50

APE058 AA2.03 - Loss of DC Power
Ability to determine and interpret the following as they apply to the Loss of DC Power: (CFR: 43.5 / 45.13)
DC loads lost; impact on ability to operate and monitor plant systems ....

Given the following conditions on Unit 1:

- The 125VDC/120VAC Auxiliary Control Power System is in normal alignment
- The supply breaker from DCA to Static Inverter KXA trips open

Based on the conditions above:

Bus KXA ___(1)___ automatically swap to its alternate power source.

The crew can verify power has been restored to KXA by observing that ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. WILL NOT
2. NC pump vibration monitors are IN SERVICE

B. 1. WILL NOT
2. the indicating light (control power) to 0RN-10AC (TRAIN 1B & 2B LLI SUPPLY) is LIT

C. 1. WILL
2. the NC pump vibration monitors are IN SERVICE

D. 1. WILL
2. the indicating light (control power) to 0RN-10AC (TRAIN 1B & 2B LLI SUPPLY) is LIT

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 50 | 50 | **C**

General Discussion

Static Inverter KXA is one of the DC loads supplied from DCA. If power is lost to Static Inverter KXA an ABT switch will automatically transfer Bus KXA to its alternate power source.

The operators can verify power is restored to KXA by verifying the NC pump vibration monitors are in service.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because the vital static inverters must be manually swapped to an alternate power supply.

Part 2 is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because the vital static inverters must be manually swapped to an alternate power supply.

Part 2 is plausible if the applicant confuses vital and auxiliary control power.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is correct.

Part 2 is plausible if the applicant confuses vital and auxiliary control power.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of the effect of a loss of a DC load and how it affects the ability to monitor plant systems.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

The applicant must first recall from memory the arrangement of the 125VDC/120VAC Auxiliary Control Power system to determine Bus KXA has an auto bus transfer feature.

The applicant must then analyze the given condition to determine what indications are available to indicate that power has been restored to KXA.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2005 MNS NRC Exam Q2 (Bank 3623)

Development References

References:
Lesson Plan OP-MC-EL-EPK (Rev 29A)

Learning Objectives:
ELEPK017

Student References Provided

APE058 AA2.03 - Loss of DC Power
Ability to determine and interpret the following as they apply to the Loss of DC Power: (CFR: 43.5 / 45.13)
DC loads lost; impact on ability to operate and monitor plant systems ....

Q50 Parent Question (2013 MNS NRC Exam Q50 (Bank 3623))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2013A MNS SRO NRC Examination QUESTION **50** 50

401-9 Comments:	Remarks/Status
	401-9 Comment: SAT 058AA2.03 Question kind of matches the K/A. 2005 MNS NRC Exam Q2 10/23/2013 Based on Chief Examiner's general comments, rearranged answer to appear less like bank question. Rearranged plausibility statements accordingly. This changed the correct answer from 'A' to 'C'. HCF 10/30/2013 Q50 approved as SAT by Chief Examiner. HCF 11/18/13

APE062 AK3.04 - Loss of Nuclear Service Water

Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: (CFR 41.4, 41.8 / 45.7)

Effect on the nuclear service water discharge flow header of a loss of CCW

Given the following initial conditions on Unit 1:

- The unit is at 100% RTP
- Both trains of KC and RN are in service

Subsequently,

- 1A RN pump TRIPS
- A Blackout occurs on **2ETB**

Based on the conditions above, the 1A KC HX ___(1)___ have cooling water because the RN essential headers ___(2)___. (Assuming no operator actions)

Which ONE (1) of the following completes the statement above?

A. 1. does
2. are always cross-connected

B. 1. does
2. automatically cross-connected when the 1A RN pump tripped

C. 1. does NOT
2. are always separated

D. 1. does NOT
2. on both units automatically separate on any Blackout on either unit

---

General Discussion

In the stem, the applicant is presented with a situation where both trains of RN and KC were placed in service on U-1. The 1A RN pump has tripped but initially the 1B RN will provide cooling to both trains of KC via normally open RN train cross connect valves. A B/O then occurs on U-2 ETB. This would result in the B Train of RN on both units aligning to the SNSWP and the A Train of RN on both units would be unaffected because the signal to realign is train related (NO B/O on A train). The B/O signal would also result in train separation on both units (1 and 2 RN-41B would close) resulting in a loss of cooling to the 1A KC HX because the 1A RN pump is unavailable.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the 1A KC HX did have cooling water flow until the Blackout occurred on Unit 2 (2ETB). And the reason it had cooling water until the Blackout occurred is that the RN Essential headers are normally cross-connected.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the 1A KC HX did have flow until the Blackout occurred on Unit 2 (2ETB). The reason that it had flow at this point is that the RN Essential headers are normally cross-connected. However, it is logical to conclude that, for Train separation purposes, the two Essential headers would normally operate isolated from each other and that they would only cross-tie on a loss of the RN pump supplying that Essential header.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because it is reasonable to conclude that, for Train separation purposes, the Essential headers would normally be operated isolated from each other. That being the case, the applicant would conclude that when the 1A RN pump tripped, flow was lost to the 1A KC HX.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because the applicant must demonstrate knowledge of the effect on the 1A KC HX of an infrequent alignment, loss of 1A RN pump and the introduction of a B/O signal on the opposite unit. Which results in a loss of RN cooling to the 1A KC HX.

Basis for Hi Cog

The question is Hi cog because the applicant must analyze the initial conditions, evaluate their effect on the KC and RN systems and predict an outcome.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-PSS-RN (Nuclear Service Water) Fig. 7.13 Rev 51

LEARNING OBJECTIVES:
OP-MC-PSS-RN Objective 10

Student References Provided

APE062 AK3.04 - Loss of Nuclear Service Water

Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: (CFR 41.4, 41.8 / 45.7)

Effect on the nuclear service water discharge flow header of a loss of CCW

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
062AK3.04

K/A is met based upon plant design and nomenclature drl 11/9/15

Q51 References

Reactor Building RV loads:

Upper containment ventilation units

Lower containment ventilation units

2.5 Discharge Paths

Objective # 8

The normal RN system discharge path is to the RC discharge crossover header which returns to Lake Norman. The SNSWP is also a discharge path however it is typically only used if the suction is also from the SNSWP to prevent undesirable changes to SNSWP level.

The VC/YC chillers' RN discharge headers have been modified so that they will normally discharge into the shared RN discharge headers. This will prevent having to declare a VC/YC train inoperable because the Unit 1A or 1B RN Essential header is isolated. The new flowpath will be the normally aligned path however, the old flowpath will still be available.

2.6 Valves

Objective # 12

2.6.1 Blackout and Safety Injection Signals

> ***Operator Fundamental Focus; Knowledge, Monitoring and Control***
> *While discussing the information presented below, **reinforce** the importance of operators **understanding** how the RN system will respond to BO or SI signals, where the indicators are to **monitor** for the expected response and the **controls** available to them (in Unit 1 and/or 2) to take manual control if automatic actions do not occur.*

The following is a listing of the various RN valves and how they respond to Safety Injection and/or Blackout signal(s). Valves which are shared between the units (0RN) can be powered and controlled from either unit. **(refer to Drawing 7.5)**

AUTO OPEN/CLOSE signals are **train related** (only the valves on the train with the Safety Injection and/or Blackout receive a signal to align).

The following valves receive auto close signals upon receipt of either Unit 1 or 2 blackout or safety injection:

- 0RN-2B (Train 1A & 2A RC Supply)
- 0RN-3A (Train 1A & 2A RC Supply)

Q51 References

- 0RN-7A (Train 1A & 2A SNSWP Supply)
- 0RN-149A (Train 1A & 2A Disch to SNSWP)
- 0RN-11B (Train 1B & 2B LLI Supply)
- 1RN-41B (Train 1B to Non-Ess Hdr Isol) Controlled only from Unit 1
- 1RN-43A (Train 1B to Non-Ess Hdr Isol) Controlled only from Unit 1
- 2RN-41B (Train 2B to Non-Ess Hdr Isol) Controlled only from Unit 2
- 2RN-43A (Train 2B to Non-Ess Hdr Isol) Controlled only from Unit 2
- 0RN-284B (Train 1B & 2B Disch to RC)

The following valves receive auto open signals upon receipt of either Unit 1 or Unit 2 blackout or safety injection:

- 0RN-9B (Train 1B & 2B SNSWP Supply)
- 0RN-152B (Train 1B & 2B Disch to SNSWP)
- 0RN-12AC (Train 1A & 2A LLI Supply)
- 0RN-13A (Train 1A & 2A LLI Supply)
- 0RN-147AC (Train 1A & 2A Disch to RC)
- 0RN-148AC (Train 1A & 2A Disch to RC)

The following valves receive auto close signals upon receipt of either a Unit 1 or Unit 2 safety injection:

- 0RN-10AC (Train 1B & 2B LLI Supply)
- 0RN-14A (Train 1A Suction X-Connect)
- 0RN-15B (Train 1B and 2B Suction X-Connect)
- 0RN-150A (Train 1A and 2A Disch X-Connect)
- 0RN-151B (Train 1B and 2B Disch X-Connect)
- 0RN-283AC (Train 1B & 2B Disch to RC)

The following valves receive auto close signals upon receipt of either Unit 1 or 2 S_P (Phase "B") signal.

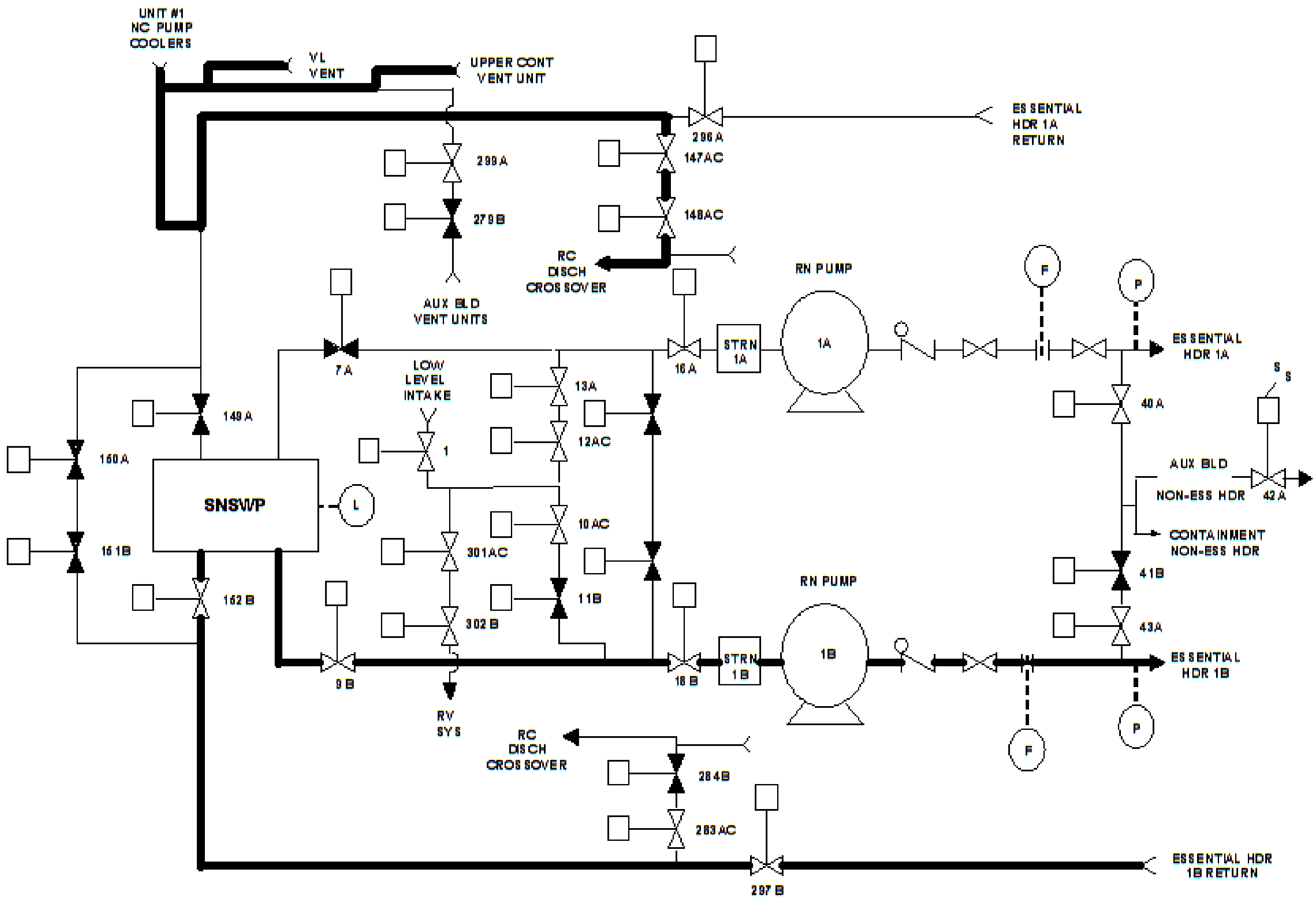
- 0RN-301AC (RV Supply from LLI)
- 0RN-302B (RV Supply from LLI)

The following valves auto open on blackout and/or SI signals (on respective unit).

- RN-16A (A RN pump Suction Isol)

Q51 References

7.13, RN System Train "B" Blackout Flow Path (12/04/03)



APE065 AA1.04 - Loss of Instrument Air

Ability to operate and / or monitor the following as they apply to the Loss of Instrument Air: (CFR 41.7 / 45.5 / 45.6)

Emergency air compressor ....

Given the following plant conditions:

- Both units are operating at 100% RTP
- An instrument air system leak develops in the Unit 1 Turbine Building
- The Diesel VI Compressors (G & H) "AUTO/OFF-RESET" selector switches are in 'AUTO"

The following indications are observed in the Control Room:

Based on the indications above, the Diesel VI Compressors ___(1)___ receive an auto start signal

If the Diesel VI Compressors auto start, the compressors will be shutdown ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. will
   2. manually

B. 1. will
   2. automatically

C. 1. will NOT
   2. manually

D. 1. will NOT
   2. automatically

General Discussion

The Diesel VI Compressors (G & H) are normally aligned for automatic start and will start if VI header pressure decreases to 90 PSIG.

Latching Relays associated with each of the Diesel VI Compressors are located on a panel near the compressors at the compressor skid. These devices are used to latch the compressors in on an AUTO start. On a compressor auto start a yellow RESET light will extinguish to indicate that the compressor has started and is latched in to run until local operator action is taken.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is correct and therefore plausible.

Second part is plausible if the applicant concludes the Diesel VI compressors will automatically shutdown at a given VI system pressure. The D, E and F VI compressors will automatically unload at specific VI system pressure setpoints.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because on decreasing VI system pressure automatic actions do occur at 85 psig (Air Dryer Bypass Isolation opens) and indicated pressure is between 85 and 90 psig.

Second part is correct and therefore plausible.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because on decreasing VI system pressure automatic actions do occur at 85 psig (Air Dryer Bypass Isolation opens) and indicated pressure is between 85 and 90 psig.

Second part is plausible if the applicant concludes the Diesel VI compressors will automatically shutdown at a given VI system pressure. The D, E and F VI compressors will automatically unload at specific VI system pressure setpoints.

Basis for meeting the K

The KA is matched because the applicant displays the ability to operate the emergency air compressors by determining if an autostart of the compressor has occurred and how to secure the compressor if an autostart does occur.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step. The applicant must read the meter indication provided to determine the current VI header pressure and then determine the affect this indication has on the VI system (i.e. automatic actions). The applicant must then recall from memory how to secure the diesel VI compressors following an auto start.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2012 MNS NRC Q27 (Bank 4622)

Development References

REFERENCES:
Lesson Plan OP-MC-SS-VI Rev 35E

LEARNING OBJECTIVES:
OP-MC-SS-VI Objective 7

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 52** 52 **A**

APE065 AA1.04 - Loss of Instrument Air

Ability to operate and / or monitor the following as they apply to the Loss of Instrument Air: (CFR 41.7 / 45.5 / 45.6)

Emergency air compressor ....

401-9 Comments:	Remarks/Status

Q52 References

Located on each of the G and H VI Compressor skids are:

- Oil Separator
- Aftercooler
- Two Afterfilters

Objective # 3

The air/oil separator is used to separate the oil and air. Initial separation is via a screening device that separates the bulk of the oil from the air and allows it to accumulate in the bottom of the air/oil separator. The accumulated oil is then routed through a thermal valve, which is sensitive to the temperature of the oil. If the oil temperature is high, the thermal valve will route the appropriate amount of oil through the air-cooled oil cooler to remove excess heat. The oil is then routed back to the compressor oil sump. On its return to the compressor oil sump the oil passes through a fluid filter to remove particulate. There is also a final fluid separator located in the upper portion of the air/oil separator used to remove most of the remaining oil vapor from the air.

The discharge from the diesel powered VI Compressors is routed to a 4" VI header in the Northeast corner of the Unit 2 Turbine Building. Additional pipe routing allows the air to be dried by the VI Dryers prior to use by the VI System loads.

Objective # 7

The diesel powered VI Compressors have the capability of automatically starting under the following conditions:

- Decreasing VI System Pressure
- Failure of the VI System Load Sequencer Panel
- Loss of Recirculated Cooling Water (KR) flow to VI Compressors D, E, and F.

A loss of KR will cause a trip of instrument air compressors A, B, C, D, E, and F if they are running. Consequently, KR flow switches 0KRFS7150, 7250 and 7300, sense Recirculated Cooling Water System (KR) flow through the instrument air compressors D, E, and F respectively. Upon loss of KR, they each send a signal to the VI compressor sequencer panel. If the sequencer panel receives three signals, it sends an automatic start signal to both of the diesel powered instrument air compressors. Note that three KR flow switch signals are required before automatic start to prevent a failure of one switch from starting the diesel powered compressors and to allow maintenance on a switch.

The Oil Separator will remove most of the oil from the outlet air. The aftercoolers will cool the air to assist the removal of moisture from the air. The afterfilters will remove the remaining oil, particulate, and water from the air.

Q52 References

Fuel Level

- Monitors the level of the fuel in the fuel tank
- Compressor trips on low fuel level

Engine RPM

- Range is 1400 to 1800 rpm
- Indicates engine speed
- Operates at 1400 rpm unloaded with the START/WARM-UP/RUN switch selected to WARM-UP
- Operates at 1800 rpm loaded

The following is a listing of the Diesel VI Compressor Control Panel Controls:

Override Button

- Disabled and not used at McGuire

Warm-Up Control Valve Handle

- Allows the engine to run at lower speeds and lower pressures until properly warmed up
- Indicates START/WARM-UP/RUN
- Warm-Up allows engine temperatures to come up and stabilize at 130°F

Engine Switch

- Used to both energize the compressor's electrical system and engage the engine starter.
- This is a two position rotary switch that can be selected to OFF/ON
- There is a 4 to 5 second time delay before the engine starts

HI/LO Valve

- Determines which pressure regulator controls the compressor operation
- Regulators are set at 85 psig-LO and 105 psig-HI

Objective # 7

Latching Relays associated with each of the Diesel VI Compressors are located on a panel near the compressors at the compressor skid. These devices are used to latch the compressors in on an AUTO start. On a compressor auto start a yellow RESET light will extinguish to indicate that the compressor has started and is latched in to run until some operator action is taken. There is a blue RESET pushbutton located on the panel to reset the latching circuit and allow for shutdown of the compressors. At this time the yellow RESET light should illuminate indicating the compressor is available for an AUTO START. The yellow RESET light lit is an indication to the operator that CONTROL POWER is available to the compressor. The RESET light being out can be an indication that a loss of control power has occurred.

The following indications are located inside the Diesel VI Compressor enclosure:

- After Filter Differential Pressure Gauges 1 and 2 (normally ≤10 psid and not in the red zone)
- Fuel Filter Differential Pressure (normally 18 to 50 psi and not in the red zone)

Engine Oil Level

- Dip Stick has oil level indication for Running Side and Stopped Side
- Within range of the low idle side of the dip stick at idle speed
- Within range of the stopped side of the dip stick while shut down
- N/A if compressor is under load

Compressor Sump Level Sight Glass

- Monitors the fluid level in the receiver tank
- Proper level is always visible in the sight glass
- Check level only while shut down
- Splashing and bubbles will not allow proper monitoring while operating
- When shut down, you should be able to see the top oil level
- Level anywhere in the sight glass is OK

Engine Coolant Level

- As monitored using Murphy Gauge
- There is a compressor trip on low coolant level

Fuel Pressure Gauge

- Monitors the pressure of the fuel to the Diesel Engine
- Normally operates around 16 psi
- Anywhere in the green is OK

Q52 References

Objective # 4

The Diesel VI Compressors operate in two modes of operation. These modes are Automatic and Manual. In the Manual Mode of operation, an operator will start and run the compressor using controls on the compressor control panel located at the compressors themselves. For a manual start of the compressor to be accomplished, the following must be true:

- The AUTO/OFF-RESET switch must be selected to the OFF-RESET position
- The START/WARM-UP/RUN switch is in the WARM-UP Position
- The HIGH/LOW switch is selected to the desired position (normally HIGH)

The operator then rotates the Engine Switch from the OFF position to the ON position and the compressor should start. Once the compressor has started and has warmed up, the operator can select the RUN position on the START/WARM-UP/RUN selector switch to allow the compressor to load. If the operator is starting the compressor as directed from the Loss of Instrument Air System Abnormal Procedure, the AP directs the operator to leave the START/WARM-UP/RUN switch in the RUN position to allow for immediate loading.

The following is a set of conditions, which will allow the Diesel VI Compressors to automatically start:

- The AUTO/OFF-RESET switch must be selected to AUTO
- The START/WARM-UP/RUN switch is selected to RUN
- The HIGH/LOW switch is selected to HIGH
- The Latching Relay picks up

The compressor will automatically start and load to the desired pressure.

Objective # 7

There are three signals, which will send an AUTO START signal to the Diesel Powered VI Compressors. These signals are:

- Loss of VI header pressure as measured by 0VIPS5070
  - ❖ set at 90 psig decreasing
  - ❖ Compressor control can be regained when pressure increases above 95 psig
- Loss of 3/3 KR flow to the D, E, and F VI Compressors
- Loss of power to the VI Sequencer Panel (SKU#43) 1SLXD/2SLXD-SMXU

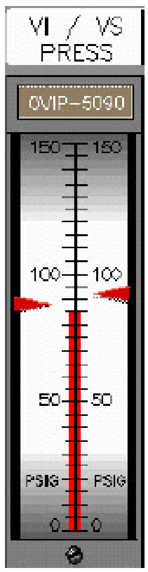
2012 MNS SRO NRC Examination QUESTION 27 | 27 | **B**

SYS078 A4.01 - Instrument Air System (IAS)
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)
Pressure gauges

Given the following plant conditions:

- Both units are operating at 100% RTP
- An instrument air system leak develops in the Unit 1 Turbine Building
- The Diesel VI Compressors (G & H) "AUTO/OFF-RESET" selector switches are in 'AUTO".

The following indications are observed in the Control Room:



Based on the indications above, the Diesel VI Compressors (G & H) are ___(1)___ AND 1VI-1812 (VI Air Dryer Bypass Filter Isol) is ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. NOT running
2. closed

B. 1. running
2. closed

C. 1. NOT running
2. open

D. 1. running
2. open

Q52 Parent Question 2012 MNS NRC Q27 (Bank 4622))

2012 MNS SRO NRC Examination QUESTION 27 27 **B**

General Discussion

The Diesel VI Compressors (G & H) are normally aligned for automatic start and will start if VI header pressure decreases to 90 PSIG.

If VI Header pressure decreases to 85 PSIG, 1VI-1812 (VI Dryer Bypass Filter Isol) will open to bypass the dryers.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible if the applicant confuses the Diesel VI Compressor auto start setpoint with the Air Dryer Bypass Isolation open setpoint.

Second part is correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible if the applicant confuses the Diesel VI Compressor auto start setpoint with the Air Dryer Bypass Isolation open setpoint.

Second part is plausible if the applicant confuses the 1VI-1812 opening setpoint with the 1VI-820 (VI to VS Control Valve) closing setpoint (90 PSIG) or with the Diesel VI Compressor auto start setpoint.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is correct.

Second part is plausible if the applicant confuses the 1VI-1812 opening setpoint with the 1VI-820 (VI to VS Control Valve) closing setpoint (90 PSIG) or with the Diesel VI Compressor auto start setpoint.

Basis for meeting the KA

The KA is matched because the applicant must be able to determine the status of the VI system by monitoring the Control Room VI Header pressure indication provided.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step. First, the applicant must read the meter indication provided to determine the current VI header pressure. Second, the applicant must recall from memory all of the automatic actions and setpoints associated with the VI system. Finally, the applicant must associate the two pieces of information (given and recalled) to identify the correct response.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

References:
Lesson Plan OP-MC-SS-VI Sections, 1.2.10, 1.2.13, and 1.3.1.1

Learning Objectives:
OP-MC-SS-VI Objectives 7 & 15

Student References Provided

SYS078 A4.01 - Instrument Air System (IAS)
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)
Pressure gauges ....

Q52 Parent Question 2012 MNS NRC Q27 (Bank 4622))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2012 MNS SRO NRC Examination QUESTION 27 | 27 | **B**

401-9 Comments:	Remarks/Status

APE077 AA2.01 - Generator Voltage and Electric Grid Disturbances

Ability to determine and interpret the following as they apply to Generator Voltage and Electric Grid Disturbances: (CFR: 41.5 and 43.5 / 45.5, 45.7, and 45.8)

Operating point on the generator capability curve........................

Given the following conditions on Unit 1:

- Turbine Load is 900 MWe
- Generator Hydrogen Pressure is 60 PSIG
- Generator Voltage is 22.8 KV

According to the Main Generator Capability Curve the accepable range of reactive load is _______.

Which ONE (1) of the following completes the below statement?

REFERENCE PROVIDED

A. 860 MVAR (Lagging) to -640 MVAR (Leading)

B. 840 MVAR (Lagging) to -710 MVAR (Leading)

C. 710 MVAR (Lagging) to -560 MVAR (Leading)

D. 690 MVAR (Lagging) to -630 MVAR (Leading)

General Discussion

Based on Siemens Energy calculated capability curve for 22.8 kV, the correct answer is 710 MVAR lagging and -560 MVAR leading.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because this would be correct for a turbine load of 900 Mwe with 75 psig H2 pressure.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because this would be correct if the applicant used the 24KV curve at 900 MWe and 75 PSIG.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible because this would be correct if the applicant used the curve for 24KV at 900 MWe and 60 PSIG.

Basis for meeting the K

The KA is matched because the applicant is required to determine and interpret the allowed MVAR loading based on the generator capability curve point that corresponds to the given parameters in the stem.

Basis for Hi Cog

This is a higher cognitive level question because it requires the applicant to apply the Generator Capability Curve to the conditions given to determine the correct response.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2008 MNS Audit Examination AUDIT Q55 (Bank 3374)

Development References

REFERENCES:
OP/1/A/6100/022 Data Book Enclosure 4.3, Curve 3.1.1 and Table 3.1.4

LEARNING OBJECTIVES:
OP-MC-GEN-MG Objective 12

Student References Provided

Generator Capability Curve 3.1.1
Generator Capability Curve 3.1.2

APE077 AA2.01 - Generator Voltage and Electric Grid Disturbances

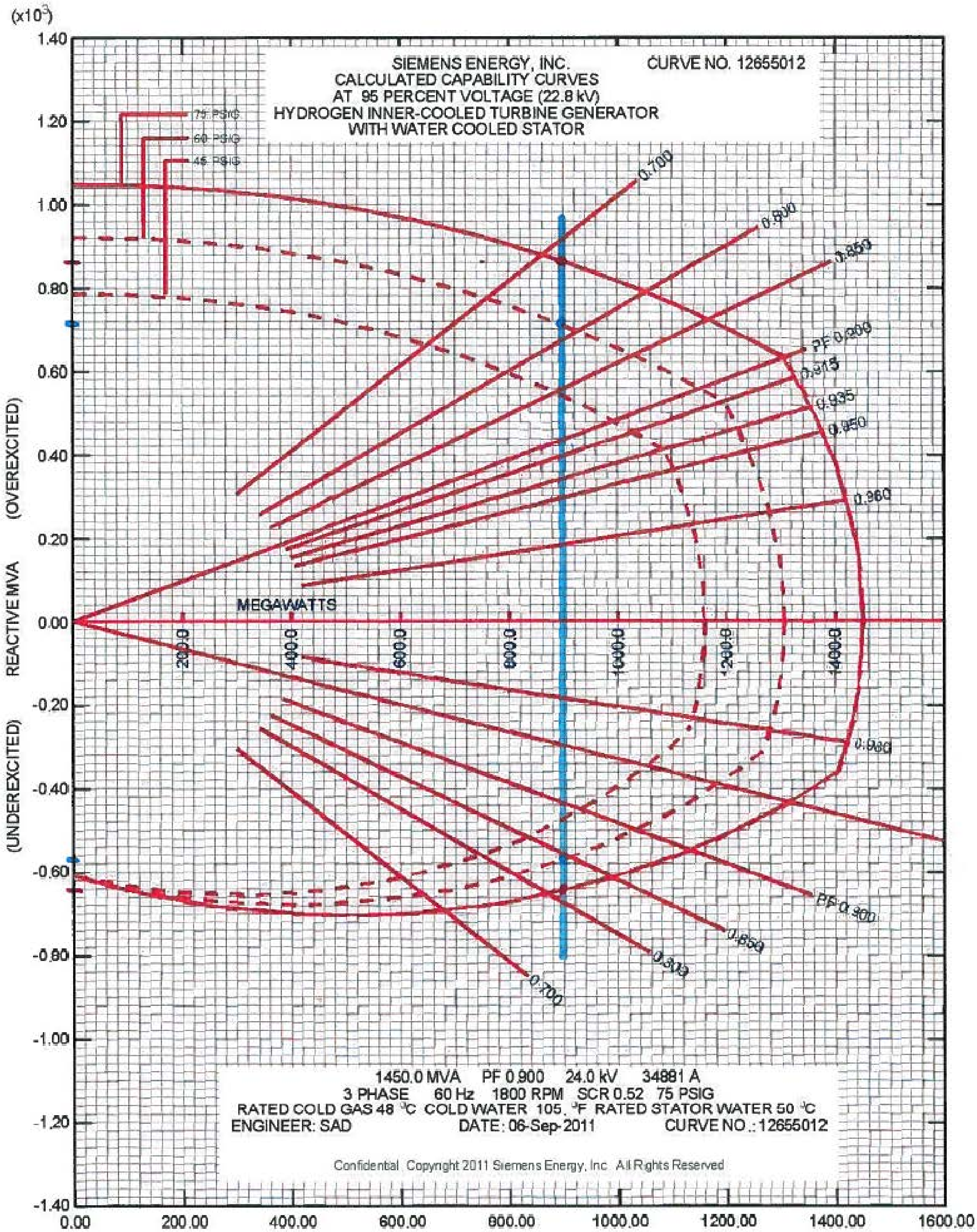
Ability to determine and interpret the following as they apply to Generator Voltage and Electric Grid Disturbances: (CFR: 41.5 and 43.5 / 45.5, 45.7, and 45.8)

Operating point on the generator capability curve.........................

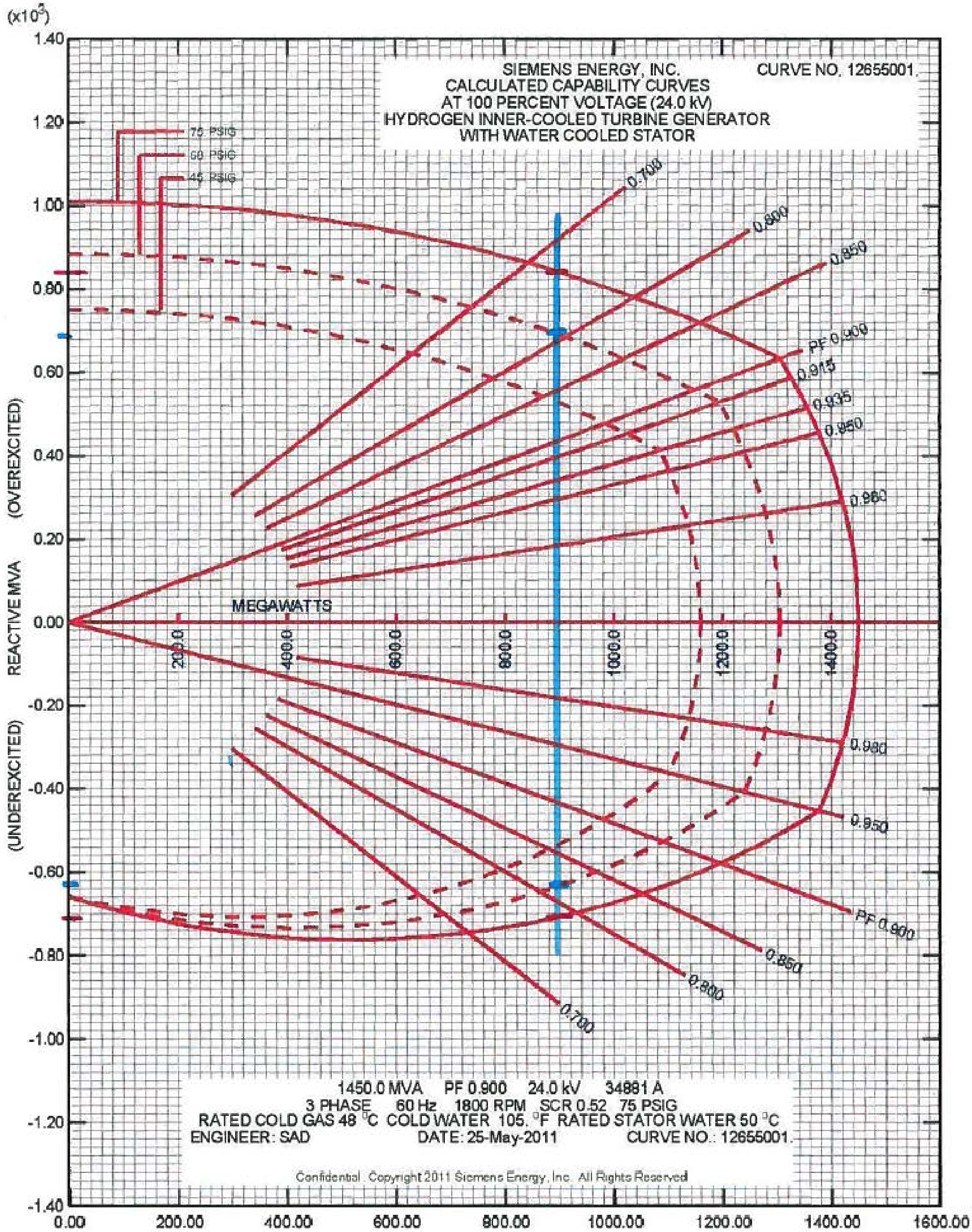
401-9 Comments:

Remarks/Status

Q53 References



Q53 References



Q53 Parent Question (2008 MNS Audit Exam Q55 (Bank 3374))

Examination Outline Cross-reference:	Level	RO	SRO
	Tier #	1	
	Group #	1	
	K/A #	077 AA2.01	
	Importance Rating	3.5	

(Ability to determine and interpret the following as they apply to Generator Voltage and Electric Grid Disturbances: Operating point on the generator capability curve)

Proposed Question: Common 55

The following conditions exist at Unit 1:

- Turbine Load is 900 MWe
- Generator Hydrogen Pressure is 60 psig.
- Generator Voltage is 22.8 KV.

Which ONE (1) of the following completes the below statement?

According to the Main Generator Capability Curve the accepable range of reactive load is _____ to ______.

REFERENCE PROVIDED

A. 840 MVAR (Lagging) -200 MVAR (Leading)

B. 700 MVAR (Lagging) -200 MVAR (Leading)

C. 840 MVAR (Lagging) -140 MVAR (Leading)

D. 700 MVAR (Lagging) -140 MVAR (Leading)

Proposed Answer: B

Explanation (Optional):

A. Incorrect. Correct for 75 psig Hydrogen Pressure.

B. Correct.

C. Incorrect. Correct for 75 psig Hydrogen Pressure on Overexcited limit and 1000MWe, rather than 900 MWe, on underexcited limit.

D. Incorrect. Correct for 60 psig Hydrogen Pressure on Overexcited limit and 1000MWe, rather than 900 MWe, on underexcited limit.

Technical Reference(s) AP/1/A/5500/05 Rev 6, p23 (Attach if not previously provided) (Including version or revision #)

Q53 Parent Question (2008 MNS Audit Exam Q55 (Bank 3374))

Proposed references to be provided to applicants during examination: Main Generator Capability Curve

Data Book Enclosure 4.3, Curve 3.1.1

Learning Objective: ______________ (As available)

Question Source:

- Bank # ______
- Modified Bank # ______ (Note changes or attach parent)
- New X

Question History: Last NRC Exam NA

Question Cognitive Level:

- Memory or Fundamental Knowledge ______
- Comprehension or Analysis X

10 CFR Part 55 Content:

- 55.41 4
- 55.43 ______

Comments:

WE04 EK1.1 - LOCA Outside Containment
Knowledge of the operational implications of the following concepts as they apply to the (LOCA Outside Containment)
(CFR: 41.8 / 41.10, 45.3)
Components, capacity, and function of emergency systems.

Given the following conditions on Unit 2:

- The crew has implemented ECA-1.2 (LOCA OUTSIDE CONTAINMENT)
- U2 FWST level is slowly lowering
- NC system pressure is 1600 PSIG and slowly lowering

In accordance with ECA-1.2,

1) the crew will FIRST stop and isolate the _______ pumps from the FWST.

2) an NC system depressurization and cooldown at _______ will be required.

Which ONE (1) of the following completes the statements above?

A. 1. NI
2. the maximum rate

B. 1. NI
2. 100°F/hr

C. 1. ND
2. the maximum rate

D. 1. ND
2. 100°F/hr

General Discussion

The first Major action in ECA-1.2 is to stop and isolate ND pumps from FWST.
One consideration during a LOCA outside of containment is to maintain FWST inventory (since there is no inventory entering the containment sump). The EP Background Document for ECA-1.2 states that operators need to take actions to isolate any potential leak paths and loss of inventory from the FWST. Stopping the associated (2A) ND Pump when closing the suction valve from the FWST is done to preserve the ND Pump from running with no suction.

ECA-1.2, step 9 first directs a cooldown to 430 °F. The method of cooldown is using the steam dumps and dumping steam at a maximum rate while attempting to avoid a Main Steam isolation. Cooling down at maximum rate is desired for a LOCA outside containment due to concerns with FWST depletion and no Cold Leg Recirc capability (no sump water).

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the high pressure injection lines will be checked later in ECA-1.2 to attempt to identify and isolate the leak.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because the high pressure injection lines will be checked later in ECA-1.2 to attempt to identify and isolate the leak.

The second part is plausible because the majority of the Eps will direct a cooldown limit of 100°F. (e.g. ECA-1.1, ES-1.2, etc).

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

The second part is plausible because the majority of the EPs will direct a cooldown limit of 100°F. (e.g. ECA-1.1, ES-1.2, etc).

Basis for meeting the K

The KA is matched because the applicant must understand how the components of the RHR and Safety Injection system interface with each other (valves, tanks, and pumps), and the implications of these relationships in assessing whether to isolate the ISLOCA or the FWST first. Also the applicant is tested on the function of the FWST by knowing where in the system this tank is located, and how it interfaces with other components of the emergency systems.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2015 MNS NRC Exam Q54 (Bank 5960)

Development References

REFERENCES:
ECA-1.2 (LOCA Outside Containment) Rev.
ECA-1.2 Bckgd doc Rev 28B

LEARNING OBJECTIVES:
OP-MC-EP-E1 Objective 3

Student References Provided

WE04 EK1.1 - LOCA Outside Containment

ILT-16-1 MNS SRO NRC Examination **QUESTION 54** 54 **C**

Knowledge of the operational implications of the following concepts as they apply to the (LOCA Outside Containment)
(CFR: 41.8 / 41.10, 45.3)

Components, capacity, and function of emergency systems.

401-9 Comments:	Remarks/Status

Q54 References

9.0 ECA-1.2, LOCA OUTSIDE CONTAINMENT

9.1. Purpose

This procedure provides guidance for a LOCA that occurs outside containment. Specifically, the objective of this procedure is to provide actions to identify and isolate a LOCA outside containment.

This entire EP is a significant deviation from the ERGs. Isolating an ISLOCA into the ND system is considered PRA significant operator action as described in PIP M-02-247. The valves used to do this isolation (NI-173A/178B) are not designed to close against the DP that could be seen during an ISLOCA, since this is a beyond design basis event. To meet the intent of this EP to isolate a break on low pressure ND system piping, this EP includes actions to cooldown and depressurize the NC system to the point where the isolation valves are capable of closing.

9.2. Symptoms/Entry Conditions

> ***Operator Fundamental Focus; Knowledge, Monitor and Teamwork***
> ***Reinforce*** *the importance of maintaining solid system knowledge to fully understand the possibility of inter-system LOCA's such as from the NC to ND. Further reinforce the importance of continuing to closely monitor and question indications that may appear to be "off-normal" for the procedure initially in progress. Monitoring is the responsibility of the control room team.*

ECA-1.2 is entered when either of the following conditions occur:

1. In E-0, when abnormal radiation occurs in the Aux Building due to a loss of NC system inventory outside containment.
2. When it is determined in E-1 or ES-1.2 that the cause of abnormal radiation is due to a loss of NC inventory outside containment.

9.3. Major Actions

The recovery/restoration technique of ECA-1.2 includes the following major action categories:

1. Stop and isolate ND pumps from FWST.
2. Ensure normally closed valves are closed.
3. Attempt to identify and isolate breaks.
4. Cooldown and depressurize the NC system.
5. Isolate break from NC system to ND system.
6. Terminate S/I.

There are two time critical actions in this EP to ensure core cooling:

1. Isolate ND suction from FWST to stop rapid depletion of FWST.

Stop break flow from NC to ND break after NC cooldown and depressurization by fully closing NI-173A and NI-178B.

Q54 References

9.4. Detailed Description of Procedural Steps

STEP 1 Monitor foldout page.

BASIS:

A foldout page is used to monitor "S/I Reinitiation Criteria". Since this EP includes significantly more operator actions and time to address cooldown and depressurization to isolate an ISLOCA, this foldout page item is necessary. "S/I Reinitiation" restarts ECCS pumps as needed since this EP reduces S/I flow in later steps. The S/I reinitiation criteria is consistent with other EPs such as ES-1.1 and ES-1.2.

STEP 2 Dispatch operator to remove white tags and close the following breakers: ... NI-173, NI-178, NI-183

BASIS:

Breakers needed to close valves to isolate ISLOCA are energized. This meets the intent of this EP to allow isolating leak.

STEPS 3 and 4 Check if ND pumps should be stopped and isolated.

Stop ND pumps and isolate potential FWST depletion path

BASIS:

As identified in PIP M-02-247, isolating FWST depletion in a timely manner is critical to maintaining core cooling. Because it takes a long time for us to isolate the ISLOCA, the FWST depletion must be secured first. This ensures FWST inventory is available for NV and NI pumps. The step first checks to see if ND could be injecting into the NC system by checking NC pressure. This ensures operators have not misdiagnosed the event. If the event is a large break LOCA, causing ND injection to NC system, this EP should not be implemented. ND should be allowed to inject to NC system if it is used for core cooling. The step verifies the break is on the ND system before isolating ND suction. The step only isolates ND suction from FWST and stops ND pumps if they are not being used for core cooling.

STEP 5 Check proper valve alignment:

BASIS:

Ensure normally closed flowpaths are closed.

If break is isolated by closing an inadvertently open flowpath, step provides transition to E-1.

Q54 References

NOTE: **NI-173 and NI-178 may not fully close if NC pressure is above 450 psig. These valves may indicate closed with valve still 20% open.**

Since ND trains are cross-tied, a check valve failure on one ND discharge line an affect either ND train.

If NC system is saturated, NC pressure may not be a good diagnostic of leak isolation. NC pressure will respond very slowly after leak is isolated, or may continue to drop if cooldown is in progress, until subcooling is restored.

STEP 6 and 7 **Try to identify and isolate break.**

Check if break is isolated.

BASIS: (includes notes)

As described in PIP M-02-247, a significantly different strategy must be used to isolate an ISLOCA into the ND system. The notes describe limitations of the isolation valves. Note 3 and substeps that check if leak is isolated provide information from ERG step 3 background "KNOWLEDGE" (reference DW-03-16). Added high head (NI) injection valves as plant specific. When the NI valve to the cold legs is isolated, NI pump miniflow is ensured or the NI pumps are shutdown until after the valve is reopened.

STEP 8 **Reset S/I and Sequencers.**

BASIS:

SI and sequencers must be reset in preparation for cooldown, depressurization, and SI reduction in subsequent steps.

NOTE: **After the Low Pressure Steamline Isolation signal is blocked, maintaining steam pressure negative rate less than 2 psig per second will prevent a Main Steam isolation.**

The following steps will perform a cooldown and depressurization as quickly as possible to reduce NC pressure low enough to allow isolation valves to close.

STEP 9 **Initiate NC system cooldown to 430 degrees F based on core exit T/C's:**

BASIS:

A max cooldown is performed to allow isolating the ISLOCA on ND system. The substeps to cooldown are similar to step used in max cooldown in E-3. A similar strategy to do a max cooldown and stop break flow is approved by WOG for SGTRs in E-3. The target temperature used in this step is higher than the lowest allowable temperature used in E-3. The lowest E-3 target temperature is selected to prevent cooling down to the point where PTS may be of concern. This bounds the target temperature used in ECA-1.2 and ensures this operator action does not cause a PTS event.

Q54 References

MNS EP/2/A/5000/ECA-1.2 **UNIT 2**	LOCA OUTSIDE CONTAINMENT	PAGE NO. **3 of 26** **Rev. 6**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3. Check if ND pumps should be stopped and isolated as follows:	
__ a. Check NC pressure - GREATER THAN 275 PSIG.	a. Perform the following: __ 1) **IF** containment pressure is less than 1 PSIG, **AND** the LOCA is only outside containment, **THEN GO TO** Step 3.b. __ 2) Contact station management to evaluate any actions to isolate potential leak. __ 3) **RETURN TO** procedure and step in effect.
__ b. ND pumps suction - ALIGNED TO FWST.	__ b. **GO TO** Step 5.
c. Check the following for indications of leak into ND System: • Abnormal ND temperatures on chart recorders: __ • ND to NC Cold Leg A and B temperature __ • ND to NC Cold Leg C and D temperature. __ • Abnormal ND System pressure.	
__ d. Check leak location - ON ND SYSTEM.	__ d. **IF** ND System has remained intact, **THEN GO TO** Step 5.
__ e. Check any ND pump - ON.	__ e. **GO TO** Step 4.d.

Q54 References

MNS EP/2/A/5000/ECA-1.2 **UNIT 2**	LOCA OUTSIDE CONTAINMENT	PAGE NO. **7 of 26** Rev. 6

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. (Continued)	
d. CLOSE the following valves:	
__ • 2NI-173A (Train A ND To A & B CL)	
__ • 2NI-178B (Train B ND To C & D CL).	
__ e. **GO TO** Step 7.	
f. Isolate NI header to cold legs as follows:	
1) Check the following valves - OPEN:	__ 1) Stop NI pumps.
__ • 2NI-115B (A NI Pump Miniflow)	
__ • 2NI-144B (B NI Pump Miniflow)	
__ • 2NI-147A (NI Pumps Miniflow Hdr Isol).	
__ 2) Do not continue until breaker for 2NI-162A (NI Pumps Cold Leg Isol) has been closed.	
__ 3) CLOSE 2NI-162A (NI Pumps Cold Leg Isol).	
4) Evaluate the following to determine if NC System leak is isolated:	
__ • NC System pressure	
__ • RVLIS	
__ • Pzr level	
__ • Local observation.	

Q54 References

MNS EP/2/A/5000/ECA-1.2 **UNIT 2**	LOCA OUTSIDE CONTAINMENT	PAGE NO. **10 of 26** **Rev. 6**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Reset the following:**	
__ a. S/I.	__ a. Reset S/I **PER** EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 23 (Local Reset of S/I Signal).
__ b. Sequencers.	b. Dispatch operator to open affected sequencer control power breaker: __ • A Train - 2EVDA Breaker 6 __ • B Train - 2EVDD Breaker 8.

NOTE
- After the Low Pressure Steamline Isolation signal is blocked, maintaining steam pressure negative rate less than 2 PSIG per second will prevent a Main Steam Isolation.
- The following steps will perform a cooldown and depressurization as quickly as possible to reduce NC pressure low enough to allow isolation valves to close.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Initiate NC System cooldown to 430°F based on core exit T/Cs as follows:**	
a. Check condenser available as follows: __ • MSIV on intact S/G(s) - OPEN __ • "C-9 COND AVAILABLE FOR STEAM DUMP" status light (2SI-18) - LIT.	__ a. **GO TO** RNO for Step 9.e.
b. Perform the following to place steam dumps in steam pressure mode: __ 1) Place "STM PRESS CONTROLLER" in manual. __ 2) Adjust "STM PRESS CONTROLLER" output to equal "STEAM DUMP DEMAND" signal. __ 3) Place "STEAM DUMP SELECT" in steam pressure mode.	

Q54 References

MNS EP/2/A/5000/ECA-1.2 **UNIT 2**	LOCA OUTSIDE CONTAINMENT	PAGE NO. **11 of 26** Rev. 6

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. (Continued)	
c. **WHEN** "P-11 PRESSURIZER S/I BLOCK PERMISSIVE" status light (2SI-18) lit, **THEN** perform the following:	
__ 1) Depress "BLOCK" on Low Pressure Steamline Isolation block switches.	
__ 2) Maintain NC pressure less than 1955 PSIG.	
__ d. **WHEN** "P-12 LO-LO TAVG" status light (2SI-18) lit, **THEN** place steam dumps in bypass interlock.	
__ e. Dump steam from intact S/G(s) to condenser at maximum rate while attempting to avoid a Main Steam Isolation.	e. Perform the following: __ 1) Ensure at least one Pzr PORV isolation valve is OPEN. 2) **IF** VI is lost, **OR** a Phase B Isolation has occurred, **THEN** align N_2 to PORVs by OPENING the following valves: __ • 2NI-430A (Emerg N2 From CLA To 2NC-34A) __ • 2NI-431B (Emerg N2 From CLA To 2NC-32B & 36B). __ 3) **IF** Pzr pressure is greater than 1955 PSIG, **THEN** depressurize to 1900 PSIG using Pzr PORV. __ 4) Depress "BLOCK" on Low Pressure Steamline Isolation block switches. __ 5) Maintain NC pressure less than 1955 PSIG. __ 6) Ensure Main Steam Isolation reset.

(RNO continued on next page)

Q54 Parent Question (2015 MNS NRC Q54 (Bank 5960) MODIFIED)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

ILT-31 MNS SRO NRC Examination QUESTION 54 54

WE04 EK3.4 - LOCA Outside Containment
Knowledge of the reasons for the following responses as they apply to the (LOCA Outside Containment)
(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.

Given the following conditions on Unit 1:

- ECA-1.2 (LOCA OUTSIDE CONTAINMENT) has been implemented
- NC System pressure is 1700 psig and stable

In accordance with ECA-1.2,

1) the crew will FIRST stop and isolate the ________ pumps from the FWST.

2) the overall mitigating strategy includes cooldown and depressurization of the NCS to allow the ________.

Which ONE (1) of the following completes the statement above?

A. 1. ND
2. Cold Leg Accumulators to inject

B. 1. NI
2. Cold Leg Accumulators to inject

C. 1. ND
2. ND isolation valves (1NI-173A and 1NI-178B) to close

D. 1. NI
2. ND isolation valves (1NI-173A and 1NI-178B) to close

Q54 Parent Question (2015 MNS NRC Q54 (Bank 5960) MODIFIED)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 54 | 54 | C

General Discussion

The first Major action in ECA-1.2 is to stop and isolate ND pumps from FWST.
The objective of ECA-1.2 is to provide actions to identify and isolate a LOCA outside containment. For a LOCA on the Residual Heat Removal (ND) system, the valves used to do this isolation are NI-173A /178B (ND to Cold Legs Cont Isol). These valves are not designed to close against the DP that could be seen during an ISLOCA. To meet the intent of ECA-1.2 to isolate a break on low pressure ND piping, this EP includes actions to cooldown and depressurize the NC system to the point where the isolation valves are capable of closing.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is correct and therefore plausible.

The second part is plausible because if the ND leak cannot be isolated before depleting the FWST, a transition to ECA-1.1 (Loss of ECR) would occur, and then the NCS is depressurized to allow CLA injection.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is plausible because the high pressure injection lines will be checked later in ECA-1.2 to attempt to identify and isolate the break.

The second part is plausible because if the ND leak cannot be isolated before depleting the FWST, a transition to ECA-1.1 (Loss of ECR) would occur, and then the NCS is depressurized to allow CLA injection.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT:

PLAUSIBLE:

The first part is plausible because the high pressure injection lines will be checked later in ECA-1.2 to attempt to identify and isolate the break.

The second part is correct and therefore plausible.

Basis for meeting the KA

The K/A is matched because the applicant must demonstrate knowledge of the reasons for the procedural direction to cooldown and depressurize the NCS to allow cycling of NI-173A/NI-178B to ensure these valves will provide leak isolation, since these valves are not designed to close against the DP that could be seen during an ISLOCA.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2013 MNS SRO AUDIT Q55 (Bank 5745)

Development References

REFERENCES:
Lesson Plan OP-MC-EP-E1 (Basis Document for ECA-1.2

LEARNING OBJECTIVES:
EPE1003
OP-MC-EP-E1 Objective 3

Student References Provided

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

ILT-31 MNS SRO NRC Examination QUESTION 54 54

WE04 EK3.4 - LOCA Outside Containment
Knowledge of the reasons for the following responses as they apply to the (LOCA Outside Containment)
(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.

401-9 Comments:

Remarks/Status
Consider sending to Chief Examiner for pre-401-9 review. Question sent to Chief Examiner for pre-401-9 review on 1/22/15. HCF Chief Examiners Early Submittal comments: K/A WE04 EK3.4 Question was submitted for preliminary review. The first bullet is a cue and is not needed. May need to add plant pressure to the initial conditions (>450 psig). Facility Response: Removed first bullet from stem and added NCS pressure to stem per chief examiners comments. SLM030215 401-9 Comment from Chief Examiner: Revised question is Satisfactory.

WE05 EK2.1 - Loss of Secondary Heat Sink

Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following:
(CFR: 41.7 / 45.7)

Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

Given the following initial conditions on Unit 1:

- The crew has implemented FR-H.1 (RESPOND TO A LOSS OF SECONDARY HEAT SINK)
- Feed and Bleed criteria is met

1) Which Cold Leg Accumulators (CLAs) provide backup motive force to open the PZR PORVs?

2) To establish adequate heat removal during Feed and Bleed, what is the MINIMUM number of PZR PORVs that must be opened?

A. 1. A and B
   2. 3

B. 1. A and B
   2. 2

C. 1. C and D
   2. 3

D. 1. C and D
   2. 2

General Discussion

CLAs A& B are aligned to supply backup N2 to the PZR PORVs if VI is lost.

Per FR-H.1, two PZR PORVs are opened to establish an NC system bleed path for heat removal.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because having three PORVs open would provide the maximum decay heat removal.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE
First part is plausible if the applicant fails to recall which 2 CLAs (A and B) supply N2 to the PORVs. C and D are just as likely a choice as A and B.

Second part is plausible because having three PORVs open would provide the maximum decay heat removal.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE
First part is plausible if the applicant fails to recall which 2 CLAs (A and B) supply N2 to the PORVs. C and D are just as likely a choice as A and B.

Second part is correct and therefore plausible.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the interrelationship between the loss of heat sink (bleed and feed in H.1 procedure) and the functions of the Pzr PORVS (to provide a bleed path for heat removal) and CLAs (role in providing a backup motive force to the PORVs)

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS ILT 2013 PreAudit 2 Q17 (Bank 4847)

Development References

REFERENCES:
FR-H.1 (Response to Inadequeate Heat Sink) Bckgd doc Rev 15
Lesson Plan OP-MC-PS-IPE (Pressurizer Pressure Control) Rev 04E

LEARNING OBJECTIVES:
EPFRH003

Student References Provided

WE05 EK2.1 - Loss of Secondary Heat Sink
Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following:
(CFR: 41.7 / 45.7)
Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and

manual features.

401-9 Comments:	Remarks/Status

Q55 References

the MCB Spray Controller is in AUTO, the Pressure Master Controller controls the Spray Controller output.

Objective #5

The Spray Controller output is ramped linearly from 0% - 100% as the Pressure Master Controller output goes from +25 psig (Error) to +75 psig (Error). Positive feedback of spray valve position (OPEN, INTERMEDIATE, or CLOSED) is provided via illuminated windows on the PV bar graph on the spray controller (Soft Control and SLIMs). These lights are generated from signals received from the valve limit switches. When the full

CLOSED limit switch is made up, the bottom window will be the only window that is lit. When the valve comes off the full CLOSED limit switch the middle window will illuminate and now both the bottom and middle windows will be lit. When the Valve reaches the full open position and the full OPEN limit switch is made up the top window will illuminate. At this point all windows, bottom, middle, and top will all be lit.

If the PV value is selected for display on the SLIMs, there are three values that will be displayed over the full range of valve motion. When the valve is full CLOSED the display will indicate 10%. When the valve comes off of the full CLOSED limits switch the display will indicate 60% and when the full OPEN limit switch is made up the display will indicate 100%. These are not actual valve position values, but artificial values set up in the SLIMs to provide the desired light indication representing valve position.

The spray valves fail closed on loss of air signal. There are Industry Operating Events where Unit Trips have been caused by a pressurizer spray valve failure to close. Spray valves are designed to fail close on loss of instrument air. However, a positioner failure could cause a valve to open or close. A "Pressurizer Spray Emergency Close" switch has been added to the Main Control Board. These switches operate in parallel with the existing SSF controls. Selecting "Close" will energize solenoid valves which will isolate operating air to the valves.

The spray valves have bypass flow. Manual valves in parallel with the spray valves are throttled to provide approximately 0.5 gpm bypass flow. This prevents thermal shock to the spray line and provides for mixing between the NCS and the PZR. The spray lines are equipped with low temperature alarms to provide indication of low bypass flow. During boration or dilution events, PZR Heaters should be placed in **MANUAL** and energized. This will result in pressure trying to increase, with resultant spray flow. Doing this will allow faster mixing of the NCS and the PZR to maintain a closer boron concentration.

When EMXA-4 is swapped to its alternate supply (SMXG), Capability to close the Spray Valves, NC-27C and NC-29C is given to SSF.

2.7 PORVs

2.7.1 PORV Operation

On an 'OPEN' signal, a solenoid actuates to align air to operate the PORVs. Normally the operating air is supplied from VI. Refer to Drawing 7.7, (PORV N_2 Backup). All three PORV's are provided with back-up N_2 from the Cold Leg Accumulators, to be

Q55 References

used if VI is lost. NC-32B & NC-36B get N_2 from CLA 'B' via NI-431B, and NC-34A from CLA 'A' via NI-430A. The N_2 regulator is set slightly less than VI press to allow VI as first choice supplier. Any time 'Low Press Mode' is selected, NI-430A & NI-431B will automatically open provided NC temperature < 320°F. NI-430A & NI-431B can be manually opened anytime with control board switch.

Note:
Refer to Annunciator Response's
1AD6-F9 (PORV NC-34A EMERG CLA N_2 ENABLED)
1AD6-F10 (PORV NC-32B EMERG CLA N_2 ENABLED)
Emphasize fact that alarms only indicate that NC34 & 32 have N_2 available but NC-34, NC-32 and NC-36 get N_2 backup.

2.7.2 PORV Control

Objective #5

Note:
Refer to Annunciator Response 1AD6
A6 (PZR Lo Press PORV NC34 Blocked) and 1AD6
B6 (PZR Lo Press PORV NC
32 & NC
36 blocked) and 1AD2
B7 (PCS PWR Supply Failure Control Cab)

Refer to Drawing 7.10, P.O. Relief Valve Control. There are three PORVs with each having two "OPEN-AUTO-CLOSE" control switches. There is one on the MCB and one on the Aux Shutdown Panel (ASP). The control switch desired for control is selected via the 'C/R-STATUS-LOCAL' switch on the ASP. When in 'AUTO', the PORV will OPEN provided Pressurizer Pressure is above the interlock pressure (2185 psig) and the control pressure is above 2335 psig for PORVs NC-32B and NC-36B.

PORV NC-34A, which is controlled by the Master Controller, will OPEN when the Error signal on the Master Controller output reaches +100 psig (Error) which is displayed on the "NC - Pressurizer and PRT" DCS Graphic.

PORVs NC-32B and NC-36B will CLOSE when Pressurizer Pressure lowers to 2327 psig. PORV NC-34A will CLOSE when the Master Controller output lowers to +80 psig (Error) displayed on the "NC - Pressurizer and PRT" DCS Graphic.

Q55 References

STEP 27 Check two Pzr PORVs and associated isolation valves – OPEN.

PURPOSE: To ensure an adequate bleed path is established and, if not, to establish alternative bleed path or cooling methods.

BASIS: After opening two Pzr PORVs, the operator should check that they are maintained in the open position. If two paths are maintained open, sufficient bleed flow exists to permit heat removal.

If two Pzr PORVs are not maintained open, the NC system may not depressurize sufficiently to permit adequate feed of subcooled S/I flow to remove core decay heat. If core decay heat exceeds feed and bleed heat removal capability, the NC system will repressurize, further reducing the feed of subcooled S/I flow and resulting in a rapid loss of inventory.

In addition, the operator should align any available source of low pressure water to at least one intact S/G, then attempt to open a S/G PORV for that S/G(s) and depressurize that S/G(s) to atmospheric pressure. This will restore secondary heat removal.

It should be noted that inventory depletion will occur from the open Pzr PORV(s) as the S/G(s) is being depressurized to atmospheric pressure. If no source of low pressure water can be aligned, then the S/G(s) should not be depressurized.

STEP 28 Isolate NV Recirc flowpath

PURPOSE: Closes NV150B and NV151A

BASIS: Ensures all injection flow goes to NC system

STEP 29 Establish Containment H2 Mitigation as follows:.

PURPOSE: Verify H2 mitigation system in service

BASIS: If H2 mitigation not previously placed in service Start H2 igniters and deenergize Ice Condenser AHUs.

STEP 30 Place all Pzr heaters in manual and off.

PURPOSE: To De-energize Pressurizer Heaters

BASIS: Prevent unnecessary heat input from the Pzr Heaters. If the heaters remain in auto they would energize due to high level deviation.

STEP 31 Have another licensed operator check S/I equipment PER Enclosure 15 (Subsequent S/I Actions) while continuing with this procedure.

EXAM BANK QUESTION: 4847 CNS **A**

Given the following conditions and sequence of events:

Initial Conditions

- Unit 1 is at 100% power.
- The crew tripped the reactor due to a loss of all feedwater
- EP/1/A/5000/E-0 (Reactor Trip or Safety Injection) was completed
- The crew was depressurizing the S/Gs to feed from the condensate booster pumps per EP/1/A/5000/FR-H.1 (Respond to a Loss of Secondary Heat Sink)

Current Conditions

- Bleed and feed criteria have been met and the crew is establishing bleed and feed per EP/1/A/5000/FR-H.1

1. Which cold leg accumulators provide backup motive force to open the PZR PORVs?
2. What is the function of the NC PORVs when establishing bleed and feed in EP/1/A/5000/FR-H.1?

A. 1. A and B
2. To provide for adequate NC system heat removal until secondary heat sink can be restored

B. 1. A and B
2. To depressurize the NC system to protect the S/G tubes from creep failure

C. 1. C and D
2. To provide for adequate NC system heat removal until secondary heat sink can be restored

D. 1. C and D
2. To depressurize the NC system to protect the S/G tubes from creep failure

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4847 CNS A

General Discussion

CLAs A& B are aligned to supply backup N2 to the PZR PORVs if VI is lost. Per H.1 step 22, two PZR PORVs are opened to establish an NC system bleed path for heat removal.
Tube failure may become a risk with Hi DP if the S/G is required to be depressurized to introduce a low pressure water source, but this is not the basis for opening the PORVs in step 22 .

Answer A Discussion

CORRECT: N2 pressure comes from A & B CLAs. PZR PORVs are required bleed path for heat removal

Answer B Discussion

First part is true N2 pressure comes from A & B CLAs. Tube failure is a plausible risk with high DP if the S/G is required to be depressurized to introduce a low pressure water source, but is not the correct step 22 basis

Answer C Discussion

N2 only comes from 2 CLAs (A and B), but C and D are plausible because they are as likely to supply N2 as A and B (but they don't). The second part is correct. PZR PORVs are required bleed path for heat removal

Answer D Discussion

N2 only comes from 2 CLAs (A and B), but C and D are plausible because they are as likely to supply N2 as A and B (but they don't).Tube failure is a plausible risk with high DP if the S/G is required to be depressurized to introduce a low pressure water source, but is not the correct step 22 basis

Basis for meeting the KA

Testing the interrelationship with the loss of heat sink (bleed and feed in H.1 procedure) and the functions of both the PORVS (to provide a bleed path for heat removal) and the CLAs (role in providing a backup motive force to the PORVs)

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2008 NRC Q17 (Bank 1717)

Development References	Student References Provided
FR-H.1 and basis	

KA	KA_desc
WE05 EK2.1	Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following: (CFR: 41.7 / 45.7)Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

WE11 EK2.2 - Loss of Emergency Coolant Recirculation

Knowledge of the interrelations between the (Loss of Emergency Coolant Recirculation) and the following:

(CFR: 41.7 / 45.7)

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.

Given the following conditions on Unit 1:

- A Large Break LOCA has occurred
- FWST level is 90 inches and lowering
- 1A ND pump is not available
- 1NI-184B (1B ND PUMP SUCTION FROM CONT SUMP ISOL) is CLOSED

1) Based on the conditions above, Cold Leg Recirc capability _______ available.

2) If ECA-1.1 (LOSS OF EMERGENCY COOLANT RECIRC) is implemented, the Foldout Page will require that ________ be secured when FWST level decreases to less than 20 inches.

Which ONE (1) of the following completes the statements above?

A. 1. is
   2. ALL ECCS pumps

B. 1. is
   2. the ND and NV pumps ONLY

C. 1. is NOT
   2. ALL ECCS pumps

D. 1. is NOT
   2. the ND and NV pumps ONLY

General Discussion

Per E-1 step 12, Check Cold Leg Recirc capability from at least one train as follows:
Train A:
● 1A ND pump - AVAILABLE and 1NI-185A (1A ND Pump Suction From Cont Sump Isol) - POWER AVAILABLE.
OR
Train B:
● 1B ND pump - AVAILABLE and 1NI-184B (1B ND Pump Suction From Cont Sump Isol) - POWER AVAILABLE.

Per ECA-1.1 Foldout page, IF FWST level goes below "FWST LEVEL LO-LO" alarm setpoint (20 inches), THEN stop all pumps taking suction from the FWST.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the B ND pump is available and the applicant may not recall the requirements for a train to be considered available for cold leg recirc (ND pump and related containment sump isolation valve).

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the B ND pump is available and the applicant may not recall the requirements for a train to be considered available for cold leg recirc (ND pump and related containment sump isolation valve).

Second part is plausible since the applicant may conclude that securing the NV and ND pumps would slow down the rate of depletion of the FWST allowing other pumps to continue to operate.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since the applicant may conclude that securing the NV and ND pumps would slow down the rate of depletion of the FWST allowing other pumps to continue to operate.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the interrelations between the RHR (ND) system and Loss of Emergency Coolant recirc (by knowing what has to be available to proceed to cold leg recirc or enter loss of ECR). The applicant must also have knowledge of the proper operation of the ECCS systems in relation to when all ECCS pumps should be secured due to depletion of the FWST.

Basis for Hi Cog

This is a high cognitive question because the applicant is required to analyze the conditions in the stem and then determine what affect these conditions will have on the availability of cold leg recirculation.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

ILT-16-1 MNS SRO NRC Examination **QUESTION 56** 56 **C**

Development References
REFERENCES: E-1 (Loss of reactor or Secondary Coolant) Rev. 17 ECA-1.1 (Loss of Emergency Coolant Recirc) Rev. 16 LEARNING OBJECTIVES: NONE

Student References Provided

WE11 EK2.2 - Loss of Emergency Coolant Recirculation
Knowledge of the interrelations between the (Loss of Emergency Coolant Recirculation) and the following:
(CFR: 41.7 / 45.7)
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.

401-9 Comments:	Remarks/Status

Q56 References

MNS EP/1/A/5000/E-1 **UNIT 1**	LOSS OF REACTOR OR SECONDARY COOLANT	PAGE NO. **12 of 25** Rev. 17

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. **Initiate evaluation of plant status as follows:**	
a. Check Cold Leg Recirc capability from at least one train as follows:	__ a. **IF** Cold Leg Recirc capability is not available from at least one train, **THEN GO TO** EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirc).
• Train A:	
__ • 1A ND pump - AVAILABLE	
__ • 1NI-185A (1A ND Pump Suction From Cont Sump Isol) - POWER AVAILABLE.	
OR	
• Train B:	
__ • 1B ND pump - AVAILABLE	
__ • 1NI-184B (1B ND Pump Suction From Cont Sump Isol) - POWER AVAILABLE.	

Q56 References

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC **Enclosure 1 - Page 1 of 1** **Foldout**	PAGE NO. **50 of 109** Rev. 16

1. **Emergency Coolant Recirc Capability Restoration:**

   - **WHEN** Cold Leg Recirc capability is restored, **THEN GO TO** Step 4.f in body of this procedure.

2. **ECCS Suction Monitoring Criteria:**

   - **IF** FWST level goes below "FWST LEVEL LO-LO" alarm setpoint (20 inches), **THEN** stop all pumps taking suction from the FWST.
   - **IF** suction source is lost to any NV, NI, ND, or NS pump, **THEN** stop pump.

3. **CA Suction Sources:**

   - **IF** CA Storage Tank (water tower) goes below 1.5 ft, **THEN** perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 20 (CA Suction Source Realignment).

4. **CLA Isolation:**

   - **IF** at least two NC T-Hots are less than 388°F, **THEN** isolate CLAs **PER** Enclosure 10 (CLA Isolation).

APE003 AK2.05 - Dropped Control Rod
Knowledge of the interrelations between the Dropped Control Rod and the following: (CFR 41.7 / 45.7)
Control rod drive power supplies and logic circuits ....

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- Control Rod P-8 (Control Bank C, **Group 1**) drops fully into the core due to a blown stationary gripper fuse
- The crew implements AP-14 (CONTROL ROD MALFUNCTION)

Subsequently,

- The blown fuse has been replaced and all requirements have been met for the operating crew to recover Control Rod P-8
- As Control Rod P-8 begins to move, annunciator 1AD-2 / A10 (ROD CONTROL URGENT FAILURE) alarms

The cause of this alarm is an Urgent Failure in Power Cabinet ______.

Which ONE (1) of the following completes the statement above?

A. 1AC

B. 2AC

C. 1BD

D. 2BD

General Discussion

An Auctioneer Amp and Comparator circuit monitors the "ordered" current versus the actual current to the coils and generates a Regulation Failure anytime the difference is out of tolerance. This is the condition that gives an Urgent Alarm when re-aligning a dropped rod.

Possible causes of a Power Cabinet Rod Control Urgent Failure are:

A Regulation Failure - "actual" current does not match demanded "current" or FULL current demanded longer than setpoint for every rod in that Power Cabinet. Any rod in a Power Cabinet that has "actual" matching "demanded" will prevent Req. failure in that Power Cabinet.

For this particular case since there is NO rod in the power cabinet for Control Bank C Group 2 that has an actual current that matches the demanded current, a Regulation Failure occurs resulting in an Urgent Failure for that Power Cabinet.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant does not fully understand the arrangement of the Power Cabinets and how they are designated, they could conclude that the failure is in Power Cabinet 1AC especially since this is the power cabinet associated with the misaligned rod.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant does not fully understand the arrangement of the Power Cabinets and how they are designated, they could conclude that the failure is in Power Cabinet 1BD.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant does not fully understand the arrangement of the Power Cabinets and how they are designated, they could conclude that the failure is in Power Cabinet 2BD.

Basis for meeting the K

The K/A is matched because the applicant must understand the relationship between the the dropped rod, the power supply arrangement to the control rods, and the logic which causes the Urgent Failure.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must analyze the given conditions to determine which rod groups are affected by the rod realignment and evaluate the given answers to determine which Power Cabinet supplies the effect group that causes the Urgent Failure alarm.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-IC-IRE (Rod Control System) Rev 27

LEARNING OBJECTIVES:
OP-MC-IC-IRE Objective 10

Student References Provided

APE003 AK2.05 - Dropped Control Rod

Knowledge of the interrelations between the Dropped Control Rod and the following: (CFR 41.7 / 45.7)

ILT-16-1 MNS SRO NRC Examination **QUESTION 57** 57 **B**

Control rod drive power supplies and logic circuits ....

401-9 Comments:	Remarks/Status

Q57 References

7.13. Power Cabinet Arrangement (03/05/97)

POWER CABINET	POWER CABINET GROUP DESIGNATION	ROD BANK	GROUP	NO. OF RCC'S
1AC	A	CONTROL BANK A	1	2
	B	CONTROL BANK C	1	4
	C	SHUTDOWN BANK A	1	4
1BD	A	CONTROL BANK B	1	4
	B	CONTROL BANK D	1	2
	C	SHUTDOWN BANK B	1	4
2AC	A	CONTROL BANK A	2	2
	B	CONTROL BANK C	2	4
	C	SHUTDOWN BANK A	2	4
2BD	A	CONTROL BANK B	2	4
	B	CONTROL BANK D	2	3
	C	SHUTDOWN BANK B	2	4
SCDE	A	SHUTDOWN BANK C		4
	B	SHUTDOWN BANK D		4
	C	SHUTDOWN BANK E		4

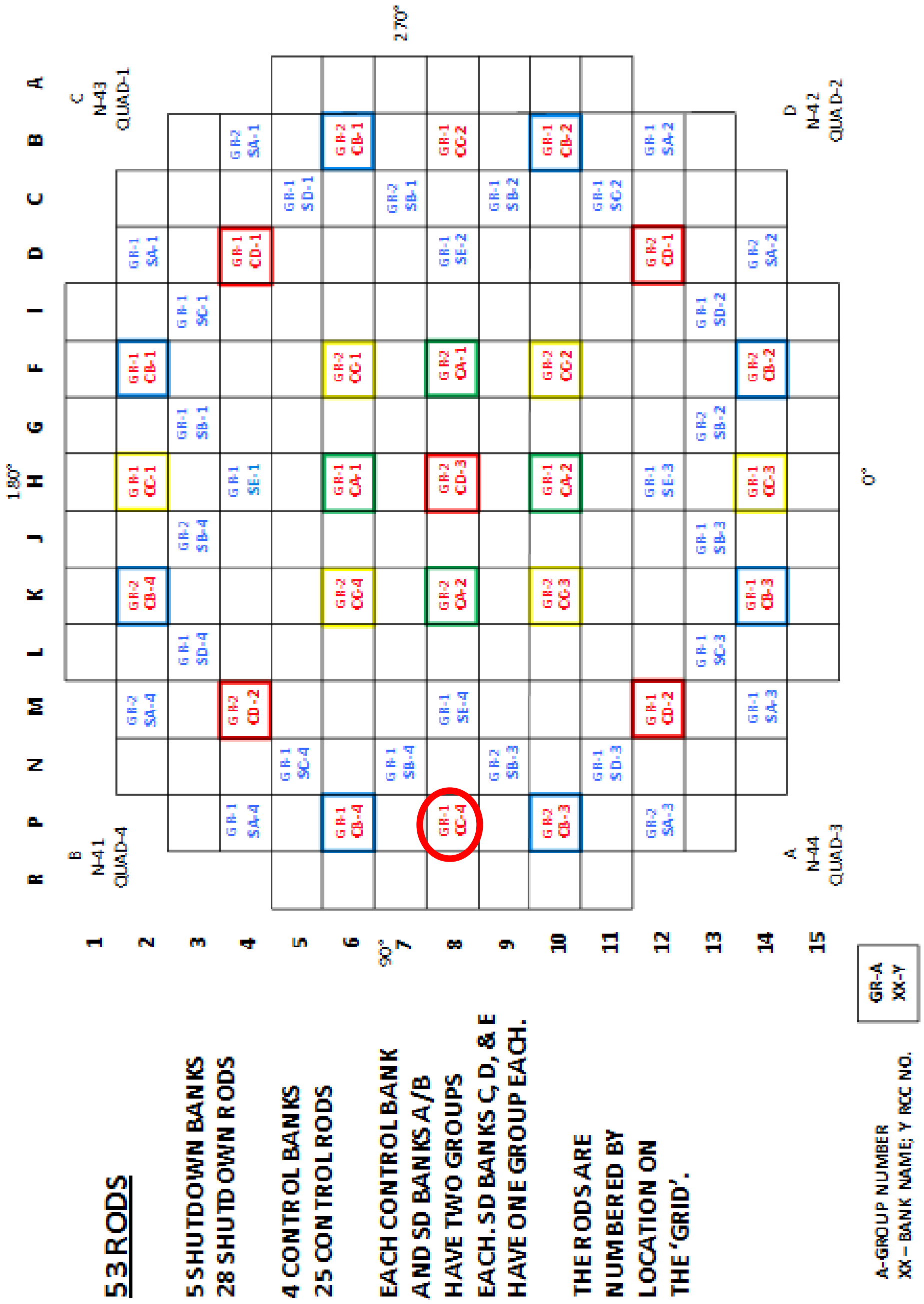
COIL CURRENT REGULATED LEVELS

CURRENT ORDER	STATIONARY GRIPPER COIL CURRENT	MOVABLE GRIPPER COIL CURRENT	LIFT COIL CURRENT
FULL	8 AMPS	8 AMPS	40 AMPS
REDUCED	4.4 AMPS	*	16 AMPS
ZERO	0 AMPS	0 AMPS	0 AMPS

*
THE MOVABLE GRIPPER COIL DOES NOT HAVE A REDUCED CURRENT ORDER. ON AN URGENT FAILURE ALARM IN A POWER CABINET, A CURRENT LEVEL OF 4.4 AMPS IS FORCED THROUGH BOTH MOVABLE AND STATIONARY GRIPPER COILS.

Q57 References

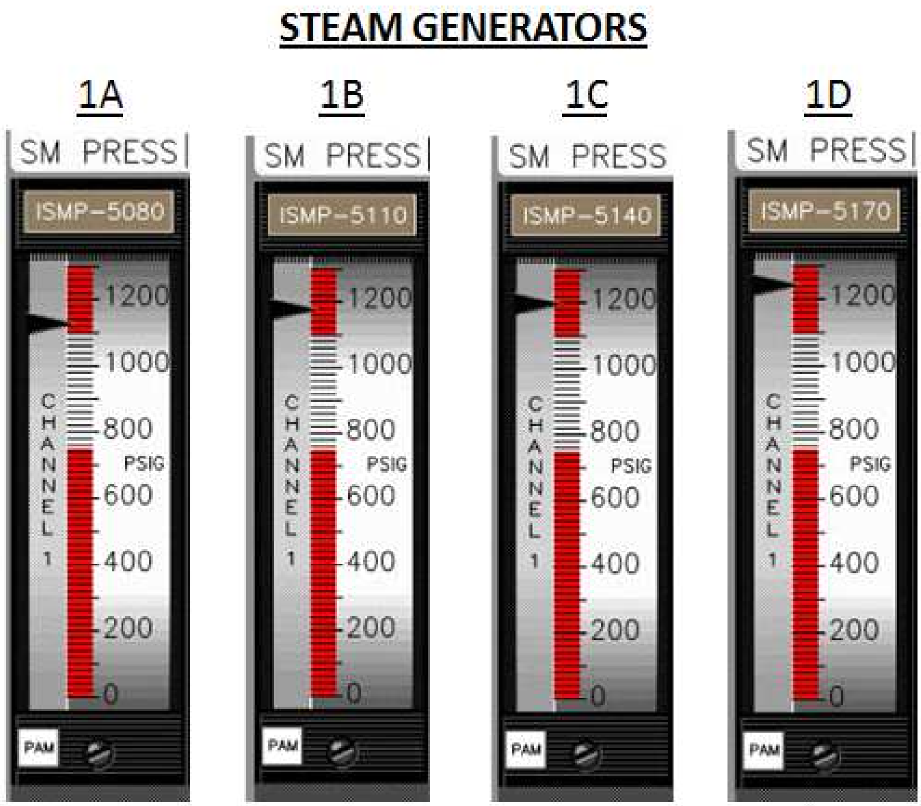
7.2. Core Map of Rod Locations (07/13/09)



WE13 EK1.2 - Steam Generator Overpressure

Knowledge of the operational implications of the following concepts as they apply to the (Steam Generator Overpressure)
(CFR: 41.8 / 41.10, 45.3)

Normal, abnormal and emergency operating procedures associated with (Steam Generator Overpressure).



Based on the indications above, the entry conditions of FR-H.2 (RESPONSE TO STEAM GENERATOR OVERPRESSURE) ___(1)___ met.

FR-H.2 is designed to address a failure of ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. are
2. a S/G PORV ONLY

B. 1. are NOT
2. a S/G PORV ONLY

C. 1. are
2. a S/G PORV AND the Main Steam Line Code Safety valves

D. 1. are NOT
2. a S/G PORV AND the Main Steam Line Code Safety valves

General Discussion

FR-H4 is used if the S/G PORV does not maintain pressure below 1170 PSIG (first code safety setpoint).

Once pressure gets to 1225 PSIG (highest code safety setting) entry into H.2 is recommended. Recommneded is used because yellow path procedures are never "REQUIRED.

FR-H.2 adresses failure of the PORVS and Safetys. FR-H.4 addresses a failure of the SM PORVs and Condenser Dumps.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because FR-H.4 is desiged to address a failure of a S/G PORV and the Condenser Dump valves.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that the entry conditions for FR-H.2 are ALL S/G pressures GREATER than 1225 PSIG as opposed to ALL S/G pressures LESS than 1225 PSIG. That being the case, the applicant would determine that the entry conditions for FR-H.2 are not met since only one S/G pressure is greater than 1225 PSIG.

The second part is plausible because FR-H.4 is desiged to address a failure of a S/G PORV and the Condenser Dump valves.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that the entry conditions for FR-H.2 are ALL S/G pressures GREATER than 1225 PSIG as opposed to ALL S/G pressures LESS than 1225 PSIG. That being the case, the applicant would determine that the entry conditions for FR-H.2 are not met since only one S/G pressure is greater than 1225 PSIG.

The second part is correct.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of the Functional Restoration Procedures (FRPs) associated with a Steam Generator Overpressure condition.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory all of the entry conditions for the Secondary Heat Sink Safety Function.

Next, the applicant must analyze the given indications and compare them to the recalled knowledge in the first step and determine if the entry conditions of FR-H.2 have been exceeded.

Finally, the applicant must recall the difference in the purposes of FR-H.2 and FR-H.4.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References	Student References Provided
REFERENCES: FR-H.2 (Response to Steam Generator Overpressure) Rev. 3 FR-H.4 (Response to Loss of Normal Steam Release Capabilitities) Rev. 2 F-0 (Critical Safety Function Status Trees) Rev. 6 Tech Spec 3.7.1 (MSSVs) Rev. 269/249 LEARNING OBJECTIVES: OP-MC-EP-FRH Objective 2	

WE13 EK1.2 - Steam Generator Overpressure

Knowledge of the operational implications of the following concepts as they apply to the (Steam Generator Overpressure)
(CFR: 41.8 / 41.10, 45.3)

Normal, abnormal and emergency operating procedures associated with (Steam Generator Overpressure).

401-9 Comments:	Remarks/Status

Q58 References

MNS EP/1/A/5000/FR-H.2 **UNIT 1**	RESPONSE TO STEAM GENERATOR OVERPRESSURE	PAGE NO. 1 of 11 Rev. 3

A. Purpose

This procedure provides actions for an overpressure condition affecting any S/G where pressure has gone above the highest steamline safety valve setpoint.

B. Symptoms or Entry Conditions

This procedure is entered from EP/1/A/5000/F-0 (Critical Safety Function Status Trees) (Heat Sink), on a yellow condition.

Q58 References

MNS EP/1/A/5000/FR-H.2 **UNIT 1**	RESPONSE TO STEAM GENERATOR OVERPRESSURE	PAGE NO. 2 of 11 Rev. 3

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
NOTE Throughout this procedure, "affected" refers to any S/G in which pressure is greater than 1225 PSIG.	
__ 1. **Check any S/G pressure - GREATER THAN 1225 PSIG.**	__ **RETURN TO procedure and step in effect.**
__ 2. **Check Feedwater Isolation status light (1SI-4) for affected S/G(s) - LIT.**	__ **Close valves on affected S/G PER Enclosure 1 (Feedwater Isolation Valves).**
__ 3. **Check affected S/G(s) N/R level - LESS THAN 92% (82% ACC).**	__ **GO TO EP/1/A/5000/FR-H.3 (Response To Steam Generator High Level).**
4. **Dump steam from the affected S/G(s) SM PORV:**	
__ a. Check affected S/G(s) SM PORV isolation valve - OPEN.	a. Perform the following: __ 1) Open affected S/G(s) SM PORV isolation valve. __ 2) **IF** affected S/G(s) SM PORV isolation valve can not be opened, **THEN GO TO** Step 5.

Q58 References

Table 3.7.1-1 (page 1 of 1)
OPERABLE Main Steam Safety Valves versus
Maximum Allowable Power Range Neutron Flux High
Setpoints in Percent of RATED THERMAL POWER

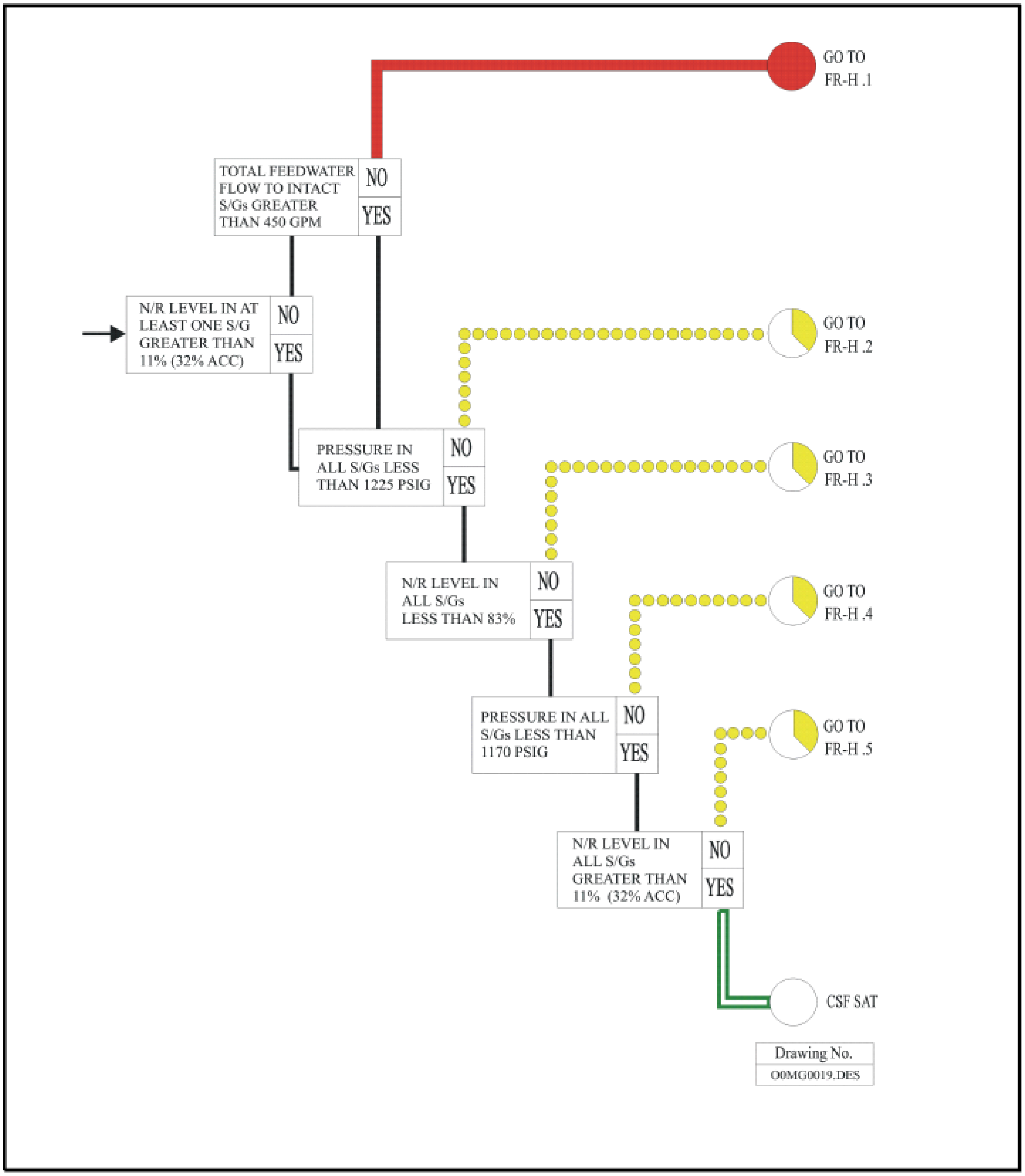
MINIMUM NUMBER OF MSSVs PER STEAM GENERATOR REQUIRED OPERABLE	MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINTS (% RTP)
4	≤ 57
3	≤ 38
2	≤ 19

Table 3.7.1-2 (page 1 of 1)
Main Steam Safety Valve Lift Settings

VALVE NUMBER				LIFT SETTING (psig ± 3%)
STEAM GENERATOR				
A	B	C	D	
SV-20	SV-14	SV-8	SV-2	1170
SV-21	SV-15	SV-9	SV-3	1190
SV-22	SV-16	SV-10	SV-4	1205
SV-23	SV-17	SV-11	SV-5	1220
SV-24	SV-18	SV-12	SV-6	1225

Q58 References

MNS EP/1/A/5000/F-0 **UNIT 1**	CRITICAL SAFETY FUNCTION STATUS TREES **Heat Sink - Page 1 of 1**	PAGE NO. **6 of 11** Rev. 6



Q58 References

MNS EP/1/A/5000/FR-H.4 **UNIT 1**	RESPONSE TO LOSS OF NORMAL STEAM RELEASE CAPABILITIES	PAGE NO. 1 of 5 Rev. 2

A. Purpose

This procedure provides actions to respond to a failure of the SM PORVs and condenser dump valves.

B. Symptoms or Entry Conditions

This procedure is entered from EP/1/A/5000/F-0 (Critical Safety Function Status Trees) (Heat Sink), on a yellow condition.

APE037 AA1.07 - Steam Generator (S/G) Tube Leak
Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak: (CFR 41.7 / 45.5 / 45.6)
CVCS letdown flow indicator ....

Given the following conditions on Unit 2:

- The crew has implemented AP-10 (NC SYSTEM LEAKAGE), Case 1 (S/G TUBE LEAKAGE)
- Pressurizer level has been stabilized
- Letdown flow is 45 GPM
- Charging flow is 110 GPM

Based on the conditions above, the estimated leak rate is ___(1)___ GPM.

Per OP/1/A/6200/001 (NV System), letdown flow through Normal Letdown shall not exceed a MAXIMUM of ___(2)___ GPM.

Which ONE (1) of the following completes the statements above?

A. 1. 65
2. 120

B. 1. 65
2. 185

C. 1. 53
2. 120

D. 1. 53
2. 185

General Discussion

The estimated leak rate is 110 gpm (Charging flow) - [45 gpm (Letdown flow) + 12 gpm (Seal return)],which equals 53 gpm.

Maximum letdown flows are as follows:
120 gpm through Normal Letdown
150 gpm through ND Aux Letdown with single Mixed Bed Demin in service
185 gpm through ND Aux Letdown with parallel Mixed Bed Demin in service.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 65 gpm will be calculated as the leak rate if the applicant only subtracts letdown flow from charging flow and fails to include seal return in their calculation.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because 65 gpm will be calculated as the leak rate if the applicant only subtracts letdown flow from charging flow and fails to include seal return in their calculation.

Second part is plausible because it is the letdown flow limit through ND aux letdown with parallel mixed bed demineralizers in service.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible because it is the letdown flow limit through ND aux letdown with parallel mixed bed demineralizers in service.

Basis for meeting the K

The KA is matched because the applicant is required to monitor letdown flow during a S/G tube leakage event and use this data to determine the leakage rate.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must perform a level of analysis concerning the given indications and then perform a calculation (solve a problem) to determine leak rate.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
OP-MC-PS-NV (Chemical Volume Control System) Rev 10
OP/1/A/6200/001 A (Chemical and Volume Control System Letdown) Rev. 53

LEARNING OBJECTIVES:
OP-MC-CNT-CNT Objective 4

Student References Provided

APE037 AA1.07 - Steam Generator (S/G) Tube Leak
Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak: (CFR 41.7 / 45.5 / 45.6)
CVCS letdown flow indicator ....

ILT-16-1 MNS SRO NRC Examination **QUESTION 59** 59 **C**

401-9 Comments:	Remarks/Status

Q59 References

- Maximum letdown flows are as follows:
  - 120 gpm through Normal Letdown
  - 150 gpm through ND Aux Letdown with single Mixed Bed Demin in service
  - 185 gpm through ND Aux Letdown with parallel Mixed Bed Demin in service.

  Basis: **Flow is limited to ensure effective demineralizer operation and to adhere to design limits of letdown piping.**

- Maximum NCP seal injection flow is 12 gpm per pump not to exceed 38 gpm total.

  Basis: **Minimize concern with overpressurizing the seal area.**

- Contact with chemicals in the Chemical Mixing Tank should be avoided at all times because:
  - LiOH is a strong base
  - N_2H_4 is a strong reducing agent and suspected carcinogen
  - H_2O_2 is a strong oxidizing agent

  Basis: **Safety concern**

- Maximum letdown header pressure is 255 psig to avoid lifting NV-156 (255 psig setpoint)

  Basis: **Self-explanatory.**

- During dilution of the NC System, at least 2 NC Pumps shall be operating, one of which in NC Loop to which charging is aligned. {PIP 02-2248}

  Basis: **Prevent pockets of diluted water in the NC System.**

- Maximum Cation Bed Demin flow is 75 gpm.

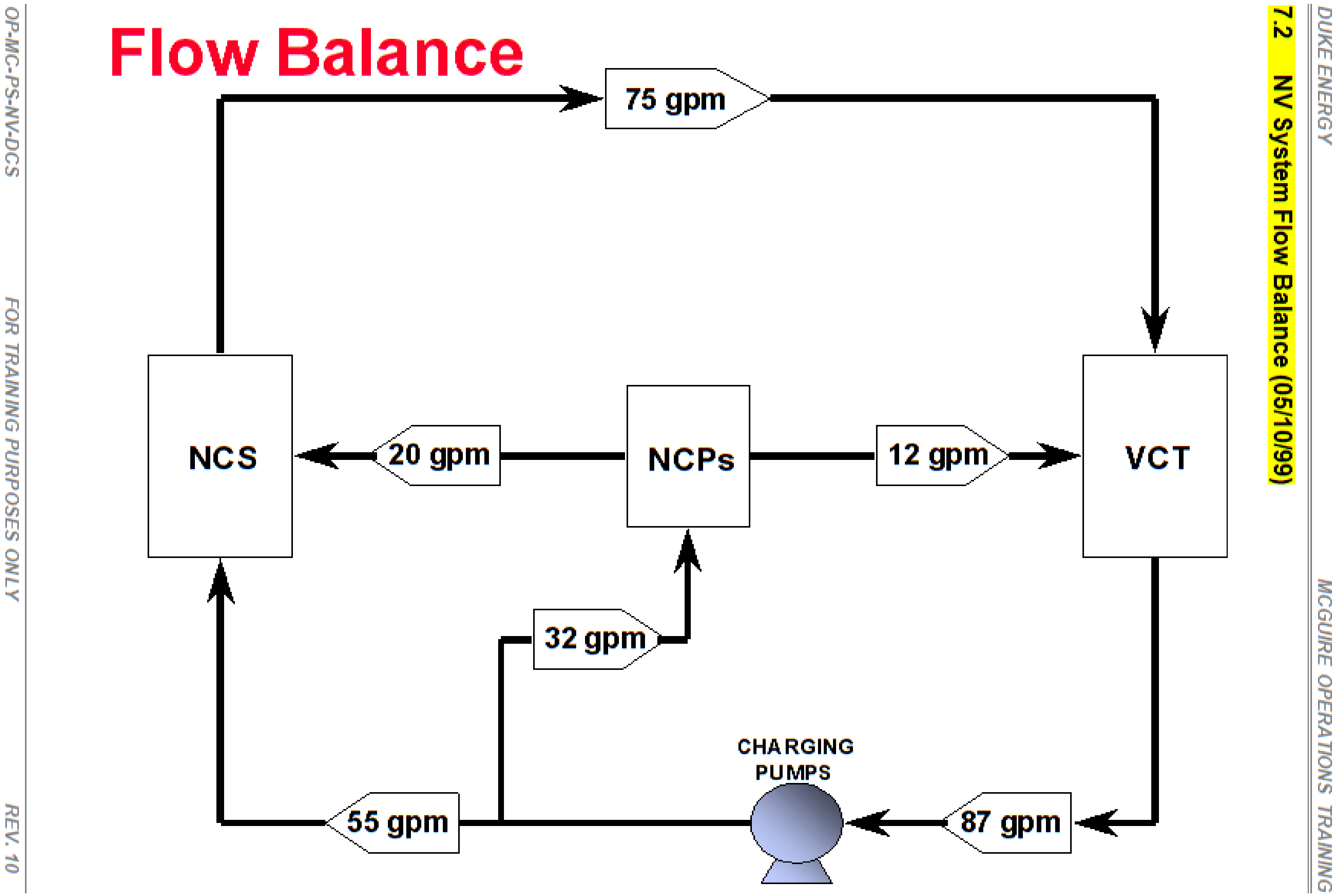
  Basis: **Higher flow rates could result in channeling through the bed, resulting in less ion removal.**

  (L&P 2.14B and 2.15B) from attached sheet

- Reducing charging flow to less than 20 gpm for greater than 20 seconds will result in automatic letdown isolation and securing of the Pzr heaters.

  Basis: **Self-explanatory.**

- Placing 1NV-238 (Charging Line Flow Control) in manual will cause the "PZR LEVEL MASTER" to transfer to manual.


OP-MC-PS-NV-DCS
FOR TRAINING PURPOSES ONLY
Page 72 of 95
REV. 10
Flow Balance
75 gpm
NCS
20 gpm
NCPs
12 gpm
VCT
32 gpm
CHARGING PUMPS
55 gpm
87 gpm
7.2 NV System Flow Balance (05/10/99)
DUKE ENERGY
MCGUIRE OPERATIONS TRAINING

APE051 AK3.01 - Loss of Condenser Vacuum

Knowledge of the reasons for the following responses as they apply to the Loss of Condenser Vacuum: (CFR 41.5,41.10 / 45.6 / 45.13)

Loss of steam dump capability upon loss of condenser vacuum ....

Given the following conditions on Unit 1:

- Unit is at 85% RTP
- Main condenser vacuum is 24.5" Hg and degrading at a rate of 0.5" Hg per minute
- Crew has entered AP-23 (LOSS OF CONDENSER VACUUM)

Based on the conditions above, Control Interlock (C-9) will block the ability to dump steam to the condenser in a MINIMUM of ___(1)___ minutes.

The reason for the Main Turbine trip on loss of Condenser vacuum is to ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. 3
2. prevent condenser damage due to over-pressurization

B. 1. 3
2. minimize low pressure turbine blading damage due to low vacuum conditions

C. 1. 9
2. prevent condenser damage due to over-pressurization

D. 1. 9
2. minimize low pressure turbine blading damage due to low vacuum conditions

---

General Discussion

Condenser Available Interlock (C-9)

This interlock blocks steam dump to the condenser if vacuum is low or there is insufficient circulating water flow. If Pressure switch 1ZMPT5030, located in condenser Section A, indicates condenser pressure is greater than 20" vacuum and at least two Circulating Water Pump breakers are closed, C-9 will be satisfied and permissive light C-9 COND AVAILABLE TO STEAM DUMP will be illuminated.

(24.5 - 20.0) = 4.5/0.5 = 9 minutes

In accordance with the background for AP-23, the basis for the Condenser vacuum trip is to prevent LP turbine blading damage due to high moisture content.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this is the answer the applicant would arrive at if they used the setpoint for the main turbine low vacuum trip. (24.5 - 23.0) = 1.5/0.5 =3

Second part is plausible since this is a concern during low vacuum conditions and is the reason for disabling steam dumps during low vacuum conditions.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since this is the answer the applicant would arrive at if they used the setpoint for the main turbine low vacuum trip. (24.5 - 23.0) = 1.5/0.5 =3

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since this is a concern during low vacuum conditions and is the reason for disabling steam dumps during low vacuum conditions.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the reason for isolating the steam dumps from the main condenser during a low vacuum condition.

Basis for Hi Cog

This is a high cog question because the applicant is required to analyze the conditions in the stem, recall from memory the C-9 interlock setpoint and then perform a calculation to determine when the C-9 interlock will isolate the steam dumps from the condenser.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References

REFERENCES:
Lesson Plan OP-MC-STM-IDE-DCS (Steam Dump System) Rev 01B
AP-23 (Loss of Condenser Vacuum) bckgd doc Rev 5
Lesson Plan OP-MC-MT-MT (Main Turbine) Rev 30

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 60** 60 **D**

LEARNING OBJECTIVES:

APE051 AK3.01 - Loss of Condenser Vacuum

Knowledge of the reasons for the following responses as they apply to the Loss of Condenser Vacuum: (CFR 41.5,41.10 / 45.6 / 45.13)

Loss of steam dump capability upon loss of condenser vacuum ....

401-9 Comments:	Remarks/Status

Q60 References

The setpoints are:

Bank	T_{AVG} - T_{REF} (°F)
1	8.1
2	13

Trip solenoid valves are energized to actuate; thus, a signal failure will prevent Tripping Open but Modulation Open may still be available.

2.3.5 Arming the steam dumps in the load rejection mode.

Objective #6

To arm the Condenser Dump Valves in the load rejection mode, T_{AVG} mode must be selected on the Steam Dump select switch, the condenser available interlock (C-9) must be satisfied, and the loss of load interlock (C-7A) must be satisfied. When all are satisfied, control board status light COND STM DUMP ARMED will illuminate.

Objective #6

Condenser Available Interlock (C-9)

This interlock blocks steam dump to the condenser if vacuum is low or there is insufficient circulating water flow. If Pressure switch 1ZMPT5030, located in condenser Section A, indicates condenser pressure is greater than 20" vacuum and at least two Circulating Water Pump breakers are closed, C-9 will be satisfied and permissive light C-9 COND AVAILABLE TO STEAM DUMP will be illuminated.

Objective #6

Loss of Load Interlock (C-7A)

Turbine load is measured by Turbine Inlet Pressure which is developed from SMAA 5211, SMAA 5221 and SMAA 5223

The Condenser arming LOWMON will actuate on a 10% step load decrease. (C-7A). "C-7A, LOSS OF LOAD INTLK COND DUMP" will illuminate. The input for C-7A comes from the three (3) Turbine Inlet Pressure channels registering a ≥10% load change and are then processed using a *DIG Count* resulting in a 2/3 logic scheme (refer to Ŵ Signal Diagram, Drop 8, Sheet 505).

2.4. Plant Trip Controller

2.4.1. The purpose of the Plant Trip Controller is to reduce T_{AVG} to the no-load value of 557°F following a reactor trip.

Q60 References

6.0 SUMMARY

Exhaust Hood High Temperature

High Temperature >175°F

High-High Temperature >250°F

Overspeed

103%; Overspeed Protection Circuit (OPC), GV's and IV's close.

110%; Mechanical Trip

111%; Electrical Trip (20-1AST)

Auto Stop Oil Pressure

45 PSIG on 2/2 ASO pressure switches, opens 20-ET and 20-ETC, turbine trips

Low Bearing Oil Pressure

11 - 12 psig on bearing oil trip header; Bearing oil and Seal oil backup pumps auto start

10 - 11 psig on bearing oil trip header; Emergency bearing oil pump auto starts.

>25 psig at pump discharge; Emergency bearing oil pump running annunciator

5 - 7 psig at #1 journal bearing, Turbine trip

Low Vacuum

25 inches of mercury, Condenser low vacuum pre-trip alarm.

20 - 23 inches of mercury, Low vacuum trip

Thrust Bearing Wear

35 psig (35 Mils); Alarm

75-80 psig (45 Mils); Turbine trip

Steam Generator (A, B, C or D) Hi Hi Level

83% Narrow range level on 1 of 3 detectors; Alarm

83% Narrow range level on 2 of 3 detectors; Turbine trip

Loss of Both Feedwater Pump Turbines

'A' Feedwater Pump turbine tripped alarm

'B' Feedwater Pump turbine tripped alarm

2 of 2 FWPT's Tripped; Turbine Trip

Reactor Trip

Any reactor trip causes a Turbine trip

Manual or Automatic

Q60 References

STEP 6:

PURPOSE:
Trip the turbine if condenser vacuum for given generator load drops below a certain value while the turbine is latched.

DISCUSSION:
Even though the given condenser vacuum setpoints are greater than the required turbine trip setpoints, we are required to trip the turbine below these values to minimize low pressure turbine blading damage during extended low vacuum conditions.

Per Engineering (Don Gabriel)
The OEM states that the turbine "should be tripped immediately if the limits in (Westinghouse Drawing) CT-25134 are exceeded". This information is intended to prevent turbine blade failure due to high backpressure on the last stage blades. In fact, the turbine blades will not fail immediately when the "do not operate" region of the drawing is entered. However, once in this region, the turbine should be returned immediately to the "operate in" region or tripped. From the operator's view, it may be better to have them trip the turbine than take the time necessary to decide if (1) the condition is valid and (2) it is not recoverable.

The limits on turbine operation with low vacuum at low loads is more restrictive than at higher loads. This is due to increased heating and blade loading forces at low steam flow (both high backpressure and reduced load are contributors). This should only be an issue at low load operation (less than 800 MW) because the low vacuum trip setting should protect (trip) the turbine above 800 MW without operator intervention.

The RNO will direct the operator around the step if the turbine is not latched.

REFERENCE:
Westinghouse DWG #CT-25134 - Backpressure (HgA) vs Load (mw)
PIP #M-01-04454

STEP 7:

PURPOSE:
Ensure sufficient AS header pressure for efficient air ejector operation.

DISCUSSION:
Very little reduction in steam pressure can cause the jets performance to drop significantly (refer to PIP M-4-00572 elevated secondary O2 levels). The jets are designed to operate with as little as 110 PSIG steam inlet pressure, but this is for dry steam (Main Steam). McGuire supplies the jets from Auxiliary Steam (wet steam), which doesn't have the energy content of dry steam for a given pressure. The jets need approximately 140 PSIG or more to operate properly when being supplied the wet steam like McGuires' Auxiliary Steam.

APE059 AA2.05 - Accidental Liquid Radioactive-Waste Release

Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: (CFR: 43.5 / 45.13)

The occurrence of automatic safety actions as a result of a high PRM system signal ....

Given the following conditions on Unit 1:

- A Ventilation Unit Condensate Drain Tank (VUCDT) release to the RC Discharge is in progress
- A 1EMF-44(L) (CONTAINMENT VENTILATION DRAINS - LOW RANGE) Trip 2 alarm is received

Which ONE (1) of the following indicates the automatic response to the EMF alarm?

COMPONENT LEGEND:

- 1WP-35 (WMT/VUCDT to RC CNTRL)
- 1WL-320 (VUCDT RAD MONITOR OUTLET)
- 1WL-322B (CONT VENT DRN OTSD ISOL)

A. 1WP-35 ONLY CLOSES

B. 1WL-320 AND 1WP-35 CLOSE

C. 1WL-322B ONLY CLOSES

D. 1WL-320 AND 1WL-322B CLOSE

General Discussion

In accordance with the WE-EMF lesson plan a 1EMF 44(L) Trip 2 alarm will automatically close 1WL-320 and WP-35 terminating the discharge from the containment ventilation unit condensate drain tank (VUCDT).

Answer A Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

This answer is plausible since 1WP-35 does receive an auto close signal and will terminate the release for a trip 2 on 0EMF-49.

Answer B Discussion

CORRECT. See explanation above.

Answer C Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

This answer is plausible since 1WL-322B does receive an auto close signal for (Phase B) containment isolation and this would isolate effluent flow into the VUCDT.

Answer D Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

Plausible since1WL-320 is correct and 1WL-322B does receive an auto close signal for (Phase B) containment isolation and this would isolate effluent flow into the VUCDT.

Basis for meeting the K

The KA is matched because the applicant demonstrates the ability to determine that the Accidental Liquid Waste Release has been terminated by demonstrating a knowledge of the automatic actions that should have occurred OR by taking or directing manual actions should those automatic actions fail to occur.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2011 MNS NRC Q59 (Bank 4412)

Development References

REFERENCES:
Lesson Plan OP-MC-WE-EMF (Radiation Monitoring System) Rev 35A

LEARNING OBJECTIVES:
OP-MC-WE-EMF Objective 3

Student References Provided

APE059 AA2.05 - Accidental Liquid Radioactive-Waste Release

Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: (CFR: 43.5 / 45.13)

The occurrence of automatic safety actions as a result of a high PRM system signal ....

401-9 Comments:

Remarks/Status

Q61 References

2.1.9 Containment Ventilation Unit Condensate Drain Tank Monitor

Objective # 2

The following channels:

- 1(2) EMF 44 (L) - Containment Vent Drains (Low Range)
- 1(2) EMF 44 (H) - Containment Vent Drains (High Range)

Are used to monitor the discharge from the containment unit condensate drain tank.

Objective # 2, 3

A 1(2) EMF-44(L) Trip 2 high radiation alarm closes the following to terminate the discharge from the VUCDT:

- 1(2)WL-320 (1(2) EMF-44 Outlet
- 1WP-35
- 1WM-46 (normally isolated)

The purpose of the auto actions is to prevent exceeding the release rate limits to the RC discharge for releases originating in the VUCDT.

This channel uses a dual range gamma liquid:

- Low Range (NaI Scint.)
- High Range (GM)

2.1.10 Nuclear Service Water Monitor

The following channels monitor the Nuclear service Water System:

- 1(2) EMF 45A (L) - Unit 1(2) Nuclear Service Water A (Low Range)
- 1(2) EMF 45A (H) - Unit 1(2) Nuclear Service Water A (High Range)
- 1(2) EMF 45B (L) - Unit 1(2) Nuclear Service Water B (Low Range)
- 1(2) EMF 45B (H) - Nuclear Service Water B (High Range)

Objective # 2

These channels monitor the nuclear service water at the outlet of the containment spray heat exchanger. 1EMF-45A monitors heat exchanger 1A while 1EMF-45B monitors heat exchanger 1B. 2EMF-45A monitors heat exchanger 2A while 2EMF-45B monitors heat exchanger 2B. These monitors are exposed to potentially radioactive fluids only during the post LOCA operation of the containment spray. A radiation reading indicates a heat exchanger tube failure.

No control action is performed on high alarm.

These channels use a dual range gamma liquid:

- Low Range (NaI Scint.)
- High Range (GM)

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2011 MNS SRO NRC Examination QUESTION 59 59

APE059 AA2.05 - Accidental Liquid Radioactive-Waste Release

Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: (CFR: 43.5 / 45.13)

The occurrence of automatic safety actions as a result of a high PRM system signal ....

Given the following plant conditions:

- A Ventilation Unit Condensate Drain Tank (VUCDT) release to the RC Discharge is in progress
- A 1EMF-44(L) Trip 2 alarm is received

Which ONE (1) of the following describes the automatic response to the EMF alarm?

A. All Unit 1 VUCDT pumps trip ONLY.

B. 1WL-322B (Cont. Vent Drn Otsd Isol) closes ONLY.

C. 1WL-320 (VUCDT Rad Monitor Outlet) AND 1WP-35 (WMT/VUCDT to RC CNTRL) close.

D. 1WL-320 (VUCDT Rad Monitor Outlet) AND 1WL-322B (Cont. Vent Drn Otsd Isol) close.

2011 MNS SRO NRC Examination QUESTION 59

59 **C**

General Discussion

In accordance with the WE-EMF lesson plan a 1EMF 44(L) Trip 2 alarm will automatically close 1WL-320 and WP-35 terminating the discharge from the drain tank.

Answer A Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

This answer is plausible if the applicant confuses the auto actions for the Trip 2 alarm with the automatic trip for the pumps on low VUCDT level. It is plausible to conclude that the pumps would automatically trip on an EMF alarm since this would stop the release.

Answer B Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

This answer is plausible since 1WL-322B does receive an auto close signal (Phase B) and since this will isolate effluent flow into the VUCDT.

Answer C Discussion

CORRECT. See explanation above.

Answer D Discussion

INCORRECT. See explanation above.

PLAUSIBLE:

Part 1 is correct.

Part 2 is plausible since 1WL-322B does receive an auto close signal (Phase B) and since this will isolate effluent flow into the VUCDT.

Basis for meeting the KA

In the event that the radiation level in the VUCDT effluent exceeds the limits allowed by the release permit, the Trip 2 alarm on 1EMF 44 should result in automatic actions to terminate the Accidental Liquid Waste Release. The applicant demonstrates the ability to determine that the Accidental Liquid Waste Release has been terminated by demonstrating a knowledge of the automatic actions that should have occurred OR by taking or directing manual actions should those automatic actions fail to occur. Therefore, the KA is matched.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must analyze a given set of conditions and determine what automatic actions should have occurred and what actions must be taken by the operators to terminate the release.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Taskmaster Bank WEEMFN013

Development References

References:

Lesson Plan OP-MC-WE-RLR Section 2.1
Lesson Plan OP-MC-WE-EMF Section 2.1.14

Learning Objectives: OP-MC-WE-RLR Objective 5, OP-MC-WE-EMF Objective 3

Student References Provided

APE059 AA2.05 - Accidental Liquid Radioactive-Waste Release

Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: (CFR: 43.5 / 45.13)

The occurrence of automatic safety actions as a result of a high PRM system signal ....

401-9 Comments:

Remarks/Status

401-9 Comment:

Q61 Parent Question (2011 MNS NRC Q59 (Bank 4412))

C

2011 MNS SRO NRC Examination QUESTION 59 | 59

SAT.

RESOLUTION:

N/A HCF 5/16/11

APE069 AK3.01 - Loss of Containment Integrity

Knowledge of the reasons for the following responses as they apply to the Loss of Containment Integrity: (CFR 41.5,41.10 / 45.6 / 45.13)

Guidance contained in EOP for loss of containment integrity ....

Given the following conditions on Unit 2:

- A Large Break LOCA has occurred
- ES-1.3 (TRANSFER TO COLD LEG RECIRC) has been implemented
- Containment pressure is 4 PSIG

ES-1.3 directs the crew to start an NS pump if Containment pressure is greater than a MINIMUM of ___(1)___ PSIG.

The reason that ES-1.3 directs the crew to reset Safety Injection (SI) and the Sequencers prior to attempting to start an NS pump is that ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. 3
2. the NS pumps are locked out until the Sequencers are reset

B. 1. 3
2. the NS pump discharge valves cannot be opened unless SI is reset

C. 1. 1
2. the NS pumps are locked out until the Sequencers are reset

D. 1. 1
2. the NS pump discharge valves cannot be opened unless SI is reset

---

General Discussion

In accordance with ES-1.3 (Transfer to Cold Leg Recirc), the crew will place and NS pump in service on the recirc flowpath if Containment pressure exceeds 3 PSIG.

ES-1.3 early on directs the crew to reset Safety Injection and the Sequencers. This is done primarily to regain control of plant equipment. However, relative to starting an NS pump on High Containment Pressure, the NS pump is locked out by the Sequencer and cannot be started until the Sequencer is reset. The sequencer cannot be reset unless SI is reset.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because the NS pump discharge valves are Containment Isolation valves. It is therefore plausible for the applicant to conclude that a Safety Injection signal would need to be reset before the valves could be opened.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because 1 PSIG is setpoint for Safety Injection on Hi Containment pressure. Also, 1 psig is the closest number to 3 psig where some action occurs or is required.
The second part is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because 1 PSIG is setpoint for Safety Injection on Hi Containment pressure. Also, 1 psig is the closest number to 3 psig where some action occurs or is required.
The second part is plausible because the NS pump discharge valves are Containment Isolation valves. It is therefore plausible for the applicant to conclude that a Safety Injection signal would need to be reset before the valves could be opened.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of the reasons for performing actions necessary to place NS in service when Containment Integrity is jeopardized.

NOTE: At most Westinghouse plants, a Loss of Containment Integrity is associated strictly with the performance of FR-Z.1 (Response to High Containment Pressure). For a Containment High Pressure condition, the Containment Spray (NS) system would normally be placed in service in accordance with FR-Z.1. However, at MNS, after ECCS water management modifications, the NS system is now always operated in accordance with ES-1.3. Consequently, if FR-Z.1 requires the NS pumps be placed in service, it directs the crew to place them in service in accordance with ES-1.3. Hence the reason that this "Containment Integrity" question is written to ES-1.3.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
ES-1.3 (Transfer to Cold Leg Recirc) Rev. 27
Lesson Plan OP-MC-ECC-NS (Containment Spray System) Rev. 33

LEARNING OBJECTIVES:

Student References Provided

OP-MC-EP-E1 Objective 4

APE069 AK3.01 - Loss of Containment Integrity

Knowledge of the reasons for the following responses as they apply to the Loss of Containment Integrity: (CFR 41.5,41.10 / 45.6 / 45.13)

Guidance contained in EOP for loss of containment integrity ....

401-9 Comments:	Remarks/Status

Q62 References

2.2. Containment Spray Pumps

Two identical containment spray pumps are installed in the Containment Spray System. Each pump is sized to deliver sufficient spray flow to the containment atmosphere through the spray heat exchangers to meet containment cooling requirements. The pumps deliver 3400 gpm to the spray headers. Pump discharge pressure is ≈200 psig.

Objective #12

The two containment spray pumps are of the vertical single stage, end-suction, side discharge centrifugal type driven by electric motors. The 400 hp, 4160 VAC, 60 cycle motors, are powered from the ETA/ETB Busses. The NS pumps have a start/stop pushbutton in the Control Room for manual operation.

Pump motors are direct-coupled and large enough for the maximum power requirement of the pump. Materials of construction suitable for use in mild boric acid solutions (such as stainless steel or equivalent corrosion resistant material) are used. The Containment Spray System is designed so that adequate net positive suction head (NPSH) is provided to the Containment Spray Pumps.

A flow element, located downstream of each Containment Spray Pump, provides indication of pump flow in the Control Room.

The NS pumps are interlocked with the Diesel Generator Load Sequencer such that the train related sequencer must be reset in order to allow the associated NS pump to start. The NS pump will be locked out because it is not an S/I or a Blackout load. This prevents the NS pump from being started while the sequencer is loading. This feature prevents the NS pump from interfering with high priority loads.

Objective #7

Each pump room has an Air Handling Unit (AHU) to provide a suitable environment for the NS Pump. The AHU starts when the pump starts or a safety injection signal is actuated. Cooling water for the AHU is provided by RN. The AHU is designed to maintain room temperature below SLC 16.9.16 requirements for pump operability.

2.3. Containment Spray Heat Exchangers

Shell and tube type heat exchangers (one per train) with the tubes welded to the tube sheet. Borated water from the lower compartment of the Containment circulates through the tubes while Nuclear Service Water circulates through the shell side. The spray heat exchangers are designed to assure adequate heat removal capacity from the water during the recirculation mode.

Q62 References

MNS EP/1/A/5000/ES-1.3 **UNIT 1**	TRANSFER TO COLD LEG RECIRC	PAGE NO. 9 of 25 Rev. 27

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. Align NS for recirc as follows:	
a. CLOSE the following valves: __ • 1NS-20A (1A NS Pump Suction From FWST Isol) __ • 1NS-3B (1B NS Pump Suction From FWST Isol).	
__ b. Check containment pressure - GREATER THAN 3 PSIG.	b. Perform the following: __ 1) Wait up to 30 seconds for 1NS-20A and 1NS-3B to close. __ 2) OPEN 1NS-18A (1A NS Pump Suction From Cont Sump Isol). __ 3) OPEN 1NS-1B (1B NS Pump Suction From Cont Sump Isol). __ 4) **IF AT ANY TIME** containment pressure goes above 3 PSIG, **THEN** perform Step 8. __ 5) **GO TO** Step 9.
c. Check at least one of the following alarms - LIT: __ • "CONT SUMP LEVEL GREATER THAN 3 FT" on 1AD-14 - LIT OR __ • "CONT SUMP LEVEL GREATER THAN 3 FT" on 1AD-15 - LIT.	c. Perform the following: __ 1) **WHEN** either 3 ft sump alarm is lit, **THEN** perform Step 8. __ 2) **GO TO** Step 9.
__ d. Check 1A NS pump - AVAILABLE TO RUN.	__ d. **GO TO** Step 8.f.

EPE074 EK2.06 - Inadequate Core Cooling

Knowledge of the interrelations between the Inadequate Core Cooling and the following : (CFR 41.7 / 45.7)

Turbine bypass and atmospheric dump valves ....

Given the following conditions on Unit 1:

- The crew has implemented FR-C.1 (RESPONSE TO INADEQUATE CORE COOLING)
- "LOW PRESSURE STEAMLINE ISOL" has been blocked
- Operators are preparing to depressurize intact steam generators to 190 PSIG

Based on the conditions above, the CRS will direct the steam dumps be opened to establish a ___(1)___ cooldown rate.

The secondary side cooldown and depressurization is a major action of FR-C.1 performed to ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. 100 °F/hour
2. enhance the reflux boiling flow effect

B. 1. 100 °F/hour
2. allow Cold Leg Accumulators and ND pumps to inject

C. 1. maximum
2. enhance the reflux boiling flow effect

D. 1. maximum
2. allow Cold Leg Accumulators and ND pumps to inject

General Discussion

Per FR-C.1 Step 15d, Dump steam from intact S/G(s) to condenser at maximum rate while attempting to avoid a Main Steam Isolation.

Per FR-C.1 bckgd doc, the rapid secondary depressurization has been shown to be the most effective way to reduce NC system pressure. NC system pressure must be reduced in order for the CLAs and ND pumps to inject.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 100 degrees per hour is the TS cooldown limit and cooldown rate required in most of the EP procedures (ES-1.2, etc.).

Second part is plausible since reflux boiling may be the form of cooling occurring and the cooldown and depressurization would enhance this.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since 100 degrees per hour is the TS cooldown limit and cooldown rate required in most of the EP procedures (ES-1.2, etc.).

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since reflux boiling may be the form of cooling occurring and the cooldown and depressurization would enhance this.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of how the secondary side cooldown and depressurization is performed (and thus the interrelations between the steam dumps and FR-C.1) and the reason for this action in FR-C.1.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2007 MNS NRC SRO Retake Examination NRC Q23 (Bank 3443)

Development References

REFERENCES:
FR-C.1 (Response to Inadequate Core Cooling) Rev 9
Lesson Plan OP-MC-EP-FRC (Core Cooling Functional Restoration Procedures) Rev 14

LEARNING OBJECTIVES:
OP-MC-EP-FRC Objective 3

Student References Provided

EPE074 EK2.06 - Inadequate Core Cooling

Knowledge of the interrelations between the Inadequate Core Cooling and the following : (CFR 41.7 / 45.7)

Turbine bypass and atmospheric dump valves ....

401-9 Comments:	Remarks/Status

Q63 References

STEP 15 Depressurize intact S/Gs to 190 PSIG as follows:

PURPOSE: To re-cover the core via S/I accumulator injection.

BASIS: The rapid secondary depressurization has been shown to be the most effective way to reduce NC system pressure. NC system pressure must be reduced in order for the CLAs and ND pumps to inject.

To prevent accumulator nitrogen injection, the operator should stop the secondary depressurization when the S/G pressure reaches 190 psig and at least two NC T-Hot temperatures fall below 388°F. This pressure and temperature value was determined such that the saturation pressure at these values is higher than the CLA pressure after the CLA water has been discharged. This precludes nitrogen injection into the NC system.

Operator Fundamental Focus; Knowledge
Reinforce *the importance and application of generic fundamental knowledge such as the relationship between temperature and pressure of the NC and S/Gs. This contributes to the basis of the limit for depressurizing intact S/Gs. Also* ***discuss*** *the reason why nitrogen is not desired in the NC is because it could affect NC flow if it accumulates in the top of the S/G tubes. This underscores the importance for operators to maintain in-depth understanding of plant equipment, systems, and emergency operating procedures and the associated bases.*

STEP 16 Check if CLAs should be isolated:

PURPOSE: To prevent accumulator nitrogen from being injected into the NC system.

BASIS: CLAs are isolated to prevent nitrogen injection into the NC system when the NC T-Hot criterion is satisfied. Two temperatures are used to ensure that one is not giving an erroneous reading. Nitrogen could collect in the high places and produce either a "hard" Pzr bubble or cause gas binding and reduced heat transfer in the S/G U-tubes. Venting the nitrogen gas also prevents injection. If it is necessary to vent the nitrogen, the operator should open the vent lines and then continue with this procedure.

Power to the CLA isolation valves is normally off and is controlled by disconnect switches in the control room. Placing power on and closing the valve can be done in one step from the control room. Switches are returned to the normal disconnect position after the valves are opened.

STEP 17 Stop all NC Pumps.

PURPOSE: To verify all NC pumps have been stopped.

BASIS: In preparation for the subsequent depressurization of the S/Gs to atmospheric pressure, the NC pumps are stopped due to the anticipated loss of Number 1 seal requirements. Continued operation may result in damage to the NC pumps.

MNS EP/1/A/5000/FR-C.1 **UNIT 1**	RESPONSE TO INADEQUATE CORE COOLING	PAGE NO. **14 of 57** Rev. 9

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. (Continued)	
__ d. Dump steam from intact S/G(s) to condenser at maximum rate while attempting to avoid a Main Steam Isolation.	d. Dump steam using all intact S/G(s) SM PORV as follows: __ 1) Ensure Main Steam Isolation reset. __ 2) Ensure SM PORVs reset. __ 3) Dump steam using all intact S/G(s) SM PORVs at maximum rate while attempting to avoid a Main Steam Isolation.
__ e. Check intact S/G pressures - LESS THAN 190 PSIG.	e. Perform the following: __ 1) <u>**IF**</u> S/G pressure going down, <u>**THEN**</u> <u>**RETURN TO**</u> Step 11. __ 2) <u>**GO TO**</u> Step 24.
__ f. Check at least two NC T-Hots - LESS THAN 388°F.	f. Perform the following: __ 1) <u>**IF**</u> NC T-Hots going down, <u>**THEN**</u> <u>**RETURN TO**</u> Step 11. __ 2) <u>**GO TO**</u> Step 24.
__ g. Stop S/G depressurization and maintain S/G pressures stable.	

Q63 Parent Question (2007 MNS NRC SRO Retake Examination Q23 (Bank 3443))

Examination Outline Cross-reference:	Level	RO	SRO
	Tier #	1	
	Group #	2	
	K/A #	W/E06 EK2.2	
	Importance Rating	3.8	

Inad. Core Cooling : 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

Question: Common 23

Unit 1 is implementing FR-C.1 *(Response to Inadequate Core Cooling)*. Given the following events and conditions:

- "LOW PRESSURE STEAMLINE ISOL" has been blocked.
- Operators are preparing to open the steam dumps to depressurize intact steam generators to 110 psig.

Which ONE (1) of the following describes the guidance that should be given to the operator opening the steam dumps?

A. The steam dumps should be fully opened to depressurize the S/Gs as quickly as possible.

B. A cooldown rate of less than 100 °F/hour should be established to prevent exceeding Tech Spec limits.

C. A cooldown rate of less than 25 °F/hour should be established to prevent pressurized thermal shock concerns.

D. The steam dumps should be carefully opened (<2 psig / sec) to prevent MSIV closure

Answer: D

Explanation (Optional):

A. Incorrect: The steam dumps should be opened slowly.
Plausible: If the candidate confuses the FR-C guidance with tube rupture guidance.

B. Incorrect: While TS limits apply, the dumps will be isolated long before that limit is approached.
Plausible: This is the TS cooldown limit.

C. Incorrect: PTS is not the immediate concern with CETs >1200 degrees.
Plausible: PTS and limiting cooldown are reasonable concerns for other events.

D. Correct: note in C.1 informs the operator that a depressurization rate of less than 2 psig/second will maintain the MSIVs open.

Technical Reference(s): OP-MC-EP-FRC page 37 (Attach if not previously provided)
EP/FR-C.1 page 11

References to be provided to applicants during examination: None

Learning Objective: OP-MC-EP-FRC Obj. 4 (As available)

Question Source: Bank # 907
Modified Bank # ______ (Note changes or attach parent)
New ______

Question History: Last NRC Exam 2002

Question Cognitive Level: Memory or Fundamental Knowledge ______
Comprehension or Analysis X

10 CFR Part 55 Content: 55.41 ______
55.43 ______

Comments:

WE03 2.1.31 - LOCA Cooldown and Depressurization

WE03 GENERIC

Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)

Given the following initial conditions on Unit 2:

- A Small Break LOCA has occurred
- The crew has entered ES-1.2 (POST LOCA COOLDOWN AND DEPRESSURIZATION) and began an NC system cooldown and depressurization

Subsequently,

- Annunciator 2AD-6 / A12 (PORV LO PRESS MODE NOT SELECTED) alarms

For this alarm to be valid, NC system temperature must be less than a setpoint of ___(1)___.

AND

Either 2NC-34A (U2 PZR PORV) or ___(2)___ (U2 PZR PORV) PORV OVERPRESS PROTECTION SELECT switch is in “NORM”.

Which ONE (1) of the following completes the statements above?

A. 1. 320°F
2. 2NC-36B

B. 1. 300°F
2. 2NC-36B

C. 1. 320°F
2. 2NC-32B

D. 1. 300°F
2. 2NC-32B

General Discussion

Annunciator 2AD-6/A12, PORV LO PRESS MODE NOT SELECTED will alarm if NC system WR temperature is less than 320°F with EITHER PORV Overpressure Protection Select switch (NC34A or NC32B) not selected to "Low Press" (i.e. in "NORM").

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since either of two PORVs selected to "NORM" will cause the alarm however, 2NC-36B is not one of the PORVs used for LTOP.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because per SO-10 (Cooldown to 240 degrees), cooldown below 300 degrees is not allowed until the PORV mode select switches are placed in the Low Pressure position.

Second part is plausible since either of two PORVs selected to "NORM" will cause the alarm however, 2NC-36B is not one of the PORVs used for LTOP.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: Se explanation above.

PLAUSIBLE:
First part is plausible because per SO-10 (Cooldown to 240 degrees), cooldown below 300 degrees is not allowed until the PORV mode select switches are placed in the Low Pressure position.

Second part is correct and therefore plausible.

Basis for meeting the K

This KA is matched because the applicant must evaluate an alarm that is received and evaluate what could have caused this alarm. Evaluating what could have caused this alarm constitutes a determination of whether plant components (i.e. the PORV Overpressure Protection Select switches) are correctly aligned for current plant conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2009 MNS RO NRC Retake Examination NRC Q68 (Bank 2268)

Development References

REFERENCES:
Lesson Plan OP-MC-PS-NC (Reactor Coolant System) Rev 38
OP/2/A/6100/10 G, Annunciator Response for Panel 2AD-6 Rev. 56

LEARNING OBJECTIVES:
OP-MC-PS-NC Objective 14

Student References Provided

WE03 2.1.31 - LOCA Cooldown and Depressurization
WE03 GENERIC
Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)

401-9 Comments:	Remarks/Status

Q64 References

Nomenclature:	PORV LO PRESS MODE NOT SELECTED	Window:	A12

Setpoint: NC temperature less than 320°F and "LOW PRESS" **NOT** selected on "PORV Overpress Protection Select 2NC34A (2NC32B)"

Origin: PORV Inst Relay GA

Probable Cause:

- NC temperature less than 320°F and "NORM" selected
- Possible relay or circuit problem

Automatic Action: None

Immediate Action: Ensure "LOW PRESS" selected for the following:

- "PORV Overpress Protection Select 2NC34A"
- "PORV Overpress Protection Select 2NC32B"

Supplementary Action: None

References: MCEE-250-00.03-01

End Of Response

Unit 2

Q64 References

pressure master. Lift setpoint for 1(2) NC-32B and 1(2) NC-36B is a fixed setpoint of 2335 psig. These valves are pneumatically operated and receive their normal motive force from the Instrument Air System. A backup source comes from A and B Cold Leg Accumulators (CLA) in the form of N_2 gas through NI430A or NI431B respectively. These valves can be manually opened by their control switches on main control board section 1(2)MC11 or they will be automatically opened when "low temperature overpressure protection" (LTOP) is in effect. LTOP provides a 380 psig lift setpoint to NC34A and NC32B when NCS temperature is less than 320^0 F and "low press" is selected on the key switch. The NC NR pressure transmitters must also be manually placed in service when NC pressure is less than 600 psig for this protection circuit to be operational. NC32B and NC36B are supplied from CLA "B" via NI-431B and NC34A is supplied from CLA "A" via NI-430A. Annunciator alarms on 1(2)AD6 alert the operator that the N_2 from the CLA to NC32B and 34A has been enabled.

Operator Fundamental Focus; Knowledge and Monitoring

Explain *that, during normal operation, the N_2 backup from the CLA is not normally selected. The CLAs have a minimum pressure required by Tech Specs therefore possible leakage or operation of the PORVs could allow the N_2 pressure to fall below the Tech Spec requirement. Thus the N_2 is only enabled when the operating mode does not have a CLA Tech Spec pressure requirement.*

Reinforce *that understanding this will prevent the operators from aligning the CLAs to the PORVs and having the undesirable consequence of impacting OPERABILTITY of the CLAs.*

Objective # 15

The common discharge line from the PORVs has a temperature element which provides indication for PORV discharge temperature via meter located on 1(2)MC10 and an alarm on **1(2)AD6 " Pzr PORV Disch Hi Temp" (setpoint 140^0 F).** This indication is used to assist in identifying if a PORV is leaking which has Tech Spec implications.

Objective # 16

Each PORV has a loop seal between the PORV and its electric isolation. These loop seals were designed to assist in preventing the leakage of H_2 through the PORV valve seat. Industry concerns were raised over potential water slug acceleration and subsequent piping damage when a PORV or safety was opened. It was determined, as documented in PIP 1-M94-1470 that in this application a water slug would not damage the piping to the extent that the PORVs would become inoperable. However, each loop seal between the PORV block valve and PORV has a drain line which normally drains the condensate back to the pressurizer **(Refer to Drawing 7.10).** Each drain line has normally open isolation valve (NC-269, 270, 271). Each valve is solenoid actuated and can be operated from the control room on 1(2)MC10. If a PORV is leaking, its associated block valve and loop seal drain isolation valve will be closed to prevent bypass of the block valve function. These drain valves do not have to be open for the PORVs to be operable.

Q64 Parent Question (2009 MNS NRC RO Retake Q68 (Bank 2268))

2009 RO NRC Retake Examination **QUESTION 68**

A

QuestionBank #	KA_system	KA_number
1868	GEN2.1	2.1.31

KA_desc
Conduct of Operations Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)

Given the following conditions on Unit 2:

- An NC system cooldown and depressurization is in progress in preparation for refueling.
- Annunciator 2AD-6 / A12 (PORV LO PRESS MODE NOT SELECTED) alarms

Which ONE (1) of the following sets of conditions could have caused this alarm?

A. - NC system **temperature** less than 320°F
- 2NC34A OR 2NC**32B** PORV OVERPRESS PROTECTION SELECT switches in "NORM"

B. - NC system **pressure** less than 380 PSIG
- 2NC34A OR 2NC**32B** PORV OVERPRESS PROTECTION SELECT switches in "NORM"

C. - NC system **temperature** less than 320°F
- 2NC34A OR 2NC**36B** PORV OVERPRESS PROTECTION SELECT switches in "NORM"

D. - NC system **pressure** less than 380 PSIG
- 2NC34A OR 2NC**36B** PORV OVERPRESS PROTECTION SELECT switches in "NORM"

Q64 Parent Question (2009 MNS NRC RO Retake Q68 (Bank 2268))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2009 RO NRC Retake Examination QUESTION 68 **A**

General Discussion

Annunciator 1AD-6/A12, PORV LO PRESS MODE NOT SELECTED will alarm if NC system WR temperature is less than 320°F with EITHER PORV Overpressure Protection Select switch (NC34A or NC32B) not selected to "Low Press" (i.e. in "NORM").

This KA is matched because the applicant must evaluate an alarm that is received and evaluate what could have caused this alarm. Evaluating what could have caused this alarm constitues a determination of whether plant components (i.e. the PORV Overpressure Protection Select switches) are correctly aligned for current plant conditions.

This question is analysis level as the applicant must analyze the alarm and associate two separate pieces of information with that alarm (i.e. NC System Temperature and which PORVs are operated by LTOP).

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Plausible because 380 PSIG is the new PORV lift setpoint when the PORV Overpressure Protection Select switches are selected to "Low Press". The PORVs listed are correct.

Answer C Discussion

Incorrct. Plausible because the NC temperature is correct. Either of two PORVs selected to "NORM" will cause the alarm however, 2NC26B is not one of the PORVs used for LTOP.

Answer D Discussion

Incorrect. Plausible because 380 PSIG is the new PORV setpoint when the PORV Overpressure Protection Select switches selected to "Low Press". Either of two PORV select switches to "NORM" will cause alarm. However, 2NC36B is not one of them.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

☑ Developed

☑ OPT Approved

☑ OPS Approved

☑ NRC Approved

Development References

Lesson Plan OP-MC-PS-NC Objective 14 page 35
OP/1/A/6100/10 G, Annunciator Response for Panel 1AD-6 page 15

Student References Provided

QuestionBank #	KA_system	KA_number
1868	GEN2.1	2.1.31

KA_desc

Conduct of Operations□Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)

401-9 Comments:

G2.1.31
No comment at this time
RFA 10/29/09

401-9 Comments RESPONSE

Considered SAT for submittal with no comments. No changes.

WE15 EA2.2 - Containment Flooding

Ability to determine and interpret the following as they apply to the (Containment Flooding)

(CFR: 43.5 / 45.13)

Adherence to appropriate procedures and operation within the limitations in the facility*s license and amendments.

Given the following on Unit 1:

- A Large Break LOCA has occurred
- Containment sump level is 7.5 feet and rising at a constant rate of 0.25 feet per minute

1) FR-Z.2 (RESPONSE TO CONTAINMENT FLOODING) entry conditions will be met in a MINIMUM of ________ minutes.

2) Why is safe plant recovery not assured for a design-basis Large Break LOCA when Containment water level requires entry into FR Z.2?

A. 1. 24
   2. Operation of critical ECCS components needed for safe recovery is endangered by submersion.

B. 1. 24
   2. Operation of the hydrogen skimmer system is compromised by the suction line becoming submerged.

C. 1. 20
   2. Operation of critical ECCS components needed for safe recovery is endangered by submersion.

D. 1. 20
   2. Operation of the hydrogen skimmer system is compromised by the suction line becoming submerged.

General Discussion

Per EP-F-0, FR-Z.2 will be entered due to an Orange condition upon Containment Sump level increasing to 12.5 feet. Containment sump level will stop going up at about 13.5 ft. as this is the level at which spillover to the in-core instrument room sump will occur.
12.5 ft. - 7.5 ft. = 5.0 ft. Level is increasing at 0.25ft/min. 5.0 ft./ .25ft/min = 20 minutes.
Per FR-Z.2 background document, Containment flooding is a concern since critical plant components necessary for plant recovery may be damaged and rendered inoperable.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because this is the time it takes to reach 13.5 ft, which is where the containment sump spills over to the incore instrument room.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible because this is the time it takes to reach 13.5 ft, which is where the containment sump spills over to the incore instrument room.

Second part is plausible since Hydrogen Skimmer fans are safety related and required by tech specs, these fans take a suction on various lower containment dead end spaces and discharge into upper containment.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since Hydrogen Skimmer fans are safety related and required by tech specs, these fans take a suction on various lower containment dead end spaces and discharge into upper containment.

Basis for meeting the K

The KA is matched since the applicant must be able to determine when to enter FR-Z.2 (Response to Containment Flooding) based on current trend in Containment Sump level (adherence to appropriate procedures) and also understand why operation outside these limits prevent safe recovery of the plant.

Basis for Hi Cog

The question is Hi Cog since the applicant must analyze the current conditions and calculate when Containment Sump level reaches the level required for entry into FR-Z.2 (Response to Containment Flooding).

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2013 MNS NRC Q63 (Bank 5208)

Development References

REFERENCES:
F-0 (Critical Safety Function Status Trees) Rev. 6
FR-Z.2 (Response to Containment Flooding) Rev. 8
Lesson Plan OP-MC-EP-FRZ (Containment) Rev. 23A

LEARNING OBJECTIVES:
OP-MC-EP-FRZ Objectives 2 & 4

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 65** 65 **C**

WE15 EA2.2 - Containment Flooding

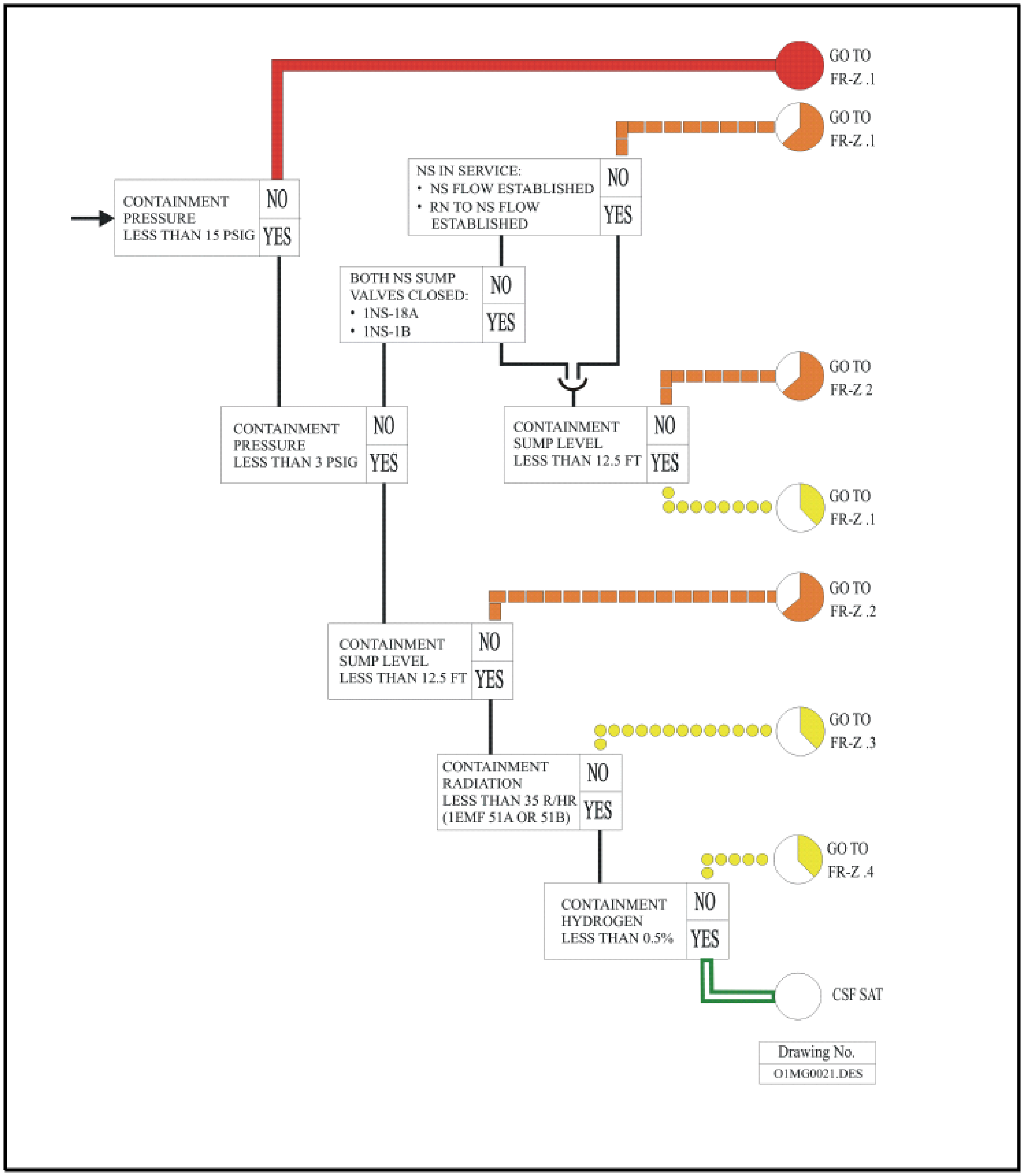
Ability to determine and interpret the following as they apply to the (Containment Flooding)
(CFR: 43.5 / 45.13)

Adherence to appropriate procedures and operation within the limitations in the facility*s license and amendments.

401-9 Comments:	Remarks/Status

Q65 References

MNS EP/1/A/5000/F-0 **UNIT 1**	CRITICAL SAFETY FUNCTION STATUS TREES **Containment - Page 1 of 1**	PAGE NO. **9 of 11** Rev. 6



Q65 References

MNS EP/1/A/5000/FR-Z.2 **UNIT 1**	RESPONSE TO CONTAINMENT FLOODING	PAGE NO. **1 of 6** Rev. 8

A. Purpose

This procedure provides actions to respond to containment flooding.

B. Symptoms or Entry Conditions

This procedure is entered from EP/1/A/5000/F-0 (Critical Safety Function Status Trees), (Containment), on an orange condition.

Q65 References

With respect to limiting containment pressure, the containment is designed to limit out-leakage at the containment design pressure to a design basis value specified in technical specifications. The containment design pressure is greater than that which is calculated to occur following a major loss of coolant accident or steamline break, which are the major accidents that can result in a high containment pressure. The design basis leakage is used in radiological analysis to ensure that offsite radiation exposures will be less than the prescribed licensing criteria set forth in 10CFR Part 100.

2.2. FR-Z.2, Response to Containment Flooding

This procedure provides actions to respond when the containment level is greater than design flood level. This level is significant since the critical systems and components, which are necessary to ensure an orderly safe plant shutdown and provide feedback to the operator regarding plant conditions, are normally located above the design flood level.

The primary purpose of the containment sump area is to collect the water injected into the containment or spilled from the NC system during an accident. The water collected in the containment sump is then available for long term core and/or containment cooling via the emergency core cooling or containment spray recirculation systems. In addition, the containment sump collects the injected or spilled water into areas such that vital systems or components will not be flooded and thus rendered inoperable.

The maximum level of water in the containment following a major accident generally is based upon the stored water volumes from the FWST, CLAs, ice condenser, and NC system. This water volume approximates the maximum water volume introduced into the containment following a LOCA plus a steamline or feedline break inside containment.

An indicated water level in the containment greater than the maximum expected volume (design basis flood level) is an indication that water volumes other than those represented by the above noted volumes have been introduced into the containment. Also, the high water level provides an indication that potential flooding of critical systems and components needed for plant recovery may occur. Identification and isolation for any broken or leaking water line inside containment is essential to maintaining the water level below the design basis flood level.

The actions in this procedure attempt to identify any unexpected source of water and isolate it if possible. Beyond that the station management is consulted to determine if transfer of containment sump water to other tanks is appropriate.

Instructor NOTES:

Emphasize

- The means for reducing high containment radiation levels

Q65 Parent Question (2013 MNS NRC Q63 (Bank 5208))

D

2013A MNS SRO NRC Examination QUESTION 63 63

WE15 2.4.4 - Containment Flooding

WE15 GENERIC

Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)

Given the following on Unit 1:

- The unit is initially at 100% RTP
- At 1100 a Large Break LOCA occurs
- At 1215, the crew is in E-1 (LOSS OF REACTOR OR SECONDARY COOLANT), waiting for the time to transfer to Hot Leg Recirc
- Containment sump level is 7.5 feet and slowly increasing

1) If Containment Sump level is increasing at a constant rate of 0.25 feet per minute, at what time is entry into FR-Z.2 (RESPONSE TO CONTAINMENT FLOODING), FIRST required?

2) Why is safe plant recovery not assured for a design-basis Large Break LOCA when Containment water level requires entry into FR Z.2?

A.
1. 1225
2. Operation of the hydrogen skimmer system is compromised by loss of direct access to the containment atmosphere.

B.
1. 1235
2. Operation of the hydrogen skimmer system is compromised by loss of direct access to the containment atmosphere.

C.
1. 1225
2. Operation of critical ECCS components needed for safe recovery is endangered by submersion.

D.
1. 1235
2. Operation of critical ECCS components needed for safe recovery is endangered by submersion.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 63 63 D

General Discussion

Per EP-F-0, FR-Z.2 will be entered due to an Orange condition upon Containment Sump level increasing to 12.5 feet. Containment sump level will stop going up at about 13.5 ft. as this is the level at which spillover to the in-core instrument room sump will occur.
12.5 ft - 7.5 ft = 5.0 ft. Level is increasing at 0.25ft/min. 5.0 ft/ .25ft/min = 20 minutes.
Per FR-Z.2 background document, Containment flooding is a concern since critical plant components necessary for plant recovery may be damaged and rendered inoperable.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant concludes ten feet is required Containment Sump level for entry into FR-Z.2
Second part is plausible since Hydrogen Skimmer fans take a suction on various lower containment dead end spaces and discharge into upper containment.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.
Second part is plausible since Hydrogen Skimmer fans take a suction on various lower containment dead end spaces and discharge into upper containment.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant concludes ten feet is required Containment Sump level for entry into FR-Z.2
Second part is correct and therefore plausible.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched since the applicant must be able to determine when to enter FR-Z.2 (Response to Containment Flooding) based on current trend in Containment Sump level.

Basis for Hi Cog

The question is Hi Cog since the applicant must analyze the current conditions and calculate when Containment Sump level reaches the level required for entry into FR-Z.2 (Response to Containment Flooding).

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2011 MNS AUDIT Q65 (Bank 4487)

Development References

References:
F-0 (Critical Safety Function Status Trees)
FR-Z.2 (Response to Containment Flooding)
Lesson Plan OP-MC-EP-FRZ

Learning Objectives:
OP-MC-EP-FRZ Objectives 2 & 4

Student References Provided

WE15 2.4.4 - Containment Flooding
WE15 GENERIC
Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)

Q65 Parent Question (2013 MNS NRC Q63 (Bank 5208))

2013A MNS SRO NRC Examination **QUESTION 63** 63 **D**

401-9 Comments:	Remarks/Status
	401-9 Comment: Editorial WE15G2.2.2 Question appears to meet the K/A. Second part of distractors C and D may not be plausible, are these safety related? 2011 MNS AUDIT Q65 10/24/2013 Hydrogen skimmer system is safety related. Fans receive essential power and start on a Phase B (3 psig in containmnet). Two trains of HSS ar required in modes 1 and 2 per TS 3.6.8. Per Chief Examiner's general comments, rearranged answers to look less like bank question. Rearranged plausibility statements accordingly. This changed the correct answer from 'B' to 'D'. SLM10/30/2013 Q63 approved as SAT by Chief Examiner. HCF 11/18/13

GEN2.1 2.1.2 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of operator responsibilities during all modes of plant operation. (CFR: 41.10 / 45.13)

Given the following initial conditions on Unit 1:

- Unit is at 30% RTP and STABLE
- Control rods are in manual

Subsequently,

- 1ETA normal incoming breaker trips OPEN
- The 1A D/G starts and is carrying the 1ETA bus
- The RO reports that reactor power has increased to 34% and is now STABLE

Per AD-OP-ALL-0203 (REACTIVITY MANAGEMENT), what actions (if any) will the crew take in response to the power increase?

A. Move control rods as necessary to restore $T_{ave} = T_{ref}$.

B. No actions are required since power is less than 100% RTP.

C. Borate to establish power at or below the pre-transient power level.

D. Reduce turbine load to establish power at or below the pre-transient power level.

General Discussion

The blackout on ETA caused auto start of the Turbine Driven Aux Feed pump. Additional steam load plus additional S/G feed flow would cause power increase.
The crew should stabilize plant conditions less than or equal to the pre-transient power level by taking the appropriate actions described below.
[PWR] During abnormal conditions requiring manual control of the reactor, ROs shall inform the CRS of the following (notification to the CRS is not required prior to taking the action):
(1) The first manual control rod insertion
(2) All manual control rod withdrawals
(3) The first manual adjustment made to the Turbine
(4) The first manual adjustment made to Feedwater
(5) Any water addition made to the VCT/LDST
(6) No further communications of manual adjustments are necessary.
When normal operation is resumed, communications return to normal operational requirements for reactivity changes.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible that the OATC will want to pull control rods to restore Tavg equal to Tref. Tavg will have lowered due to the increase in steam demand from the TDCA pump start. Manual rod withdrawals are not allowed during transient conditions in accordance with AD-OP-ALL-0203

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible if applicant concludes any actions described in AD-OP-ALL-0203 only apply if 100% RTP has been exceeded.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since emergency boration is an option to reduce power in various EPs and APs. However, it is not an option provided in AD-OP-ALL-0203 for "at power" system transients.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to demonstrate operator responsibilities in regard to reactivity management due to an up-power transient at low power levels.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2007 MNS NRC Retake Examination Q14 (Bank 3434)

Development References

REFERENCES:
AD-OP-ALL-0203 (Reactivity Management) Rev 2

LEARNING OBJECTIVES:
NONE

Student References Provided

GEN2.1 2.1.2 - GENERIC - Conduct of Operations
Conduct of Operations

Q66 References

REACTIVITY MANAGEMENT	AD-OP-ALL-0203
	Rev. 2
	Page 45 of 90

5.2.6 Abnormal Operations (continued)

f. Peer-checks during Abnormal Operations:

(1) Peer-checks are not required for reactivity manipulations during performance of Abnormal and Emergency Procedures unless additional manpower is available.

(2) The CRS is prohibited from performing peer-check of reactivity related manipulations.

(3) Peer-checks are not required when responding to a failure requiring manipulation of Reactivity Management related components.

g. [PWR] During abnormal conditions requiring manual control of the reactor, ROs shall inform the CRS of the following (notification to the CRS is not required prior to taking the action):

(1) The first manual control rod insertion

(2) All manual control rod withdrawals

(3) The first manual adjustment made to the Turbine

(4) The first manual adjustment made to Feedwater

(5) Any water addition made to the VCT/LDST

(6) No further communications of manual adjustments are necessary. When normal operation is resumed, communications return to normal operational requirements for reactivity changes.

h. During an "at power" system transient, the Control Room crew shall respond with deliberate and conservative actions including a manual reactor trip if required.

i. The crew should stabilize plant conditions less than or equal to the pre-transient power level by taking the appropriate actions described above.

j. There may be events where the crew experiences a transient greater than 5% above pre-transient power level, takes appropriate action and stabilizes core thermal power less than or equal to the pre-transient power level and still meets the intent of these standards.

Q66 Parent Question (2007 MNS NRC Retake Q14 (Bank 3434))

Examination Outline Cross-reference:

Level	RO	SRO
Tier #	1	
Group #	1	
K/A #	056 2.1.2	
Importance Rating	3.0	

Loss of Off-site Power: Knowledge of operator responsibilities during all modes of plant operation.

Question: Common 14

Unit 1 is increasing power when the following occurs:

- Control rods are in manual
- The plant is at 30% power when a loss of 1ETA occurs.
- The 1A D/G starts and is carrying the 1ETA bus.
- The RO reports reactor power has increased from 30% to 34%

Per SOMP 01-02, Reactivity Management, which ONE (1) of the following describes the required crew actions, if any, to address the power increase?

A. Insert rods to restore Tave=Tref.

B. No actions required since power is less than 100%.

C. Crew should reduce turbine load to establish power at or below the pre-transient power level.

D. The crew should emergency borate using 1NV-265, Boric Acid To NV Pumps to establish power at or below the pre-transient power level.

Q66 Parent Question (2007 MNS NRC Retake Q14 (Bank 3434))

Answer: C

Explanation The blackout on ETA caused auto start of the Turbine Driven Aux Feed pump. Additional steam load plus additional S/G feed flow would cause power increase.

A. **Incorrect**: Expectation per SOMP 01-02 (Reactivity Management) is to stabilize the plant conditions less than or equal to pre-transient power level.
Plausible: If candidate thinks the SOMP 01-02 requirements only apply to operation above 100% power.
B. **Incorrect**: Same reason as above
C. **Correct:**
D. **Incorrect** Emergency boration is not an option provided in SOMP 01-02. Reducing turbine load gives much faster response than boration
Plausible: This option is offered in various EPs and APs to reduce power.

Technical Reference(s): SOMP 01-02 page 14 (Attach if not previously provided)

References to be provided to applicants during examination: None

Learning Objective: OP-MC-ADM-OMP Obj. 40 (As available)

Question Source: Bank # ______
Modified Bank # ______ (Note changes or attach parent)
New X

Question History: Last NRC Exam ______

Question Cognitive Level: Memory or Fundamental Knowledge X
Comprehension or Analysis ______

10 CFR Part 55 Content: 55.41 ______
55.43 ______

Comments:

ILT-16-1 MNS SRO NRC Examination **QUESTION 66** 66 **D**

Knowledge of operator responsibilities during all modes of plant operation. (CFR: 41.10 / 45.13)

401-9 Comments:

Remarks/Status

GEN2.1 2.1.36 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7)

Given the following conditions on Unit 1:

- The unit is in Mode 6
- "A" ND Train is in operation
- "B" ND Train is available

Which ONE (1) of the following conditions would prevent commencing fuel movement?
(Consider each individually)

A. The reactor has been subcritical for 96 hours.

B. The Equipment Hatch is closed with 2 bolts fastened.

C. The Refueling Cavity level is lowered to 370” on 1NCP-5990 (NC WR LEVEL).

D. MCB Annunciator 1AD10/F-1 (UPPER CONT AIRLOCK RX DOOR OPEN), alarms.

General Discussion

According to Technical Specification LCO 3.9.4, the equipment hatch must be closed and held in place by a minimum of four bolts during movement of recently irradiated fuel assemblies within containment. Since there is only two bolts holding the hatch in place, movement of recently irradiated fuel assemblies within containment must be stopped immediately (LCO 3.9.4 Condition A).

Answer A Discussion

INCORRECT: See explanation above

PLAUSIBLE:
Plausible since SLC 16.9.17 requires that the reactor be shutdown greater than 72 hours during movement of irradiated fuel assemblies in the reactor vessel.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since Technical Specification LCO 3.9.7,requires Refueling cavity water level to be maintained > 23 ft above the top of reactor vessel flange.

Answer D Discussion

INCORRECT: See explanation above

PLAUSIBLE:
Plausible since Technical Specification LCO 3.9.4, requires that a minimum of one door in each air lock must be closed during movement of recently irradiated fuel assemblies within containment.

Basis for meeting the K

The KA is matched because the operator must have knowledge (i.e. conditions that result in a suspension of Core Alterations) of the effect of a loss of containment integrity under shutdown conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2013 MNS NRC Q66 (Bank 1561)

Development References

REFERENCES:
Tech Spec 3.9.4 (Containment Penetrations)

LEARNING OBJECTIVES:
NONE

Student References Provided

GEN2.1 2.1.36 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7)

401-9 Comments:

Remarks/Status

Q67 References

3.9 REFUELING OPERATIONS

3.9.4 Containment Penetrations

LCO 3.9.4 The containment penetrations shall be in the following status:

a. The equipment hatch closed and held in place by a minimum of four bolts;

b. A minimum of one door in each air lock closed; and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere either:

1. closed by a manual or automatic isolation valve, blind flange, or equivalent, or

2. exhausting through an OPERABLE Containment Purge Exhaust System HEPA filter and charcoal adsorber.

APPLICABILITY: During movement of recently irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Suspend movement of recently irradiated fuel assemblies within containment.	Immediately

Q67 References

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.4.1	Verify each required containment penetration is in the required status.	In accordance with the Surveillance Frequency Control Program
SR 3.9.4.2	Perform required Containment Purge Exhaust System Testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP

Q67 Parent Question (2013 MNS NRC Q66 (Bank 1561))

2013A MNS SRO NRC Examination QUESTION 66 66 **B**

GEN2.1 2.1.36 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7)

Given the following conditions on Unit 1:

- The unit is in Mode 6
- "A" ND Train is in operation
- "B" ND Train is available

Which ONE (1) of the following conditions would prevent commencing fuel movement? (Consider each individually)

A. The reactor has been subcritical for 96 hours.

B. The Equipment Hatch is closed with 2 bolts fastened.

C. The Refueling Cavity level is lowered to 370” on 1NCP-5990 (NC WR LEVEL).

D. MCB Annunciator 1AD10/F-1 (UPPER CONT AIRLOCK RX DOOR OPEN), alarms.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 66 | 66 | **B**

General Discussion

According to Technical Specification LCO 3.9.4, the equipment hatch must be closed and held in place by a minimum of four bolts during movement of recently irradiated fuel assemblies within containment. Since there is only two bolts holding the hatch in place, movement of recently irradiated fuel assemblies within containment must be stopped immediately (LCO 3.9.4 Condition A).

Answer A Discussion

INCORRECT: See explanation above

PLAUSIBLE:
Plausible since SLC 16.9.17 requires that the reactor be shutdown greater than 72 hours during movement of irradiated fuel assemblies in the reactor vessel.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Plausible since Technical Specification LCO 3.9.7,requires Refueling cavity water level to be maintained > 23 ft above the top of reactor vessel flange.

Answer D Discussion

INCORRECT: See explanation above

PLAUSIBLE:
Plausible since Technical Specification LCO 3.9.4, requires that a minimum of one door in each air lock must be closed during movement of recently irradiated fuel assemblies within containment.

Basis for meeting the K

The KA is matched because the operator must have knowledge (i.e. conditions that result in a suspension of Core Alterations) of the effect of a loss of containment integrity under shutdown conditions.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS Exam Bank Q1561

Development References

References:
Tech Spec 3.9.4 (Containment Penetrations)

Learning Objectives:
NONE

Student References Provided

GEN2.1 2.1.36 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7)

401-9 Comments:

Remarks/Status

401-9 Comment: SAT

G2.1.36 Question appears to match K/A. Not very discriminating. CNS Exam Bank 10/24/2013

Per Chief Examiner's general comments, rearranged answers to look less like bank question. Rearranged plausibility statements

Q67 Parent Question (2013 MNS NRC Q66 (Bank 1561))

accordingly. This changed the correct answer from 'C' to 'B'. HCF 10/30/2013

Q66 approved as SAT by Chief Examiner. HCF 11/18/13

GEN2.1 2.1.45 - GENERIC - Conduct of Operations
Conduct of Operations
Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4)

Given the following plant conditions:

- The Main Control Room has been evacuated
- AP-17 (LOSS OF CONTROL ROOM) has been implemented
- Both Auxiliary Shutdown Panels (ASP) are manned

The Operator at the Unit 1 ASP believes that the following indications at the Unit 1 ASP are not indicating correctly:

1. NC System Cold Leg Temperature
2. NC System Hot Leg Temperature
3. NC System WR Pressure
4. NC System Letdown Flow

Which ONE (1) of the following indicates the parameters listed above that can be verified using redundant indications at the Safe Shutdown Facility (SSF)?

A. 1 & 4

B. 2 & 4

C. 1 & 3

D. 2 & 3

General Discussion

The following indications are available at the Auxiliary Shutdown Panels (ASP):

Reactor Coolant System Wide Range Hot Leg Temperature (0-700°F) Loop D Hot Leg
Reactor Coolant System Wide Range Cold Leg Temperature (0-700°F) Loop D Cold Leg
Regenerative Heat Exchanger Letdown Temperature (100-600)
A & B ND Pump Discharge Temperature (50-400°F)
A, B, C, & D ND to Cold Leg Temperatures (50-400°F)
Wide Range Reactor Coolant System Pressure (0-3000 psig)
Narrow Range Reactor Coolant System Pressure (PZR Press) (1700-2500 psig)
Letdown Pressure (0-600 psig)
Pressurizer Level (0-100%)
Letdown Flow (0-200 gpm)
SR Nuclear Flux (10-1 - 105 cps, separately detected, not part of the NIS)

The following indications are available at the Safe Shutdown Facility (SSF):

A NC Loop Cold Leg Temperature (0-700°F)
D NC Loop Cold Leg Temperature (0-700°F)
Core Exit Thermocouples (CETs)
S/G WR Levels (0-100%)
D NC Loop WR Pressure (0-3000 psig)
Pressurizer Level (0-100%)
SR Nuclear Flux (10-1 - 105 cps, separately detected, not part of the NIS)

Of the ASP indications listed, NC System Cold Leg Temperature and NC System WR Pressure are the only indications with diverse (redundant) indications available at the SSF.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because NC system cold leg temperature is available at the SSF. Since Standby Makeup Pump flow is available at the SSF it would be logical to conclude that Letdown flow is also available at the SSF.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Since both Hot Leg and Cold Leg Temperature are available at the ASP, it is logical to conclude that both would be available at the SSF as well. Since Standby Makeup Pump flow is available at the SSF it would be logical to conclude that Letdown flow is also available at the SSF.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Since both Hot Leg and Cold Leg Temperature are available at the ASP, it is logical to conclude that both would be available at the SSF as well. NC System WR Pressure is available at both locations.

Basis for meeting the K

The K/A is matched because the applicant is required to identify diverse indications available to validate the response of the indications provided at the Auxiliary Shutdown panel.

Basis for Hi Cog

Basis for SRO only

ILT-16-1 MNS SRO NRC Examination **QUESTION 68** 68 **C**

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2014 MNS Audit Exam Q67 Bank 5282

Development References
REFERENCES: Lesson Plan OP-MC-CP-ASP (Auxiliary Shutdown Panel) Section 2.1 (Panel Indications) Rev. 14A Lesson Plan OP-MC-CP-AD (Safe Shutdown Facility) Section 2.1 (Primary System Control) Rev. 42 LEARNING OBJECTIVES: OP-MC-CP-ASP Objective 2

Student References Provided

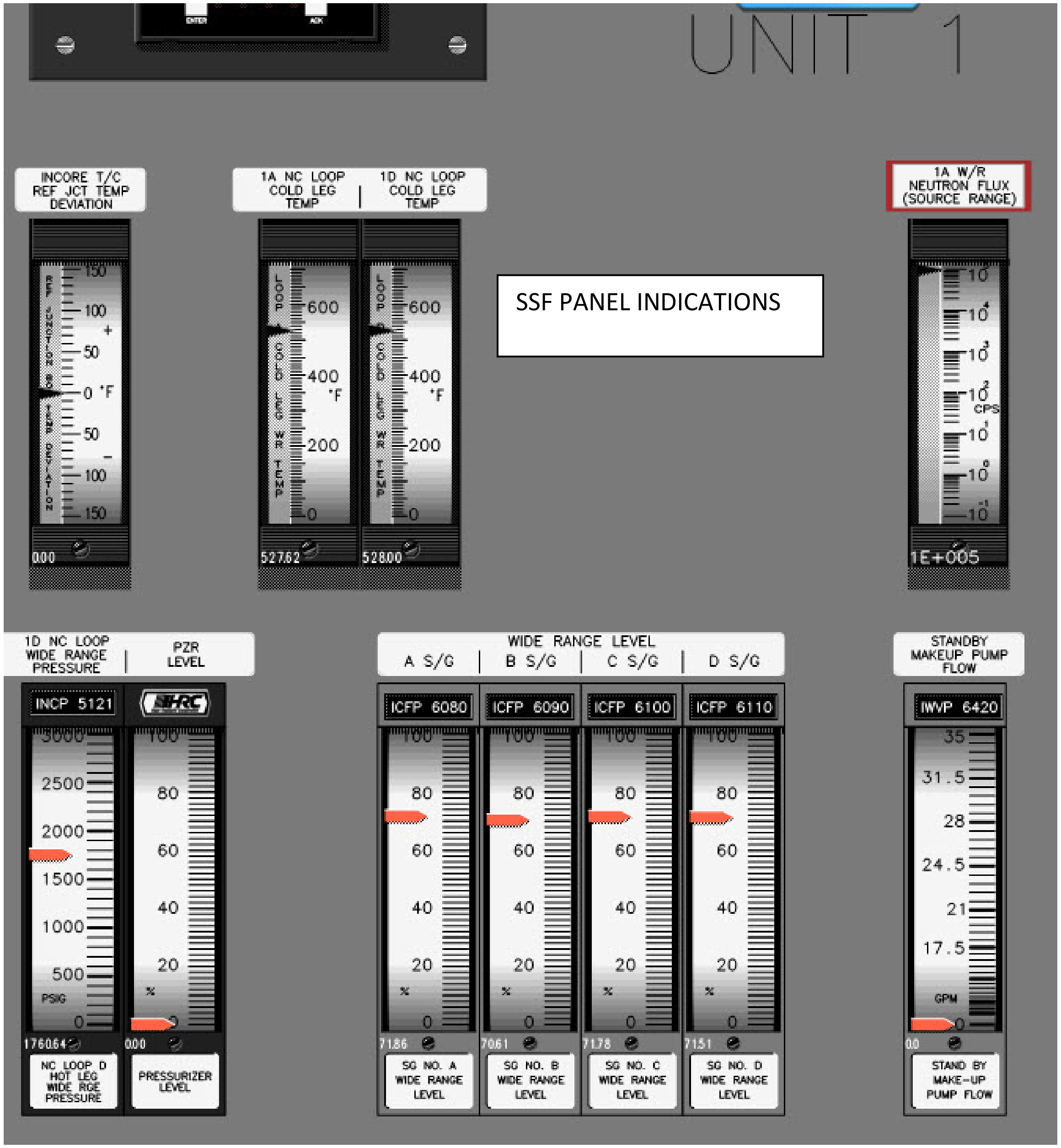
GEN2.1 2.1.45 - GENERIC - Conduct of Operations

Conduct of Operations

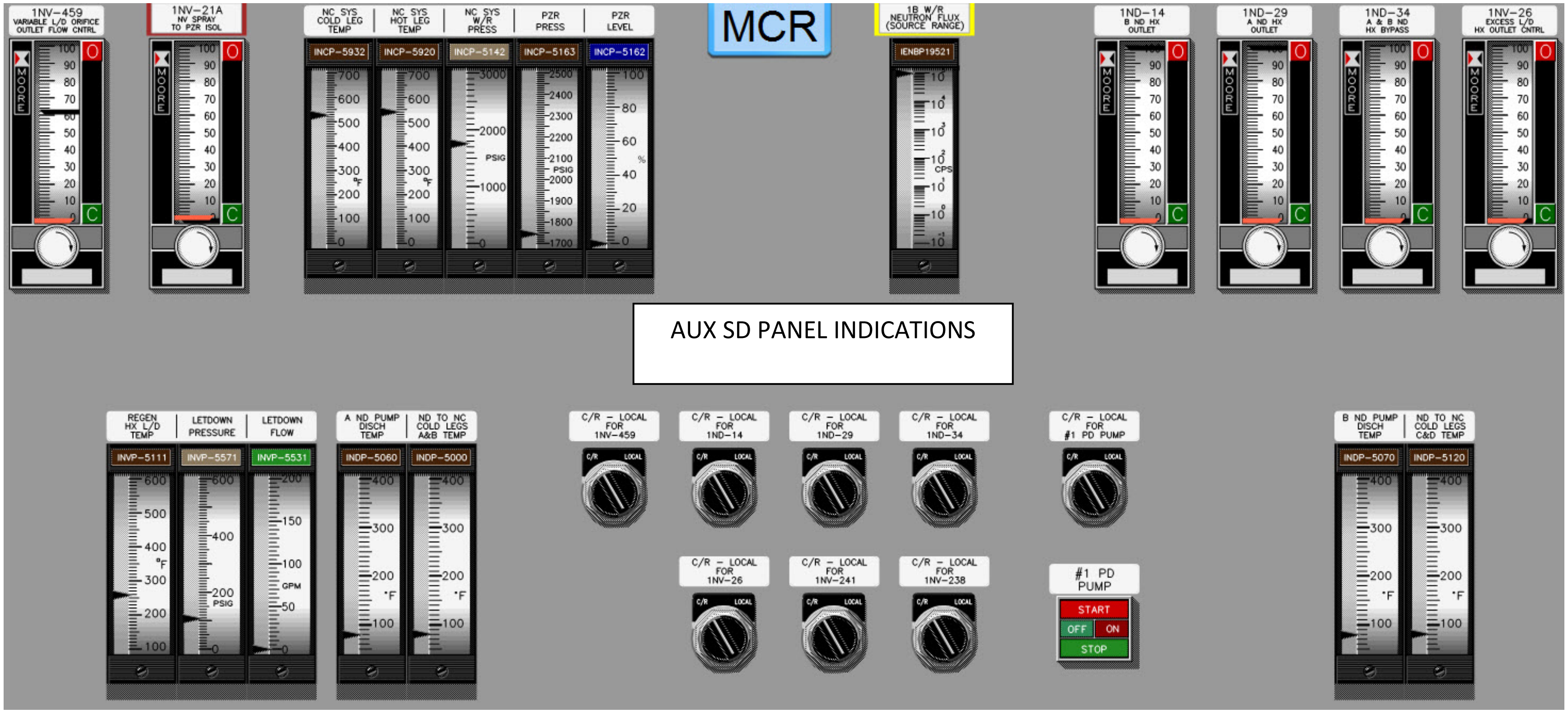
Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4)

401-9 Comments:	Remarks/Status

Q68 References



Q68 References



ILT-30 MNS SRO Audit Examinatio QUESTION 67 67 **A**

GEN2.1 2.1.45 - GENERIC - Conduct of Operations
Conduct of Operations
Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4)

Given the following plant conditions:

- The Main Control Room has been evacuated due to toxic gas
- AP-17 (LOSS OF CONTROL ROOM) has been implemented
- Both Auxiliary Shutdown Panels (ASP) are manned

The Operator at the Unit 1 ASP believes that the following indications at the Unit 1 ASP are not indicating correctly:

1. NC System Cold Leg Temperature
2. NC System Hot Leg Temperature
3. NC System WR Pressure
4. NC System Letdown Flow

Which ONE (1) of the following indicates the parameters listed above that can be verified using redundant indications at the Safe Shutdown Facility (SSF)?

A. 1 & 3 ONLY

B. 2 & 3 ONLY

C. 1, 3, & 4

D. 2, 3, & 4

ILT-30 MNS SRO Audit Examinatio QUESTION 67 67 **A**

General Discussion

The following indications are available at the Auxiliary Shutdown Panels (ASP):

Reactor Coolant System Wide Range Hot Leg Temperature (0-700°F) Loop D Hot Leg
Reactor Coolant System Wide Range Cold Leg Temperature (0-700°F) Loop D Cold Leg
Regenerative Heat Exchanger Letdown Temperature (100-600)
A & B ND Pump Discharge Temperature (50-400°F)
A, B, C, & D ND to Cold Leg Temperatures (50-400°F)
Wide Range Reactor Coolant System Pressure (0-3000 psig)
Narrow Range Reactor Coolant System Pressure (PZR Press) (1700-2500 psig)
Letdown Pressure (0-600 psig)
Pressurizer Level (0-100%)
Letdown Flow (0-200 gpm)
SR Nuclear Flux (10-1 - 105 cps, separately detected, not part of the NIS)

The following indications are available at the Safe Shutdown Facility (SSF):

A NC Loop Cold Leg Temperature (0-700°F)
D NC Loop Cold Leg Temperature (0-700°F)
Core Exit Thermocouples (CETs)
S/G WR Levels (0-100%)
D NC Loop WR Pressure (0-3000 psig)
Pressurizer Level (0-100%)
SR Nuclear Flux (10-1 - 105 cps, separately detected, not part of the NIS)

Of the ASP indications listed, NC System Cold Leg Temperature and NC System WR Pressure are the only indications with diverse (redundant) indications available at the SSF.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because there are Core Exit Thermocouple indications available at the SSF. If the applicant confuses NC Hot Leg temperature indications with CET indication they could conclude that

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because if LTOP was in service and pressure was greater than 385 PSIG, both of the PORV should be open. Therefore it would be reasonable for the applicant to select this response if he failed to realize that LTOP has not been placed in service.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because 1ND-1B is interlocked with NC system WR pressure at 385 PSIG and cannot be opened until NC pressure is below this value. Prior to ND being placed in service, the feeder breaker for this is opened and maintained open during RHR operation. If the applicant does not recall that this breaker is maintained open it would be reasonable to believe that this valve would close if actual pressure was at 460 PSIG.

Basis for meeting the K

The K/A is matched because the applicant is presented with a scenario is which an annunciator (1ND-2A Open and NC Hi Press) has alarmed which is associated with the RHR (ND) system aligned in a shutdown cooling mode. Also in the stem there is conflicting NC pressure indication given and he must then demonstrate the ability to select the correct alternate indication which could be utilized to confirm the annunciator is valid.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must perform a level of analysis concerning the given indications and determine the resulting effect and predict a response.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO Audit Examinatio QUESTION 67 67 **A**

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References
References: Lesson Plan OP-MC-CP-ASP (Auxiliary Shutdown Panel) Section 2.1 (Panel Indications) Lesson Plan OP-MC-CP-AD (Safe Shutdown Facility) Section 2.1 (Primary System Control) Learning Objectives: OP-MC-CP-ASP Objective 2

Student References Provided

GEN2.1 2.1.45 - GENERIC - Conduct of Operations
Conduct of Operations
Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4)

401-9 Comments:

Remarks/Status
401-9 Comment: UNSAT G2.1.45 Question appears to match K/A. I realize this is a bank question off of a previous NRC exam but distractors C and D are not plausible. 2011 MNS NRC Exam Q #4 10/24/2013 Did not believe we could come up with plausible distracters to replace 'C' and 'D'. Replaced question. HCF 10/31/13 Q67 approved as SAT by Chief Examiner. HCF 11/18/13

GEN2.2 2.2.18 - GENERIC - Equipment Control

Equipment Control

Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.
(CFR: 41.10 / 43.5 / 45.13)

Regarding Maintenance Rule Assessments,

1) NSD-403 (SHUTDOWN RISK MANAGEMENT) is the official tool for performing risk assessments in _______ and below.

2) when using the Electronic Risk Assessment Tool (ERAT), the color associated with a key safety function being immediately and directly threatened is _______.

Which ONE (1) of the following completes the statements above?

A. 1. MODE 3
2. RED

B. 1. MODE 4
2. RED

C. 1. MODE 3
2. WHITE

D. 1. MODE 4
2. WHITE

General Discussion

In accordance with ADM-MRA, NSD-403 (Shutdown Risk Management) is the official tool for performing risk assessment in MODES 4, 5, 6 and NO MODE.

The color associated with a Key Safety Function being immediately and directly threatened is red.

The color associated with a condition where the capability of the ERAT tool has been exceeded is white.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant does not recall the applicability of NSD-403 since MODE 3 is a shutdown condition specified by Tech Specs.

The second part is correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant does not recall the applicability of NSD-403 since MODE 3 is a shutdown condition specified by Tech Specs.

The second part is plausible if the applicant misinterprets the question and concludes that it is asking the color associated with a condition where the ERAT software is being exceeded.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant misinterprets the question and concludes that it is asking the color associated with a condition where the ERAT software is being exceeded.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the procedures used to assess and manage shutdown risk.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2013 MNS NRC Q68 Bank 5212

Development References

REFERENCES:
Lesson Plan OP-MC-ADM-MRA Section 2.1
Rev. 11

LEARNING OBJECTIVES:
OP-MC-ADM-MRA Objectives 5 & 6

Student References Provided

GEN2.2 2.2.18 - GENERIC - Equipment Control
Equipment Control

ILT-16-1 MNS SRO NRC Examination **QUESTION 69** 69 **B**

Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.
(CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:	Remarks/Status

Q69 References

Modes 4, 5, 6, and No Mode (<200°F)

Directive NSD-403, *Shutdown Risk Management*, is our official tool for risk(s) assessment during operation in Mode 4, 5, 6, and/or No Mode (<200°F); however, the Electronic Risk Assessment Tool is used in conjunction with this procedure for monitoring purposes during OUTAGE conditions.

Although Mode 4, 5, 6, and No Mode are considered "shutdown" modes, plant equipment necessary for plant cooldown and/or heatup can have a significant risk associated with their removal from service.

2.2 Definitions:

2.2.1 AGGREGATE RISK: The collective risk impact from all plant activities. Aggregate risk considers both the level of risk and duration of maintenance activities, as well as other plant conditions that may affect plant risk (e.g., weather). The successive addition of accumulated risk impacts is called the cumulative risk.

2.2.2 AVAILABILITY: An SSC is available if it is capable of performing its intended function under realistic conditions. An SSC is still considered available if it can be restored to functional status within the timeframe required.

2.2.3 COMPLEX MAINTENANCE PROCESS**:** Structured approach that is used to ensure that on-site groups are appropriately involved in the planning and execution of work that is complex to plant operations. The Complex Maintenance Process can be initiated at any point in the system work window schedule development.

2.2.4 CORE DAMAGE FREQUENCY: The plant specific incidence rate of reactor core damage (heat-up and uncovery of the reactor core to the point of severe fuel damage). The CDF is normally expressed on an annual basis (events per year) but may also be expressed on an hourly or daily basis. The baseline CDF (calculated in the Level 1 PRA) represents the normally expected, average annual core damage frequency. The causes of core damage include anticipated transients, internal accident initiating events, and certain external events that can occur in combination with random equipment failures, maintenance unavailability, human errors, and common cause failures.

2.2.5 CORE DAMAGE PROBABILITY: The integration of the core damage frequency (CDF) over a specific period of time. For example, if the average CDF during a 3 day period is 2.0 E-08per hour; the CDP would be (2.0E-08 / hr) x (72 hr) = 1.44E-06.

2.2.6 CRITICAL MAINTENANCE PROCESS**:** Structured approach that is used to ensure that on-site groups are appropriately involved in the planning and execution of work that is critical to plant operations. The Critical Maintenance Process can be initiated at any point in the system work window schedule development.

Q69 References

Objective # 6

Electronic Risk Assessment Tool Colors and their Associated Risk

Color	Set Points	Definition
Green	Base - < 2 X Base CDF	The **Key Safety Function** is at minimum **Risk**. The plant is fully capable of performing the associated safety function. GREEN is the baseline for the **Safety Function Assessment** Trees and **Plant Transient Assessment** Trees.
Yellow	≥ 2 X Base - < 2.5E-4	The **Key Safety Function** is in a reduced condition. The plant's ability to perform the associated safety function is reduced but still acceptable.
Orange	≥ 2.5E-4 - < 1E-3	The **Key Safety Function** is in a degraded condition, and steps should be taken to minimize the amount of time in this condition. Prior PORC approval is required when entering a planned activity which ERAT has assessed as an ORANGE condition. Planned activities that have received PORC approval in the past do **NOT** required PORC review in the future. Changes made to planned activities that have been previously reviewed and approved by the PORC shall be reviewed by the PORC Chairperson to determine if a subsequent review by the PORC is required. There should be in place a written risk management plan developed by the Work Control organization. The Work Control organization will ensure that this written risk management plan is developed. **When** entering an orange condition from emergent work, the Operations Shift Manager (SM) will ensure development of a work plan to restore the system, structure, or component (SSC). This may require involvement from Maintenance Tech Support and/or Engineering. The SM will evaluate the restoration plan and have final authority whether the plan is implemented. Additionally, at their discretion, the SM's may require development of a written risk management plan per NSD 213.
Red	≥ 1E-3	The **Key Safety Function** is immediately and directly threatened. Operation in a valid red configuration is **NOT** normally allowed. PORC approval is required for all planned entries into a Red condition. **IF** the plant is unexpectedly placed into a RED configuration, IMMEDIATE remedial action is required and **AN Operations SRO Assigned to the WCC Shall Notify Senior Station Management (Work Control Superintendent, Operations Superintendent and Plant Manager)**. RED is the highest **RISK** level for the **Safety Function Assessment** Trees and **Plant Transient Assessment** Trees.
White		The data represents a situation that exceeds the capabilities of the ERAT software (i.e. - missing data, not a logical configuration or N/A to operating mode). This condition requires review by the Site ERAT Expert.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2013A MNS SRO NRC Examination QUESTION 68

68

GEN2.2 2.2.18 - GENERIC - Equipment Control
Equipment Control
Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.
(CFR: 41.10 / 43.5 / 45.13)

Regarding Maintenance Rule Assessments:

NSD-403 (SHUTDOWN RISK MANAGEMENT) is the official tool for performing risk assessment in MODES ___(1)___.

When using the Electronic Risk Assessment Tool (ERAT), the color associated with a condition where the capability of the ERAT software has been exceeded is ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. 4, 5, 6, and No MODE <u>ONLY</u>
2. RED

B. 1. 3, 4, 5, 6 and No MODE
2. RED

C. 1. 4, 5, 6, and No MODE <u>ONLY</u>
2. WHITE

D. 1. 3, 4, 5, 6 and No MODE
2. WHITE

Q69 Parent Question (2013 MNS NRC Q68 (Bank 5252))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 68 68 **C**

General Discussion

In accordance with ADM-MRA, NSD-403 (Shutdown Risk Management) is the official tool for performing risk assessment in MODES 4, 5, 6 and NO MODE.

The color associated with a condition where the capability of the ERAT tool has been exceeded is white.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant misinterprets the question and concludes that it is asking the color associated with a condition where the highest level of acceptable risk has been exceeded as opposed to the capability of the ERAT software being exceeded.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant does not recall the applicability of NSD-403 since MODE 3 is a shutdown condition specified by Tech Specs.

The second part is plausible if the applicant misinterprets the question and concludes that it is asking the color associated with a condition where the highest level of acceptable risk has been exceeded as opposed to the capability of the ERAT software being exceeded.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant does not recall the applicability of NSD-403 since MODE 3 is a shutdown condition specified by Tech Specs.

The second part is correct.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the procedures used to assess and manage shutdown risk.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

References:
Lesson Plan OP-MC-ADM-MRA Section 2.1

Learning Objectives:
OP-MC-ADM-MRA Objectives 5 & 6

Student References Provided

GEN2.2 2.2.18 - GENERIC - Equipment Control
Equipment Control
Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.
(CFR: 41.10 / 43.5 / 45.13)

Q69 Parent Question (2013 MNS NRC Q68 (Bank 5252))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2013A MNS SRO NRC Examination QUESTION 68 68

401-9 Comments:

Remarks/Status
401-9 Comment: SAT G2.2.18 Question appears to match K/A. 10/24/2013 No changes to question at this time.SLM10/30/2013 Q68 approved as SAT by Chief Examiner. HCF 11/18/13

GEN2.2 2.2.38 - GENERIC - Equipment Control
Equipment Control
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

Given the following conditions on Unit 2:

- NC system temperature is 195°F
- NC system pressure is 320 PSIG

Based on the conditions above, the FWST ___(1)___ required to be OPERABLE per Technical Specification 3.5.4 (Refueling Water Storage Tank).

Per Technical Specification 3.5.4, if FWST level is less than the borated water volume required by Surveillance Requirement 3.5.4.2, action is required to restore the FWST to OPERABLE status ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. is
   2. immediately

B. 1. is
   2. within 1 hour

C. 1. is NOT
   2. immediately

D. 1. is NOT
   2. within 1 hour

General Discussion

TS 3.5.4 for FWST applies in Modes 1-4. If inoperable for any reason other than boron concentration or temperature, the FWST must be restored to OPERABLE status within 1 hour.
Per T.S definitions the unit is currently in Mode 5.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the FWST is used for various functions in Mode 5 and below. However, it is only required to perform its ECCS function in modes 1-4.

Second part is plausible since the applicant may conclude that the importance of the FWST would require a short action time to restore to operable. Also, there are several other TS required actions in Mode 5 and below that require immediate actions to restore.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the FWST is used for various functions in Mode 5 and below. However, it is only required to perform its ECCS function in modes 1-4.

Second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since the applicant may conclude that the importance of the FWST would require a short action time to restore to operable. Also, there are several other TS required actions in Mode 5 and below that require immediate actions to restore.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the conditions and limitations of Tech Spec requirements for the refueling water storage tank.

Basis for Hi Cog

This is a high cog question because the applicant must apply more than one mental process to answer the question. First the applicant must analyze the given conditions to determine what the current plant mode is and then recall from memory the modes of applicability and one hour or less tech spec actions for the FWST.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	MODIFIED	2008 CNS RO NRC Retake Examination NRC Q70 (Bank 1770)

Development References

REFERENCES:
TS 3.5.4 (RWST) Rev. 184/166

LEARNING OBJECTIVES:
OP-MC-FH-FW Objective 5

Student References Provided

GEN2.2 2.2.38 - GENERIC - Equipment Control
Equipment Control
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

401-9 Comments:	Remarks/Status

Q70 References

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.4 Refueling Water Storage Tank (RWST)

LCO 3.5.4 The RWST shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RWST boron concentration not within limits. OR RWST borated water temperature not within limits.	A.1 Restore RWST to OPERABLE status.	8 hours
B. RWST inoperable for reasons other than Condition A.	B.1 Restore RWST to OPERABLE status.	1 hour
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

Q70 References

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify RWST borated water temperature is $\geq$ 70°F and $\leq$ 100°F.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.2	Verify RWST borated water volume is $\geq$ 383,146 gallons.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.3	Verify RWST boron concentration is within the limits specified in the COLR.	In accordance with the Surveillance Frequency Control Program

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 1770 CNS

D

Unit 1 NC systems conditions are 248°F and 600 psig.

1. For the stated plant conditions, is the FWST required to be operable per Technical Specification 3.5.4 (Refueling Water Storage Tank)?
2. When the FWST is required to be operable, and the FWST is below the borated water volume required by SR 3.5.4.2, what is the required action?

A. 1. No
2. Immediately take action to restore the FWST to operable status

B. 1. No
2. Restore the FWST to operable status within 1 hour

C. 1. Yes
2. Immediately take action to restore the FWST to operable status

D. 1. Yes
2. Restore the FWST to operable status within 1 hour

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 1770 CNS D

General Discussion

TS 3.5.4 for FWST applies in Modes 1-4. If inoperable for any reason other than boron concentration, it must be restored to OPERABLE status within 1 hour

Answer A Discussion

Immediately taking action is plausible because due to the importance of the FWST it would require a short action time.
No is plausible. Modes 1-3 applicability is plausible because TS 3.5.2 for 2 trains of ECCS are Modes 1-3 and the FWST supplies borated water for ECCS. Therefore it is plausible that the FWST is not required for Mode 4

Answer B Discussion

1 hour action is correct
No is plausible. Modes 1-3 applicability is plausible because TS 3.5.2 for 2 trains of ECCS are Modes 1-3 and the FWST supplies borated water for ECCS. Therefore it is plausible that the FWST is not required for Mode 4

Answer C Discussion

Mode 1-4 applicability is correct.
Immediately is plausible because due to the importance of the FWST it would require a short action time.

Answer D Discussion

Correct: The action for insufficient volume is 1 hour. FWST is required operable in Mode 4

Basis for meeting the KA

The question tests the conditions and limitations of Tech Spec requirements for the refueling water storage tank.

Basis for Hi Cog

Student must determine what plant mode is and know the modes of applicability for the FWST to get this correct.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

Development References
TS 3.5.4

Student References Provided

KA	KA_desc
GEN2.2	Equipment ControlKnowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)
2.2.38	

GEN2.3 2.3.13 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)

An Operator needs to access an area with a general area radiation dose rate of 1100 mREM/hr to hang a clearance tag.

In accordance with AD-RP-ALL-2017 (ACCESS CONTROLS FOR HIGH, LOCKED HIGH, AND VERY HIGH RADIATION AREAS),

1) the correct radiation posting for this area is a _______.

2) the Radiation Protection requirements for entry are _______.

Which ONE (1) of the following completes the statements above?

A. 1. High Radiation Area
   2. continuous RP coverage

B. 1. High Radiation Area
   2. a documented RP briefing ONLY

C. 1. Locked High Radiation Area
   2. continuous RP coverage

D. 1. Locked High Radiation Area
   2. a documented RP briefing ONLY

General Discussion

Per AD-RP-ALL-1000,

High Radiation Area: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem in one hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Locked High Radiation Area: An area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 1.0 rem in one hr. at 30 centimeters from the radiation source or from any surface that the radiation penetrates. These areas are locked or guarded and require continuous RP coverage for entry.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may confuse the dose rates associated with High (>100 mr/hr but less than 1000 mr/hr) and Locked High (>1000 mr/hr) Radiation areas.

Second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible since the applicant may confuse the dose rates associated with High (>100 mr/hr but less than 1000 mr/hr) and Locked High (>1000 mr/hr) Radiation areas.

Second part is plausible since this would be correct if the applicant determines the area to be a high radiation area and this is a requirement for entry into areas designated as high radiation and above.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct and therefore plausible.

Second part is plausible since this is a requirement for entry into areas designated as high radiation and above.

Basis for meeting the K

The KA is matched because the applicant is required to have knowledge of the radiological safety requirements pertaining to Locked High Radiation entry.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS 2013 Pre-Audit 1 SRO Examination Q71 (Bank 4801)

Development References

REFERENCES:
AD-RP-ALL-2017 (Access Controls for High, Locked High, and Very High Radiation Areas) Rev. 2

Student References Provided

LEARNING OBJECTIVES:
NONE

GEN2.3 2.3.13 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)

401-9 Comments:	Remarks/Status

Q71 References

3.0 DEFINITIONS (continued)

5. **Enclosure**: Structure built to surround a radiation source to prevent inadvertent access by an individual or a portion of the individual's whole body.

6. **High Radiation Area (HRA)**: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1mSv) in one hour at 30 centimeters from the radiation source or any surface that the radiation penetrates.

7. **Individually Keyed**: Areas keyed where a specific key provides access to only one area.

8. **Locked High Radiation Area (LHRA)**: An area, accessible to individuals, in which radiation levels could result in the following:

   a. An individual receiving a dose equivalent in excess of 1.0 rem (10mSv) in one hour at 30 centimeters from the radiation source or any surface that the radiation penetrates.

   b. An area accessible to individuals with dose rates in excess of 1.0 rem per hour at 30cm from the radiation source or 30cm from any surface that the radiation penetrates.

9. **Personal External Alarm (PEA)**: A device attached to an electronic alarming dosimeter (EAD) which emits a loud noise or vibrates to alert the worker of an EAD alarm in high noise areas or when the worker has a hearing deficiency.

10. **Physically Challenge**: To take the actions necessary to ensure access to an area is secured or locked by pushing and pulling on a padlock, turning a door knob, pushing, and pulling on a door or gate, or verifying a carabineer or latching device is engaged.

11. **Positive Control**: Control required by an individual assigned to prevent inadvertent entry into a LHRA or VHRA by unauthorized personnel. This control is provided by an individual positioned at a point sufficient to prevent inadvertent entry into the area by unauthorized personnel.

12. **Positive Latching Device**: A device that prevents access without a physical action by an individual.

13. **Remote Monitoring**: Technologies that include hardware, (e.g., cameras, video monitors, telemetry transmitters, wired and wireless audio systems, etc.), and software, (e.g., telemetry, audio and camera control, etc.), allowing monitoring and coverage of work from a location other than the work area.

14. **Secure**: To make firm, tight, or well fastened with a physical or mechanical device. Requires a physical action by an individual to make unsecure.

Q71 Parent Question (2013 CNS Pre-Audit Q71 (Bank4801))

EXAM BANK QUESTION: 4801 CNS

D

An operator needs to access an area with a general area radiation dose rate of 1100 mrem/hr to hang a red tag.

1) What is the correct radiation posting for the area?
2) What are the Radiation Protection requirements associated with entering this area?

A. 1) High Radiation Area
   2) Only a documented RP Briefing is required

B. 1) High Radiation Area
   2) Continuous RP coverage is required

C. 1) Locked High Radiation Area
   2) Only a documented RP Briefing is required

D. 1) Locked High Radiation Area
   2) Continuous RP coverage is required

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4801 CNS

D

General Discussion

Per the SD, a buddy is required in modes 1-4. RP and the WCCSRO permission is required.

Answer A Discussion

RP and WCC SRO is correct.
It is plausible that the buddy system is only required in Modes 1 & 2 under conditions when the Rx is at power

Answer B Discussion

Correct: RP and WCC SRO permission is required. Buddy system applies in Modes 1-4

Answer C Discussion

RP approval only is plausible since it is required in all modes and WCC approval isn't. WCC SRO is required in Modes 1 & 2.
It is plausible that the buddy system is only required in Modes 1 & 2 under conditions when the Rx is at power

Answer D Discussion

RP approval only is plausible since it is required in all modes and WCC approval isn't. WCC SRO is required in Modes 1 & 2.
Buddy system is required in Modes 1-4

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2009 NRC Q72 (Bank 1672)

Development References
SD 3.1.2

Student References Provided

KA	KA_desc
GEN2.3 2.3.13	Radiation ControlKnowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)

GEN2.3 2.3.4 - GENERIC - Radiation Control
Radiation Control
Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

Given the following conditions on Unit 1:

- Mode 4 valve checklist PT is being performed
- The PT calls for independent verification of a single valve located in a room with a general area dose rate of 110 mREM/hr
- Estimated time to independently verify the valve's position is 5 minutes

In accordance with NSD-700 (VERIFICATION TECHNIQUES), independent verification of the valve above ___(1)___ be waived because ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. can NOT
2. the general area dose rate is less than 500 mREM/hr

B. 1. can NOT
2. the radiation exposure for a single verification is within the allowable limit

C. 1. can
2. the general area dose rate is greater than 100 mREM/hr

D. 1. can
2. the radiation exposure for a single verification exceeds the allowable limit

---

General Discussion

According to NSD-700, Independent and/or Concurrent Verification may be waived if the exposure to an individual of greater than 10 mRem for a single verification would occur or if dose rate in the room is >1 R/hr. This waiver requires supervisory approval and documentation.

The total exposure would be 9.17 mR which is less than the dose limit of 10mR for a single verification. (110 mR/hr x 5min x 1hr / 60min) + 9.17mR

Answer A Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible because this statement is a true statement, but the NSD 700 limit is 1R/hr not 500 mR/hr.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible because per NSD 700, IV may be waived when dose rate in an area is greater than 1 R/hr, not 100mR /hr.

Answer D Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant does not recall the guideline of 10 mrem for a single verification criteria or miscalculates the potential exposure.

Basis for meeting the K

This KA is matched because the applicant must evaluate a potential exposure hazard and determine which requirement applies to that potential exposure.

Basis for Hi Cog

This is a high cog question because the applicant is required to calculate the potential exposure and then apply a limit recalled from memory to correctly answer the question.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2015 MNS NRC Exam Q72 Bank 5287

Development References

REFERENCES:
NSD-700 Section 700.8 (Exceptions) Rev. 7

LEARNING OBJECTIVES:
OP-MC-ADM-DIR Objective 23

Student References Provided

GEN2.3 2.3.4 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

401-9 Comments:

Remarks/Status

Q72 References

700.8 EXCEPTIONS

Independent and/or Concurrent Verification may be waived under any of the following situations with appropriate supervisory approval and documentation:

1. If it would result in a significant personnel radiation exposure as defined below:
   a. Individual radiation exposure of greater than 10 mrem for a single verification.
   b. Access to an area with a dose rate equal to or greater than 1 rem/hour.
   c. Procedures containing several verification steps, each with high exposures but less than the above exposure limits should be considered for being waived if exposure from verification would exceed 100 mrem per week.
2. In situations that present a significant personnel safety risk.
3. If valves perform a safety function which receive an automatic signal to move to their proper safety position, unless these valves are removed from operability in a manner that would prevent automatic actuation.
4. General vent and drain valves which would NOT prevent a safety-related system from performing its safety function.
5. Under emergency conditions.

D

ILT-31 MNS SRO NRC Examination QUESTION 72 72

GEN2.3 2.3.4 - GENERIC - Radiation Control
Radiation Control
Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

Given the following conditions on Unit 1:

- Mode 4 valve checklist PT is being performed
- The PT calls for independent verification of a single valve located in a room with a general dose rate of 110 mREM/hr
- Estimated time to independently verify the valve's position is 5 minutes

In accordance with NSD-700 (VERIFICATION TECHNIQUES), independent verification of the valve above ___(1)___ be waived because ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. can
   2. the general area dose rate is greater than 100 mREM/hr

B. 1. can NOT
   2. the general area dose rate is less than 500 mREM/hr

C. 1. can
   2. the radiation exposure for a single verification exceeds the allowable limit

D. 1. can NOT
   2. the radiation exposure for a single verification is within the allowable limit

---

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-31 MNS SRO NRC Examination QUESTION 72 | 72 | D

General Discussion

According to NSD-700, Independent and/or Concurrent Verification may be waived if the exposure to an individual of greater than 10 mrem for a single verification would occur or if dose rate in the room is >1 R/hr. This waiver requires supervisory approval and documentation.

The total exposure would be 9.17 mR which is less than the dose limit of 10mR for a single verification.

Answer A Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible because per NSD 700, IV may be waived when dose rate in an area is greater than 1 R/hr, not 100mR /hr.

Answer B Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible because this statement is a true statement, but the NSD 700 limit is 1R/hr not 500 mR/hr.

Answer C Discussion

INCORRECT. See explanation above.

PLAUSIBLE:
This answer is plausible if the applicant does not recall the guideline of 10 mrem for a single verification criteria or miscalculates the potential exposure.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the KA

This KA is met because the applicant must evaluate a potential exposure hazard and determine which requirement applies to that potential exposure.

Basis for Hi Cog

This is an analysis question because the applicant is required to calculate the potential exposure and then apply a limit recalled from memory to correctly answer the question.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2014 MNS Audit Q72 (Bank 5287)

Development References

REFERENCES:
NSD-700 Section 700.8 (Exceptions)

LEARNING OBJECTIVES:
OP-MC-ADM-DIR Objective 23

Student References Provided

GEN2.3 2.3.4 - GENERIC - Radiation Control
Radiation Control
Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

401-9 Comments:

Remarks/Status

401-9 Comment from Chief Examiner: SAT

Facility Response: N/A

GEN2.4 2.4.11 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)

Given the following initial conditions on Unit 1:

- "B" Train equipment is in service

Subsequently,

- The 1B RN pump amps are swinging
- The following annunciators alarm:
    - 1AD-12 / A-4 (B RN PMP DISCHARGE LO PRESS)
    - 1AD-12 / C-4 (B RN PUMP SUCTION LO PRESS)
- The crew implements AP-20 (LOSS OF RN)

PROCEDURE LEGEND:

AP-20, CASE I (LOSS OF OPERATING RN TRAIN)
AP-20, CASE II (LOSS OF LOW LEVEL OR RC SUPPLY CROSSOVER)

Based on the conditions above, the crew will enter AP-20, ___(1)___.

In accordance with the AP-20 mitigating strategy for this event, the crew ___(2)___ swap the RN pump suction to the SNSWP?

Which ONE (1) of the following completes the statements above?

A. 1. Case I
2. will

B. 1. Case I
2. will NOT

C. 1. Case II
2. will

D. 1. Case II
2. will NOT

General Discussion

Based on the indications given, the Operator will select Case II of AP-20 as the applicable section of the procedure.

Since the "RN Pump Discharge Lo Press" would be present for both cases of AP-20, selection of the correct Case is dependent upon the "RN Pump Suction Lo Press" alarm being present with the "RN Pump Discharge Lo Press" alarm.

Early in Case II of AP-20, the procedure directs the crew to swap the RN pump suction to the SNSWP.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the "RN PMP DISCHARGE LO PRESS" annunciator is an entry condition for Case I.

The second part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the "RN PMP DISCHARGE LO PRESS" annunciator is an entry condition for Case I.

The second part is because Case I does not direct the crew to swap the RN pump suction supply to the SNSWP.

Answer C Discussion

CORRECT : See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

One concern when swapping the RN pump suction to the SNSWP is depletion of the inventory in the pond. Therefore, it is plausible for the applicant to conclude that other actions would be taken to restore suction from the LLI so as to preclude having to swap the suction to the SNSWP.

Basis for meeting the K

The KA is matched because item requires knowledge of the entry conditions and mitigating strategy for AP-20 (Loss of RN).

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

Development References

REFERENCES:
AP-20 (Loss of RN) Rev. 34

LEARNING OBJECTIVES:
OP-MC-AP-20 Objective 2

Student References Provided

GEN2.4 2.4.11 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:	Remarks/Status

Q73 References

MNS AP/1/A/5500/20 UNIT 1	LOSS OF RN	PAGE NO. 1 of 172 Rev. 34

A. **Purpose**

The purpose of this procedure is to ensure proper response in the event of a loss of nuclear service water, to assess plant conditions, and identify the appropriate steps for the following cases:

Case I Loss of Operating RN Train

Case II Loss of LLI or RC Supply Crossover.

Q73 References

MNS AP/1/A/5500/20 **UNIT 1**	LOSS OF RN Case I Loss of Operating RN Train	PAGE NO. **2 of 172** **Rev. 34**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **"A RN PMP DISCHARGE LO PRESS" alarm**
- **"B RN PMP DISCHARGE LO PRESS" alarm**
- **"A RN PUMP ABNORMAL FLO" alarm**
- **"B RN PUMP ABNORMAL FLO" alarm**
- **RN Non-Essential Header pressure low**
- **RN pump tripped**
- **RN pump discharge pressure less than 50 PSIG**
- **Entry into this AP has been specified by another procedure.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. **Check for potential loss of LLI as follows:**	**Perform the following:**
__ • Check Unit 2 RN pump(s) that are aligned to LLI - OPERATING PROPERLY.	__ a. IF loss of RN due to clogged RN strainer, **THEN GO TO** Step 2.
__ • Check suction flowpath - AVAILABLE.	__ b. IF loss of LLI suction supply to RN pumps has occurred, **THEN GO TO** Case II (Loss of Low Level or RC Supply Crossover).
__ 2. **Announce occurrence on page.**	

Q73 References

MNS AP/1/A/5500/20 **UNIT 1**	LOSS OF RN Case II Loss of Low Level or RC Supply Crossover	PAGE NO. **45 of 172** Rev. 34

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **"A RN PMP SUCTION LO PRESS" alarm**
- **"B RN PMP SUCTION LO PRESS" alarm**
- **"A RN PMP DISCHARGE LO PRESS" alarm**
- **"B RN PMP DISCHARGE LO PRESS" alarm**
- **1A RN pump amps indicate low**
- **1B RN pump amps indicate low**
- **Visual observation of Cowans Ford Dam failure with potential loss of LLI**
- **Notification from plant personnel of potential loss of LLI**
- **Entry into this AP has been specified by another procedure.**

Q73 References

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 2. **Have Unit 2 operator check 2A sequencer reset light - LIT.**	**Have Unit 2 operator perform the following:** __ a. Reset S/I on Unit 2. __ b. Reset sequencers on Unit 2. __ c. Wait 10 seconds to ensure 2A sequencer will remain reset. __ d. <u>**IF**</u> 2A sequencer reset light remains lit for greater than 10 seconds, <u>**THEN**</u> <u>**GO TO**</u> Step 3. __ e. Dispatch operator to open Unit 2 breaker 2EVDA Breaker 6 (2A D/G Sequencer DC Control Power). __ f. <u>**IF**</u> 0RN-7A (Train 1A & 2A SNSWP Supply) switch indication is lit, <u>**THEN**</u> depress and hold 2A sequencer reset pushbutton until 2EVDA Breaker 6 is open.
3. **Align RN suction to SNSWP as follows:**	
__ a. OPEN 0RN-7A (Train 1A & 2A SNSWP Supply)	__ a. Attempt to OPEN 0RN-7A using opposite unit's control switch.
__ b. OPEN 0RN-9B (Train 1B & 2B SNSWP Supply).	__ b. Attempt to OPEN 0RN-9B using opposite unit's control switch.
__ 4. **Wait up to 60 seconds for RN valves to open.**	

GEN2.4 2.4.25 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)

Given the following plant conditions:

- Fire Brigade has extinguished a fire in the Unit 2 Turbine Building
- "A" Main Fire Pump is out-of-service
- "1A" and "1B" Jockey Pumps are OFF
- "B" Main Fire Pump is running
- "C" Main Fire Pump is OFF

The automatic start setpoint for the "B" Main Fire Pump on decreasing fire header pressure is ___(1)___ PSIG.

In accordance with OP/1/A/6400/002A (FIRE PROTECTION SYSTEM), the sequence for returning the Fire Protection system to normal alignment is to ___(2)___.

Which ONE (1) of the following completes the statements above?

A.
1. 73
2. place the Jockey Pump to be started in "MAN", "START" the Jockey Pump selected to "MAN", and stop the "B" Main Fire Pump.

B.
1. 73
2. stop the "B" Main Fire Pump, place the Jockey Pump to be started in "MAN", and "START" the Jockey Pump selected to "MAN".

C.
1. 78
2. place the Jockey Pump to be started in "MAN", "START" the Jockey Pump selected to "MAN", and stop the "B" Main Fire Pump.

D.
1. 78
2. stop the "B" Main Fire Pump, place the Jockey Pump to be started in "MAN", and "START" the Jockey Pump selected to "MAN".

General Discussion

In accordance with OP/1/A/6400/002A (Fire Protection System) Enclosure 4.1 (Startup and Normal Operation of RF/RY System) Section 3.7 (Stopping a Main Fire Pump):

1) IF only one Main Fire Pump is running perform the following:
   A. Place the RF Jockey Pump to be started in "MAN"
   B. Depress "START" for selected RF Jockey Pump.
   C. HOLD until RF Pressurizer Tank pressure indicates greater than or equal to 107 psig.
   D. Stop running Main Fire Pump.

As system pressure continues to decrease, a pressure switch starts the "A" Fire Pump when system pressure decreases to 83 psig as seen on the Control Room Pressure Gauge. A second pressure switch starts the "B" Fire Pump when system pressure decreases to 78 psig as seen on the Control Room Pressure Gauge. A third pressure switch starts the "C" Fire Pump when system pressure decreases to 73 psig as seen on the Control Room Pressure Gauge. There is a backup pressure switch on an orificed line on the pump discharge for each Main Fire Pump. These switches are set for 60 psig and serve as a backup fire pump start and test switch.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the auto-start setpoint for the 'C' Main Fire Pump.

The second part is correct and therefore plausible.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the auto-start setpoint for the 'C' Main Fire Pump.

The second part is plausible because in the initial conditions, neither Jockey Pump is running. It is plausible for the applicant to conclude that a Jockey Pump does not need to be started prior to stopping the Main Fire pump.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct and therefore plausible.

The second part is plausible because in the initial conditions, neither Jockey Pump is running. It is plausible for the applicant to conclude that a Jockey Pump does not need to be started prior to stopping the Main Fire pump.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the Fire Protection System operating procedure in regards to returning the system to a normal alignment after an automatic start of a fire pump on low header pressure.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2013 MNS NRC Exam Q74 Bank 5217

Development References

REFERENCES:
OP/1/A/6400/002A Enclosure 4.1 (Startup and Normal Operation of RY/RY System), Section 3.7 Rev. 143

Student References Provided

ILT-16-1 MNS SRO NRC Examination **QUESTION 74** 74 **C**

Lesson Plan OP-MC-SS-RFY Rev 30 LEARNING OBJECTIVES: NONE

GEN2.4 2.4.25 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:	Remarks/Status

Q74 References

3.7 Stopping a Main Fire Pump

☐ 3.7.1 Check all Mulsifyre and Deluge valves are "RESET" or "ISOLATED".

_____ 3.7.2 **IF** three Main Fire Pumps running,
THEN stop one of the following: (NA other Main Fire Pumps)

- _____ A Main Fire Pump
- _____ B Main Fire Pump
- _____ C Main Fire Pump

_____ 3.7.3 **IF** two Main Fire Pumps running,
THEN stop one of the following: (NA other Main Fire Pumps)

- _____ A Main Fire Pump
- _____ B Main Fire Pump
- _____ C Main Fire Pump

_____ 3.7.4 **IF** only one Main Fire Pump running,
THEN perform the following:

3.7.4.1 Start a RF Jockey Pump as follows:

A. Place RF Jockey Pump to be started in "MAN": (NA other Jockey Pump)

- _____ "A RF Jockey Pump"
- _____ "B RF Jockey Pump"

B. Depress "START" for selected RF Jockey Pump. (NA other Jockey Pump)

- _____ "A RF Jockey Pump"
- _____ "B RF Jockey Pump"

_____ 3.7.4.2 **HOLD** until RF Pressurizer Tank pressure indicates greater than or equal to 107 psig per 0RFPG5540 (RF Pressurizer Tank Press). (located SRV, 739+3, S29 near tank) {PIP M-10-5209}

3.7.4.3 Stop running Main Fire Pump. (NA other Main Fire Pumps)

- _____ A Main Fire Pump
- _____ B Main Fire Pump
- _____ C Main Fire Pump

Unit 1

manual mode. Chemistry Procedure OP/0/B/6200/118 (Chlorine Addition to Fire Protection System) indicates the RF System should be chlorinated to 1 - 5 ppm with a maximum of 10 ppm Chlorine concentration whenever RL temperature is greater than 62 F.

Operator Fundamental Focus; Control
Explain *that several system and operational adjustments have been made to prevent "problem" waste streams from reaching the radwaste (WL) systems.* ***Explain*** *that, because of the additional chemicals added to the RF system (Sodium Hypochlorite and Corrosion inhibitor), care should be taken in the event the RF system needs to be drained and discussions should take place to determine the best course of action when draining this and other systems containing chemicals that may be harmful to radwaste treatment system components.*
Emphasize *understanding what liquid types are in each system, and where to route system leaks and drains, are behaviors that support the fundamental control principle of knowing which steps or actions result in undesirable consequences if not performed correctly.*

2.3 Main Fire Pumps

When the Jockey Pumps can no longer supply enough water to meet the demand of the fire protection system, system pressure decreases until one of the main fire pumps start. (refer to Drawing 7.2 or 7.14) There are three full capacity fire pumps designed to sequentially start in the event that the fire protection system pressure continues to decrease. These pumps take suction from Lake Norman and can deliver at least 2,500 gpm at 125 psig each. Each pump is designed to meet the maximum demand for sprinklers and water spray systems plus 750 gpm for hose streams. A self-contained pressure regulator is provided at the discharge of each fire pump to prevent overpressurization of the Fire Protection System when a fire pump is operating. The fire pumps are located in the Intake Structure.

Objective #5

Operator Fundamental Focus; Monitoring
Introduce *the information below by explaining that multiple actuations will occur in the event the sprinkler system(s) actuate.* ***Emphasize*** *the importance of the operator understanding how the system is designed to respond and explain that this information will support the operator in monitoring automatic system response by providing the setpoints for various actuations, the indicators used to monitor key system parameters (pressurizer tank level and pressure) and the expected response.*

The pressure at which the pumps start is staggered so all three pumps do not start at the same time. When the sprinkler systems or mulsifyre systems activate, the water demand will cause system pressure and level in the pressurizer tank to decrease. When the level in the pressurizer tank reaches 43", the first jockey pump will start. The standby jockey pump will start at 41". As system pressure continues to decrease, **a pressure switch starts the "A" Fire Pump when system pressure decreases to 83 psig as seen on the Control Room Pressure Gauge**. **A second pressure switch starts the "B" Fire Pump when system pressure decreases to 78 psig as seen on**

Q74 References

the Control Room Pressure Gauge. A third pressure switch starts the "C" Fire Pump when system pressure decreases to 73 psig as seen on the Control Room Pressure Gauge. There is a backup pressure switch on an orificed line on the pump discharge for each Main Fire Pump. These switches are set for 60 psig and serve as a backup fire pump start and test switch.

Each Fire Pump has a "A,(B)(C) Main Fire Pump Fail to Start" annunciator located on 1AD13 D4 (E4) (F4) respectively. These annunciators are activated if the discharge pressure of the associated pump does not reach a preset value after a motor start time delay. When the main fire pumps are in service for more than 30 minutes the jockey pumps should be stopped. When the main fire pumps are no longer needed, the jockey pumps are restarted and the fire pumps are stopped.

Objective #3

The "A" & "B" Main Fire Pumps receive power from the 6.9 KV busses 2TB-8 and 1TD-8 respectively. **The "A" & "B" Pumps can be started/stopped, regardless of fire system header pressure, from the control room on MC-9 using start/stop pushbuttons on E-30 contactors**. However, if system pressure is less than the Auto Start Pressure (or drops to less than Auto Start Pressure when the pump is stopped) the pump will restart. The A & B pumps will also start automatically at preset fire header pressures. Once an auto start has occurred, the pumps must be manually shut down from the control room.

The "C" Main Fire Pump receives its power supply **from the McGuire Fire Pump Substation (MFPSS) 44/12.47/480VAC Pad Mount Transformer, i.e., from an independent 44KV line from Riverbend Steam Station.** Automatic start of "C" Fire Pump is initiated by two pressure switches (RYPS5030 or RFPS5003). **It can be manually started using a start pushbutton on the E-30 contactor in the control room** (remote) regardless of what fire header pressure is. **A manual start (local) of this pump can also be made from a control cabinet in the pump room located at the intake using a start pushbutton or a manual start handle.** The **"C" pump can be manually stopped from the control room using the stop pushbutton on the E-30 contactor or on the control panel in the pump room using the stop pushbutton.**

Objective #6

A pressure gauge mounted on the wall outside the Lube Oil Storage House in the Service Building Basement and a pressure gauge in the control room located on MC-9 are used to monitor Fire Protection System header pressure.

PIP M97-1733 discusses a problem that resulted in the Main Fire Pumps Auto Re-Starting after a manual shutdown. This resulted in working on the re-circulation valves of "A" and "B" fire pumps where they could close without losing too much of the header pressure and causing the auto start of one of the pumps.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

B

2013A MNS SRO NRC Examination QUESTION 74 | 74 |

GEN2.4 2.4.25 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)

Given the following plant conditions:

- A fire has occurred in the Unit 2 Turbine Building basement
- The “A' Main Fire Pump auto-started due to a low fire header pressure signal
- The fire brigade has extinguished the fire after forty-five minutes
- “1A” and “1B” Jockey Pumps are OFF
- “A” Main Fire Pump is running
- “B” and “C” Main Fire Pumps are OFF

(1) The automatic start setpoint for the ‘A' Main Fire Pump on decreasing fire header pressure is _______ PSIG.

(2) In accordance with OP/1/A/6400/002A (FIRE PROTECTION SYSTEM), the sequence for returning the Fire Protection system to normal alignment is to _________.

Which ONE (1) of the following completes the statements above?

A.
1. 73
2. Place the Jockey Pump to be started in “MAN”, “START” the Jockey Pump selected to “MAN”, and stop the “A” Main Fire Pump.

B.
1. 83
2. Place the Jockey Pump to be started in “MAN”, “START” the Jockey Pump selected to “MAN”, and stop the “A” Main Fire Pump.

C.
1. 73
2. Stop the ‘A' Main Fire Pump, place the Jockey Pump to be started in “MAN”, and “START” the Jockey Pump selected to “MAN”.

D.
1. 83
2. Stop the ‘A' Main Fire Pump, place the Jockey Pump to be started in “MAN”, and “START” the Jockey Pump selected to “MAN”.

Q74 Parent Question (2013 MNS NRC Q74 (Bank 5217))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2013A MNS SRO NRC Examination QUESTION 74 | 74 | **B**

General Discussion

In accordance with OP/1/A/6400/002A (Fire Protection System) Enclosure 4.1 (Startup and Normal Operation of RF/RY System) Section 3.7 (Stopping a Main Fire Pump):

1) IF only one Main Fire Pump is running perform the following:
   A. Place the RF Jockey Pump to be started in "MAN"
   B. Depress "START" for selected RF Jockey Pump.
   C. HOLD until RF Pressurizer Tank pressure indicates greater than or equal to 107 psig.
   D. Stop running Main Fire Pump.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the auto-start setpoint for the 'C' Main Fire Pump.

The second part is correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the auto-start setpoint for the 'C' Main Fire Pump.

The second part is plausible because in the initial conditions, neither Jockey Pump is running. It is plausible for the applicant to conclude that a Jockey Pump does not need to be started prior to stopping the Main Fire pump.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the auto-start setpoint for the 'C' Main Fire Pump.

The second part is correct.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the Fire Protection System operating procedure.

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2011 MNS AUDIT Q68 (Bank 3796) MODIFIED

Development References

References:
OP/1/A/6400/002A Enclosure 4.1 (Startup and Normal Operation of RY/RY System)

Learning Objectives:
NONE

Student References Provided

GEN2.4 2.4.25 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)

Q74 Parent Question (2013 MNS NRC Q74 (Bank 5217))

2013A MNS SRO NRC Examination QUESTION **74** 74 **B**

401-9 Comments:	Remarks/Status
	401-9 Comment: UNSAT G2.4.25 Question appears to match the K/A. Will a jockey pump start if taken to start? Are these separate switches (manual and start)? As written distractors A, B and C do not make sense 2011 MNS AUDIT Q #68 10/24/2013 The RF Jockey pump controls have 4 control pushbuttons (START, STOP, AUTO, MANUAL) and two indicating lights (ON/OFF). If a jockey pump is in AUTO, the AUTO pushbutton is maintained in the depressed or engaged position and the pump will start and stop automatically based on RF Pressurizer tank level. When the MANUAL pushbutton is depressed, it releases the AUTO pushbutton from the engaged position and the pump will not automatically start. With the jockey pump in MANUAL, it will not start until the START pushbutton is depressed. Once the jockey pump is running in MANUAL, it will not stop until the STOP pushbutton is depressed. A picture of the RF Pump / RF Jockey pump controls has been added to the references to clarify the switch arrangement. Re-wrote question to provide distracters with better clarity. This should fix the Chief Examiner's concerns. Will discuss during written exam review. HCF 10/31/13 Q74 approved as SAT by Chief Examiner. HCF 11/18/13

GEN2.4 2.4.31 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

Given the following conditions on Unit 1:

- The unit is in MODE 4
- LTOP key switches for PORVs are selected to "NORM" position
- "A" Train of ND in service
- Annunciator 1AD-9 / A1 (1ND-2A OPEN AND NC HI PRESS) has just come into alarm
- NC WR pressure is indicating 460 PSIG

Which ONE (1) of the following describes the redundant indication which would be used to verify that this annunciator is valid?

COMPONENT LEGEND:

1ND-2A (C HL SUCTION TO ND ISOLATION)
1ND-1B (C HL SUCTION TO ND ISOLATION)
1NC-34A (PZR PORV)

A. PORV 1NC-34A would be lifting

B. 1ND-1B would have auto closed

C. CF&E sump level increasing

D. PRT Level increasing

General Discussion

Annunciator 1AD-9/ A1 (1ND-2A Open and NC Hi Press) alarm setpoint is 440 PSIG NC System WR pressure.
The suction relief for the RHR (ND) pump opens at 450 PSIG and relieves to the PRT.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because if LTOP was in service either or both of the LTOP PORVs would be lifting based on current NC system pressure.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because 1ND-1B is interlocked with NC system WR pressure at 385 PSIG and cannot be opened until NC pressure is below this value. Prior to ND being placed in service, the feeder breaker for this is opened and maintained open during RHR operation. If the applicant does not recall that this breaker is maintained open it would be reasonable to believe that this valve would close if actual pressure was at 460 PSIG.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because the CF&E sumps receive relief valve discharge flow from various systems including the NCP thermal barriers and the NCDT reliefs. The applicant could conclude that this as a reasonable flowpath for the ND suction relief valves.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because the applicant is presented with a scenario in which an annunciator (1ND-2A Open and NC Hi Press) associated with the RHR (ND) system has alarmed and the applicant must demonstrate knowledge of alternate indications which could be utilized to confirm the annunciator is valid.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must perform a level of analysis concerning the given indications and determine the resulting effect and predict a response.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2011 MNS NRC Q4 Bank 4358

Development References

REFERENCES:
Lesson Plan OP-MC-PS-ND (Residual Heat Removal) Rev. 49
Lesson Plan OP-MC-PS-IPE-DCS Rev. 04F
Annunciator Response for 1AD-9/ A1 Rev 57

LEARNING OBJECTIVE:
OP-MC-PS-ND Objective #6

Student References Provided

GEN2.4 2.4.31 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

401-9 Comments:

Remarks/Status

Q75 References

- ND-58A (Train A ND to NV & NI Pumps)
- NS-43A (A ND to NS Cont. Outside Isol)

Interlocks associated with ND-1B and ND-2AC ensure that:

- The ND system is not over-pressurized as a result of opening the suction isolations with high NCS pressure.
- The ND pump suctions will not be simultaneously crossed tied between the NCS, FWST and containment sump. With these valves open, the NCS and the FWST could be drained to the containment sump through ND-4B (B ND Pump Suction from FWST or NC) and ND-19A (A ND Pump Suction from FWST or NC).
- The ND pumps will not spray NCS fluid into containment through the auxiliary containment spray header.
- The NCS fluid will not be diverted from its normal residual heat removal flow path.

There are no automatic closure signals for ND-1B and ND-2AC. Annunciators on AD9, "ND-2A OPEN AND NC HI PRESS" and "ND-1B OPEN AND NC HI PRESS", will warn the operator if NCS pressure is 440 psig (or greater) with ND-1A or ND-2AC open/intermediate. The purpose of this annunciator is to alert the operator that double barrier isolation between the NCS and ND systems does not exist when the plant is pressurized and not on ND cooling. Upon receipt of this alarm, the immediate operator action is to reduce NCS pressure until the alarm clears.

Operator Fundamental Focus; Knowledge and Control
The previous section described the interlocks (and bases) associated with ND-1B and ND-2AC. ***Emphasize*** *that these are closing interlocks only and that there are no automatic closure signals for ND-1B and ND-2AC.*

Objective #6

ND-1B and ND-2AC shall be closed with power removed while the ND system is aligned for standby readiness to prevent overpressurization of the ND system. Overpressure protection for the ND system is provided by the ND system suction relief valves which open at 450 psig and the ND to NCS cold leg and hot leg discharge relief valves which lift at 600 psig. There is also a relief valve on the suction line from the Containment Sump which relieves at 150 psig. Unit 1 has the relief valve on the A Train sump line and Unit 2 has the relief valve on the B Train sump line. These valves have isolation valves which are normally locked open but must be procedurally closed prior to placing ND in RHR mode of operation. All of these relief valves discharge to the PRT.

The relief valves on the containment sump suction line will prevent pressure build up that could occur from NC system check valve leakage. The pressure could cause a DP across the sump isolation valve and impede the valve from opening when required. The relief valve thus helps maintain the system in standby readiness.

Valve ND-2AC shall be capable of closing to isolate the NC pressure boundary during a station blackout event. ND-1B and ND-2AC shall be capable of opening following a loss of offsite power and station blackout to help cool the unit to a safe shutdown condition.

Q75 References

Nomenclature:	1ND-2A OPEN AND NC HI PRESS	Window:	A1

Setpoint: 440 psig NC System Pressure with 1ND-2A (C NC Loop to ND Pumps) Open/Intermediate

Origin: 1NCPT-5120 and Relay "BA" in 1ATC8

Probable Cause:

- Loss of power to SSPS {PIP 1-M97-0560}
- NC System pressurization with 1ND-2A (C NC Loop to ND Pumps) Open/Intermediate

Automatic Action: None

Immediate Action:

1. IF loss of power to SSPS has occurred, alarm is expected and no further action required.
2. IF NC pressure is greater than 440 psig, reduce pressure to less than 385 psig by adjusting letdown flow greater than charging flow to maintain NCS Pressure 325 - 340 psig.
3. IF pressure CANNOT be reduced, perform the following:
   A. Monitor PRT for possible lifting of ND Pump(s) suction relief(s) at 450 psig.
   B. Go to AP/1/A/5500/019 (Loss of ND or ND System Leakage).
4. IF pressure reduction successful, perform the following:
   A. Monitor PRT for possible lifting of ND Pump(s) suction relief(s) at 450 psig.
   B. IF ND Pump(s) suction relief(s) lifted, check closed when pressure decreases.

Supplementary Action: Refer to Tech Specs.

References:

- Tech Specs
- NSM MG-12238
- PIP 1-M97-0560

End Of Response

Unit 1

Q75 References

Operator Fundamental Focus; Knowledge and Control
Annunciators alert the Operator whenever pressure is less than the interlock setpoint of 2185 psig -8 psig dead band = 2177 psig. A loss of KXA or KXB will prevent automatic operation of the PORVs, but manual operation is still possible. Manual operation of the PORVs is provided via the "OPEN" & "CLOSE" position of the control switches selected for control. When 'OPEN" is selected, the Low Pressure Interlock (2185 psig) is not in effect.
**Emphasize** that operators must know how components fail and how they can be operated in abnormal situations. **Reinforce** that operators must take manual actions (in accordance with procedure direction, if available) when automatic actions do not or cannot occur.

Two of the PORVs have low temperature-overpressure protection (LTOP), NC-34A (TR "A") and NC-32B (TR "B"). Both have control circuitry like the one shown for NC-32B on Drawing 7.10, P.O. Relief Valve Control. When NC temperature gets less than 320°F, a train related bistable, (Loop D WR Th for TR "A" and Loop C WR Tc for TR "B") energizes. The signal generated by this bistable performs two functions. One, it annunciates to alert the Operator to select the low pressure mode of operation on the MCB keylock switch. Two, it satisfies the temperature permissive part of the "Low Pressure" mode OPEN circuitry. With the PORV selector switch in "AUTO" (at either the MCB or ASP), "Low Pressure" mode selected, and temperature less than 320°F, the PORV will open when NC pressure increases above 380 (±2 psig). At the same time a PORV XXX Actuated annunciator will illuminate. This pressure is sensed off NC Narrow Range (0-600 psig) Loop "D" pressure transmitter NCPT5122 (TR "A") for NC-34A and Loop "C" NCPT5142 (TR "B") for NC-32B, and can be read on the OAC. When cooling down and depressurizing the plant, the operating procedure does not direct the Operator to select "Low Pressure" control until pressure reaches 325 psig. This ensures the "NORM Mode" high pressure bistable has reset before being selected for control. When NC temperature increases to greater than 320°F, an annunciator alerts the Operator to select the "NORM" mode of control.

3.0 SYSTEM OPERATION

3.1 Normal Operation

3.1.1 Forming a Pressurizer Steam Bubble during Unit startup

OP/1/A/6100/SU-8 - Heatup to 200 Degrees F

Objective #13

The following is a synopsis of the procedure steps; refer to procedure for actual steps.

1. Monitor the following parameters:
   Letdown flow
   Charging flow
   Pzr Surge Line temperature
   Pzr Steam space temperature
   Pzr Water space temperature

Q75 Parent Question (2011MNS NRC Q4 (Bank 4358))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

A

2011 MNS SRO NRC Examination QUESTION **4** 4

SYS005 2.4.31 - Residual Heat Removal System (RHRS)
SYS005 GENERIC
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

Given the following conditions on Unit 1:

- The unit is in MODE 4 with the "A" Train of ND in service
- LTOP key switches for PORVs are selected to "NORM" position
- Annunciator 1AD-9 / A1 (1ND-2A Open and NC Hi Press) has just come in alarm
- NC WR pressure is indicating 460 PSIG

Which ONE (1) of the following describes the redundant indication which would be used to verify that this annunciator is valid?

A. PRT Level increasing ONLY

B. CF&E sump level increasing ONLY

C. 1ND-1B ("C" HL Suction to ND Isolation) would have auto closed

D. PORVs NC-32B and NC-34A would be lifting

Q75 Parent Question (2011MNS NRC Q4 (Bank 4358))

2011 MNS SRO NRC Examination QUESTION 4 4 **A**

General Discussion

In the scenario given, the Unit is shutdown in Mode 4 on RHR cooling. Annunciator 1AD-9/ A1 (1ND-1A Open and NC Hi Press) has alarmed and the alarm setpoint for this annunciator is 440 PSIG NC System WR pressure. The suction relief for the RHR (ND) pump opens at 450 PSIG and relieves to the PRT.

The applicant is asked to determine what alternate indication could be used to validate that this alarm is valid and the actual NC System is greater than 440 PSIG. Additional information given in the stem of the question is that the LTOP key switches are in the "normal" The correct answer is "A" which would be consistent with actual NC system pressure being greater than the ND suction relief setpoint of 450 PSIG which would therefore be open and relieving to the PRT which would result in an increasing PRT level. 1ND-1B is in series with 1ND-2A in the suction of the ND piping and has a open permissive at 385 PSIG but when RHR is in service, the FDR breakers for these two valves are maintained open. LTOP PORV setpoint is 385 PSIG when LTOP is placed in service but with the LTOP key switches is normal, LTOP is not in service

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the CF&E sumps are located in the containment building and receive a number or relief valve discharge flow from various systems including the NCP thermal barriers and the NCDT reliefs. The applicant could conclude that this as a reasonable flowpath for the ND suction relief valves.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because 1ND-1B is interlocked with NC system WR pressure at 385 PSIG and cannot be opened until NC pressure is below this value. Prior to ND being placed in service, the feeder breaker for this is opened and maintained open during RHR operation. If the applicant does not recall that this breaker is maintained open it would be reasonable to believe that this valve would close if actual pressure was at 460 PSIG.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because if LTOP was in service and pressure was greater than 385 PSIG, both of the PORV should be open. Therefore it would be reasonable for the applicant to select this response if he failed to realize that LTOP has not been placed in service.

Basis for meeting the KA

The K/A is matched because the applicant is presented with a scenario is which an annunciator (1ND-2A Open and NC Hi Press) has alarmed which is associated with the RHR (ND) system aligned in a shutdown cooling mode. Also in the stem there is conflicting NC pressure indication given and he must then demonstrate the ability to select the correct alternate indication which could be utilized to confirm the annunciator is valid.

Basis for Hi Cog

This is a higher cognitive level question because the applicant must perform a level of analysis concerning the given indications and determine the resulting effect and predict a response.

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

Development References
Lesson Plan OP-MC-PS-ND Objective #6 Lesson Plan OP-MC-PS-ND Pg 21 of 81 Lesson Plan OP-MC-PS-IPE-DCS Pg 31 of 81 Annunciator Response for 1AD-9/ A1

Student References Provided

Q75 Parent Question (2011MNS NRC Q4 (Bank 4358))

2011 MNS SRO NRC Examination **QUESTION 4** | 4 | **A**

SYS005 2.4.31 - Residual Heat Removal System (RHRS)
SYS005 GENERIC
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

401-9 Comments:

Remarks/Status
401-9 Comment: SAT. Not sure why you use Only. Explain CF & E level increase. RESOLUTION: Initially used ONLY with answer 'A' to clearly differentiate it from answer 'D'. During Fleet review, the comment was made that answer 'A' stuck out since it was the only answer that had ONLY and that ONLY should be added to the end of answer 'B' to make it more plausible. Considered CF&E sump level increasing to be plausible since it is in containment (as is the PRT) and since it is not normal to associate a pump suction relief being directed to the PRT. HCF 5/9/11 No changes made to this question during review with Chief Examiner. HCF

SYS012 A2.01 - Reactor Protection System (RPS)

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

Faulty bistable operation ....

Given the following initial conditions on Unit 1:

- The unit is increasing power following a Refueling Outage
- At 42% reactor power, the P-8 permissive bistable fails "AS IS"

Subsequently,

- Reactor power is currently 52%
- 1A NCP trips

Based on the conditions above, an automatic Reactor trip signal ___(1)___ be generated.

If subsequent conditions require implementation of FR-S.1 (RESPONSE TO NUCLEAR GENERATION / ATWS), the crew will transition from FR-S.1 to E-0 (REACTOR TRIP OR SAFETY INJECTION) ___(2)___.

Which ONE (1) of the following completes the statements above? (CONSIDER EACH SEPARATELY)

A. 1. will
   2. after FR-S.1 is performed to completion

B. 1. will NOT
   2. after FR-S.1 is performed to completion

C. 1. will
   2. immediately upon a successful Reactor trip

D. 1. will NOT
   2. immediately upon a successful Reactor trip

General Discussion

On increasing power P-8 enables the 1/4 loop loss of flow Reactor Trip and Reactor Trip on Turbine Trip. On decreasing power, P-8 automatically blocks the above listed trip. For the conditions given, because P-8 failed "as is" below the setpoint (48%), a single-loop loss of flow will NOT initiate a reactor trip. In this case, loss of flow would have to occur on a second loop for the reactor trip to occur.

Per the EOP Rules of Usage, once the conditions have been met to implement FR-S.1, it must be entered and performed to completion.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant confuses operation of the faulty P-8 bistable and concludes the single-loop loss of flow trip is functional.

Second part is correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is plausible if applicant confuses operation of the faulty P-8 bistable and concludes the single-loop loss of flow trip is functional.

The second part is plausible since it is logical to conclude that when the entry conditions for FR-S.1 are no longer met, that transition back to E-0 is allowed. Additionally, it is also plausible since it is a common misconception and a common mistake made by Licensed SROs that transition back to E-0 is permissible as soon as the reactor trip is successful.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
First part is correct.

The second part is plausible since it is logical to conclude that when the entry conditions for FR-S.1 are no longer met, that transition back to E-0 is allowed. Additionally, it is also plausible since it is a common misconception and a common mistake made by Licensed SROs that transition back to E-0 is permissible as soon as the reactor trip is successful.

Basis for meeting the K

The K/A is matched since the applicant must be able to predict the impact of the faulty P-8 permissive bistable on current plant conditions and have knowledge of the Emergency Procedure rules of usage to determine what procedure flowpath is required.

Basis for Hi Cog

This question is a High Cognitive question because the applicant must be able to analyze plant conditions to determine the status of the P-8 permissive when it failed and based on current plant conditions determine the impact this failure will have.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
Part 1 of this question can be answered using only systems knowledge and is therefore RO knowledge. However, it is included to meet the "predict the impacts of" part of the K/A.

Part 2 of the question can NOT be answered using system knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
Neither part of this question can be answered by knowing the immediate actions of either E-0 or FR-S.1.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
Neither part of this question can be answered by knowing the entry conditions of E-0 or FR-S.1. It is related to transition from FR-S.1 back to E-0.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

5) The question requires knowledge of the EOP rules of usage to determine when procedure transition is allowed. Therefore, it is SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: Lesson Plan OP-MC-IC-IPE Rev. 33 OMP 4-3 Rev. 42 LEARNING OBJECTIVES: ICIPE011 OP-MC-ADM-OMP Objective 6

Student References Provided

SYS012 A2.01 - Reactor Protection System (RPS)

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

Faulty bistable operation ....

401-9 Comments:

Remarks/Status

Q76 References

NC Pump Bus Low Voltage (2/4 busses = 74%) - this anticipatory loss of coolant flow trip protects against DNB. This "at-power" trip protection is auto-blocked < 10% power (P-7) and is automatically reinstated > P-7.

Objective # 10

NC Pump Bus Under Frequency (2/4 busses = 56 Hz) - this anticipatory loss of coolant flow trip protects against DNB. The trip also trips open all four NC pump breakers to prevent electrical braking of the pump motors during frequency decay. A reduction in pump speed would reduce fly wheel inertia and pump coast down flow capability. This "at-power" trip protection is auto-blocked < 10% power (P-7) and is automatically reinstated > P-7.

SG Lo-Lo Level (2/4 channels on 1/4 SGs = 17%) - protects against a loss of heat sink. This protection also causes an auto-start of the CA motor driven pumps (2/4 channels on 1/4 SGs) and the CA turbine driven Pump (2/4 channels on 2/4 SGs).

Single Loop Loss of Flow (2/3 channels in 1/4 loops = 88%) - protects against DNB. This protection is auto-blocked < 48% (P-8) and automatically reinstated > P-8.

Two Loop Loss of Flow (2/3 channels in 2/4 loops = 88%) - protects against DNB. This protection is auto-blocked < 10% (P-7) and automatically reinstated > P-7.

Safety Injection (any SI signal 1/2 Trains) - initiates a reactor trip during LOCA events.

Turbine Trip (2/3 channels ASO < 45psig, 4/4 stop valves closed) - protects against loss of integrity by preventing Pressurizer PORVs from opening on turbine trip at high power.

Objective # 4, 10

General Warning (2/2 Trains) - protects against a loss of both protection trains. Anytime a General Warning is present on both SSPS trains a reactor trip will occur. General Warning is caused by: loose circuit board card; loss of voltage (AC or DC); SSPS train in "Test"; a Reactor Trip By-pass breaker in the Connected position and Closed; a Logic Ground Return fuse blown.

3.1.3 Protection Permissive Interlocks

Objective # 11

P-4 (Reactor Trip Breaker and Bypass Breaker Open for a given train) - initiates: Turbine Trip; Feedwater Isolation (coincident with low Tavg of 553 °F); Allows reset of SI signal after one minute time-out; Inputs to Steam Dump Control System for plant trip mode.

P-6 (1/2 IR instruments > 10^{-5}%) - allows Manual Block of SR reactor trip. On a power reduction, provides automatic reinstatement of SR reactor trip when 2/2 IR channels < 10^{-5} %.

P-7 (2/4 PR instruments > 10% or Turbine Inlet Pressures > 10%) - Enables (unblocks) the "at power" reactor trips: Pzr Hi-Level, Pzr Lo-Pressure, 2 Loop

Q76 References

Loss of Flow, NCP UV, and NCP UF. The above trips are automatically blocked when below P-7, 3/4 PR < 10% and Turbine Inlet Pressure < 10%.

Objective # 11

P-8 (2/4 PR instruments > 48% power) - enables Single Loop Loss of Flow and Reactor Trip upon Turbine Trip.

P-10 (2/4 PR instruments > 10%) - allows Manual Block of PR High Flux / Low Setpoint reactor trip. Allows Manual block of IR High Flux Rod Stop (C-1) and Reactor Trip. Blocks SR HI Flux Trip. P-10 provides an input to P-7. Below P-10 (3/4 PR instruments < 10%) - allows Manual reset of SR Reactor trip. This is used if one IR channel does not decrease below P-6 to Auto energize the SR circuit.

P-11 (2/3 Presurizer Pressure instruments < 1955 psig) - allows Manual Block of Lo-Pzr pressure SI (Auto instate > P-11); allows Manual block of Lo Press Stm Line Isol (Auto instate > P-11); Allows Manual block of motor driven CA pump Auto-start (Auto instate > P-11); and initiates opening of Cold Leg Accumulator isolation valves when > P-11.

P-12 (2/4 Lo-Lo TAVG < 553°F) - provides Auto-block of steam dumps preventing excessive cooldown by the steam dumps.

P-13 (Turbine Inlet Pressure > 10%) - this turbine at power permissive provides an input to P-7. Signal is developed using a 1/2 Logic from Channels 1 and 2 Turbine Inlet Pressure.

P-14 (2/3 Hi-Hi level instruments on 1/4 SGs > 83%) - actuates a Turbine Trip, CFPT Trip and Feedwater Isolation.

3.1.4 Control Interlocks

Objective # 12

C-1 (1/2 IR channels > 20%) - blocks Auto and Manual rod withdrawal.

C-2 (1/4 PR channels > 103%) - blocks Auto and Manual rod withdrawal.

C-3 (2/4 ΔT channels within 2% of OTΔT setpoint) - blocks Auto and Manual rod withdrawal plus actuates a turbine runback at 200%/min for 2.3 seconds out of 30 seconds.

C-4 (2/4 ΔT channels within 2% of OPΔT setpoint) - blocks Auto and Manual rod withdrawal plus actuates a turbine runback at 200%/min for 2.3 seconds out of 30 seconds.

C-5 (Turbine Inlet Pressure < 15%) - blocks Auto rod withdrawal.

C-7A (Turbine Inlet Pressure step change decrease > 10%.) - arms condenser dump valves on a load rejection. Signal is developed using a 2/3 Logic from Channels 1, 2, and 3 Turbine Inlet Pressure.

Q76 References

7.16.1.6 Completion of Red or Orange Path Procedure

Once procedure is entered due to a red or orange condition, that procedure should be performed to completion, unless preempted by some higher priority condition. It is expected that the actions in the procedure will clear the red or orange condition before all the operator actions are complete. However, these procedures should be performed to the point of the defined transition to a specific procedure or to the "procedure and step in effect" to ensure the condition remains clear. At this point any lower priority red or orange paths currently indicating or previously started but **NOT** completed shall be addressed.

FR-S.1, P.1 and Z.1 can be entered from either an orange or red path status. **IF** the color changes from orange to red while you are in one of these EPs, the crew should continue and complete the EP from where they are. Crew does **NOT** have to backup and restart the EP. **IF** the orange path is exited, and it subsequently turns red, the EP must be re-entered at Step 1.

Upon continuation of recovery actions in Optimal Recovery procedure, some judgment may be required by the operator to avoid inadvertent reinstatement of a Red or Orange condition by undoing some critical step in the Function Recovery procedure. The Optimal Recovery procedures are optimal assuming that safety equipment is available. The appearance of a Red or Orange condition in most cases implies that some equipment or function required for safety is **NOT** available, and by implication some adjustment may be required in the Optimal Recovery procedure.

SYS013 A2.06 - Engineered Safety Features Actuation System (ESFAS)

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

Inadvertent ESFAS actuation ....

Given the following conditions on Unit 2:

- The unit is in MODE 3
- A cooldown is in progress to comply with TS 3.0.3
- NC system pressure is 1980 PSIG
- NC system temperature is 500°F
- An inadvertent actuation of SI Train B occurs

Based on the conditions above,

1) Ice Bed temperatures will ________.

2) the optimal procedure flowpath to mitigate this event is to implement ________.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

E-0 (REACTOR TRIP OR SAFETY INJECTION)
ES-1.1 (SI TERMINATION)
AP-35 (ECCS ACTUATION DURING PLANT SHUTDOWN)

A. 1. increase
2. AP-35

B. 1. remain the same
2. AP-35

C. 1. increase
2. E-0 and then transition to ES-1.1

D. 1. remain the same
2. E-0 and then transition to ES-1.1

General Discussion

According to CNT-NF, the glycol loop removes heat from the ice condenser AHUs, floor coolers, and ice machines and returns it to the chiller packages. Additionally, there are containment isolation valves on the supply and return header (NF-228A, NF-233B and NF-234A) which will close on an ST (Phase A) signal. According to the ECC-ISE lesson plan, an ST signal (Phase A) occurs on a Safety Injection actuation, and hence the glycol pumps will be isolated from the Containment. Therefore, ice temperature will increase during this event.

In accordance with OMP 4-3, because a Safety Injection signal has occurred above P-11 (1955 PSIG), entry into E-0 is required. As the crew progresses through E-0, they will be directed to transition to ES-1.1 when SI Termination criteria are met.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible since the plant is in a shutdown condition and in the midst of a cooldown. If the applicant does not recall that AP-35 is only applicable below P-11 (1955 PSIG), they would logically conclude that AP-35 is the appropriate procedure to mitigate the consequences of the event.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because an actual Safety Injection has not occurred. Given the conditions, Containment temperature and pressure would NOT be increasing (i.e. no LOCA inside Containment). Therefore, if the applicant does not determine that Glycol to Containment has been isolated, since nothing has occurred to change temperature and pressure inside Containment, Ice Bed temperatures would remain unchanged.

The second part is plausible since the plant is in a shutdown condition and in the midst of a cooldown. If the applicant does not recall that AP-35 is only applicable below P-11 (1955 PSIG), they would logically conclude that AP-35 is the appropriate procedure to mitigate the consequences of the event.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because an actual Safety Injection has not occurred. Given the conditions, Containment temperature and pressure would NOT be increasing (i.e. no LOCA inside Containment). Therefore, if the applicant does not determine that Glycol to Containment has been isolated, since nothing has occurred to change temperature and pressure inside Containment, Ice Bed temperatures would remain unchanged.

The second part is correct.

Basis for meeting the K

The KA is matched because the operator must demonstrate the ability to (a) predict the impacts of the Containment isolation on the Ice Condenser System (i.e. Ice Temperature increase); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations (i.e. procedure flowpath).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must analyze the given conditions to determine the effect of the inadvertent Safety Injection on Ice Bed temperatures.

Next, the applicant must analyze the given conditions to determine the appropriate procedure flowpath.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
Part 1 of this question can be answered using only systems knowledge and is therefore RO knowledge. However, it is included to meet the "predict the impacts of" part of the K/A.

Part 2 of the question can NOT be answered using system knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
Neither part of this question can be answered by knowing the immediate actions of either E-0. AP-35 has no immediate actions.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
Because E-0 and AP-35 have the same entry conditions, the applicant cannot answer the second part of the question solely by knowing the entry conditions for AP-35 or E-0. The applicant must analyze the conditions given and then select the correct procedure based on that analysis.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

5) The question requires the applicant to analyze the conditions in the stem of the question and then select the correct procedure based on that analysis. Again, since AP-35 and E-0 have the same entry conditions, the applicant cannot select the correct procedure based soley on knowledge of the entry conditions. Therefore, the question is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	2009 MNS Audit SRO Examination AUDIT Q87 (Bank 3205)

Development References
REFERENCES: OMP 4-3 Rev. 42 E-0 (Reactor Trip or Safety Injection) Rev. 28 AP-35 (ECCS Actuation During Plant Shutdown) Rev. 19 LEARNING OBJECTIVES: NONE

Student References Provided

SYS013 A2.06 - Engineered Safety Features Actuation System (ESFAS)

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

Inadvertent ESFAS actuation ....

401-9 Comments:

Remarks/Status

Q77 References

7. Use Of Approved Procedure

7.1 Use of Control Copies

Since EPs, APs, and FSGs are used during emergency situations and require immediate access, the Control Copy of the procedure will be used to perform the steps. The Control Copy of any EP or AP or FSG should be replaced by the SSA. The procedure group should be contacted after the use of any EP or AP or FSG.

7.2 EP Entry

Generally, entry into the emergency procedure set is limited to two conditions:

- **IF** a safety injection or reactor trip occurs or is required with initial conditions above P-11, the operator will enter EP/1,2/A/5000/E-0 (Reactor Trip or Safety Injection). (During a normal plant heatup, selected rods may be withdrawn as available source of negative reactivity insertion. **IF** these rods are dropped with initial conditions below P-11, most of the EP steps do **NOT** apply, so implementing EPs is **NOT** required. APs dealing with reason rods were dropped should provide adequate guidance to address this situation.)

NOTE: The following reactor trips do **NOT** require entry into E-0:

- Control rod drop tests performed at power levels below 5% full power.
- Trip was initiated and specifically called for in an in-progress test procedure or was part of a planned shutdown.
- Trip with initial conditions less than P-11 as discussed above.

- **IF** a complete loss of power on both emergency busses takes place, the operator will enter EP/1,2/A/5000/ECA-0.0 (Loss of All AC Power). This includes any time during the performance of any other EP.

During periods when EPs are **NOT** being implemented, the SPDS and critical safety function status trees may be used to determine or identify abnormal conditions. EPs referenced by them may be used to correct the alarming condition.

Q77 References

MNS EP/2/A/5000/E-0 **UNIT 2**	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. 1 of 38 Rev. 28

A. Purpose

This procedure provides actions to check proper response of the automatic protection systems following manual or automatic actuation of a reactor trip or safety injection, to assess plant conditions, and to identify the appropriate recovery procedure.

B. Symptoms or Entry Conditions

1. **The following are symptoms that require a reactor trip, if one has not occurred:**
   - Any valid alarm on Reactor trip first out panel
   - 1/2 S/R channels - 10^5 CPS (below P6)
   - 1/2 I/R channels - 25% Power (below P10)
   - 2/4 P/R channels - 25% Power (below P10)
   - 2/4 P/R channels - 109% Power
   - 2/4 P/R channels - +5%/2 seconds
   - 2/4 Pzr Press channels - 2385 PSIG
   - 2/4 Pzr Press channels - 1945 PSIG (above P7)
   - 2/3 Pzr Level channels - 92% (above P7)
   - 2/4 NC Pump buses - 74% of normal voltage (5082 V) (above P7)
   - 2/4 NC Pump buses - 56 Hz (above P7)
   - 2/3 NC flow channels in 2/4 loops - 88% (above P7)
   - 2/3 NC flow channels in 1/4 loops - 88% (above P8)
   - 2/4 Loop Delta Ts - greater than OTDT setpoint (variable)
   - 2/4 Loop Delta Ts - greater than OPDT setpoint (variable)
   - 2/3 Auto -stop oil press channels - 45 PSIG (above P8)
   - 4/4 Turbine Throttle valves - Closed (above P8)
   - 2/4 S/G Level channels in any S/G - Lo-Lo (17%)
   - 1/2 Trains S/I - Actuated
   - 2/2 SSPS Trains - General Warning alarm.

2. **The following are symptoms of a reactor trip:**
   - Any reactor trip annunciator - LIT
   - Rod bottom lights - LIT
   - Neutron flux - RAPIDLY GOING DOWN.

3. **The following are symptoms that require a reactor trip and safety injection, if one has not occurred:**
   - 2/4 Pzr pressure channels less than 1845 PSIG
   - 2/3 Containment pressure channels greater than 1 PSIG.

Q77 References

MNS EP/2/A/5000/E-0 **UNIT 2**	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. 2 of 38 Rev. 28

4. **The following are symptoms of a reactor trip and safety injection:**

- Any S/I annunciator - LIT
- NV, ND, NI pumps - ON
- "SAFETY INJECTION ACTUATED" status light (2SI-18) - LIT
- "LOCA SEQ ACTUATED TRAIN A(B)" status lights (2SI-14) - LIT.

Q77 References

MNS AP/2/A/5500/35 **UNIT 2**	ECCS ACTUATION DURING PLANT SHUTDOWN	PAGE NO. 2 of 54 Rev. 19

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **"MANUAL S/I RX TRIP" alarm**
- **"PZR LO PRESS S/I RX TRIP" alarm**
- **"HI CONT PRESS S/I RX TRIP" alarm**
- **"SAFETY INJECTION ACTUATED" Status Light**
- **"LOCA SEQ ACTUATED TRN A" Status Light**
- **"LOCA SEQ ACTUATED TRN B" Status Light**
- **"MONITOR LIGHT PANEL" alarms due to changing equipment status.**

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 3205 MNS **A**

Given the following conditions on Unit 2:

- A cooldown is in progress to comply with TS 3.0.3
- NC system pressure is 1980 PSIG
- NC system temperature is 500°F
- Containment pressure is within TS limits.
- A technician error has caused actuation of SI Train B.

Which ONE (1) of the following describes the impact on the ice temperature, AND the procedure flowpath to mitigate the consequences of this event?

A. Ice Temperature will INCREASE; AND
The crew will enter E-0 (Reactor Trip or Safety Injection) and transition to ES-1.1 (SI Termination).

B. Ice Temperature will INCREASE; AND
The crew will enter AP-35 (ECCS Actuation During Plant Shutdown).

C. Ice Temperature will REMAIN UNCHANGED; AND
The crew will enter E-0 (Reactor Trip or Safety Injection) and transition to ES-1.1
(SI Termination).

D. Ice Temperature will REMAIN UNCHANGED; AND
The crew will enter AP-35 (ECCS Actuation During Plant Shutdown).

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 3205 MNS A

General Discussion

Answer A Discussion

Correct. 1st part correct, 2nd part correct. According to CNT-NF (p29; Rev 30), the glycol loop removes heat from the ice condenser AHUs, floor coolers, and ice machines and returns it to the chiller packages. According to CNT-NF (p29; Rev 30), there are containment isolation valves on the supply and return header (NF-228A, NF-233B and NF-234A) which will close on an ST signal. According to ECC-ISE (p17; Rev 34), an ST signal (Phase A) occurs on a Safety Injection actuation, and therefore the glycol pumps will be isolated from the Containment. Therefore, ice temperature will increase during this event. According to OMP 4-3 (p6; Rev 27), the operator should enter EP/2/A/5000/E-0 if an automatic reactor trip or safety injection occurs, or the need for a manual reactor trip or safety injection occurs, with plant conditions > P-11. Therefore, if Pzr Pressure is > 1955 PSIG, then E-0 should be entered on a Safety Injection actuation. E-0 does NOT address the operation of the NF valves. Eventually, E-0 will direct the operator to transition to EP/2/A/5000/ES-1.1, SI Termination.

Answer B Discussion

Incorrect. 1st part correct, 2nd part wrong. According to AP/2/A/5500/35 (p1; Rev 14), this procedure covers operator actions for an ECCS actuation from initial plant conditions below P-11 (Safety Injection Block Permissive, less than 1955 PSIG). However, the stated conditions have the plant above P-11. This is plausible if the operator incorrectly believes that AP35 is the correct procedure to mitigate the consequences of the event.

Answer C Discussion

Incorrect. 1st part wrong, 2nd part correct. This is plausible because of the operator may not recognize that the glycol pumps have been isolated and that there is now, no cooling to the Ice Condenser.

Answer D Discussion

Incorrect. 1st part wrong, 2nd part wrong. This is plausible because of the operator may not recognize that the glycol pumps have been isolated and that there is now, no cooling to the Ice Condenser; and because the operator may incorrectly believe that AP35 is the correct procedure to mitigate the consequences of the event.

Basis for meeting the KA

The KA is matched because the operator must demonstrate the ability to (a) predict the impacts of the Containment isolation on the Ice Condenser System (i.e. Ice Temperature increase); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations (i.e. procedure flowpath).

Basis for Hi Cog

Basis for SRO only

The question is SRO-Only because the question cannot be answered by knowing system knowledge, immediate operator actions, or EOP Entry conditions alone; but rather requires that the operator assess plant conditions, and then prescribe a procedure or a portion of the procedure by recalling of a strategy within the procedure (i.e. Use E-0 and EP network vs. AP35).

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	

Development References

Student References Provided

KA	KA_desc
SYS025 A2.04	Ability to (a) predict the impacts of the following malfunctions or operations on the ice condenser system; correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)Containment isolation

SYS061 2.4.31 - Auxiliary / Emergency Feedwater (AFW) System
SYS061 GENERIC
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

Given the following conditions on Unit 1:

- The unit is at 12% RTP preparing to roll the main turbine
- M1A1276 (U1 CA Temp at Chk Vlv 1CA-37) alarms on the OAC

Based on the conditions above, in accordance with OP/1/A/6250/002 (AUXILIARY FEEDWATER SYSTEM), the method that will **FIRST** be used to reduce the temperature at the check valve is to ___(1)___.

Based on the actions taken to reduce the temperature at the check valve, the U1 TD CA pump is ___(2)___.

Which ONE (1) of the following completes the statements above?

COMPONENT LEGEND:

1CA-37 (#1 TD CA TO S/G D)
1CA-36AB (U1 TD CA PUMP DISCH TO 1D S/G CONTROL)
1CA-38B (U1 TD CA PUMP DISCH TO 1D S/G ISOL)

A. 1. close 1CA-36AB and monitor temperature for 15 minutes
   2. OPERABLE

B. 1. close 1CA-36AB and monitor temperature for 15 minutes
   2. INOPERABLE

C. 1. close 1CA-38B and start the U1 TD CA pump aligned for recirculation to the UST
   2. OPERABLE.

D. 1. close 1CA-38B and start the U1 TD CA pump aligned for recirculation to the UST
   2. INOPERABLE

General Discussion

The consequence of the situation described would be overheating of the TD CA pump discharge piping which could lead to voiding and ultimately steam binding associated with this pump. The OAC alarm response associated with OAC point M1A1276 directs the crew to reduce CA system piping temperature per OP/1/A/6250/002. Enclosure 4.5 of this procedure directs the operators to first close the control valve on the affected line, which in this case would be 1CA-36AB or the D S/G. If this is unsuccessful, then the pump is run in recirc to cool the discharge line but all of the remaining motor operated control valves would have to be closed first and this would only be done if the closure of the single control valve was not successful. The stem of the question asked for the FIRST action.
The operability of the TD CA pump is affected by the closure of the Air Operated flow control valve (1CA-36 AB). Above 10% RTP, closing this valve renders the pump inoperable.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is correct.

Part 2 is plausible because it the unit was below 10% RTP the action of closing the control valve would not affect the operability of the associated AFW pump.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because this action is correct but the stem of the question asked for what method would be used First.

Part 2 is plausible if the applicant confuses 1CA-38B with 1CA-36AB. Since the OPERABILITY of both valves is determined by the same surveillance this is possible. If the unit was below 10% RTP the action of closing the control valve would not affect the operability of the associated AFW pump. The surveillance requirements of Tech Spec 3.7.5 simply state that the requirement for "automatic" AFW valves to be open does not apply less than 10% RTP. Therefore, it is possible for the applicant to conclude that that closing 1CA-38B would not render the TD CA pump inoperable.

Answer D Discussion

INCORRECT: See explanation above,

PLAUSIBLE:
Part 1 is plausible because this action is correct but the stem of the question asked for what method would be used First.

Part 2 is correct.

Basis for meeting the K

The alarm response for the OAC alarm associated with the TD CA pump directs the operator to an Operating Procedure to mitigate the consequences of the event. The question requires the applicant to have knowledge of the Operating Procedure directed by OAC alarm response. Therefore, the K/A is matched.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must recall from memory the sequence of actions required by the Operating Procedure to mitigate the event.

Next, the applicant must analyze the given conditions to determine if the actions taken to mitigate the event will render the TD CA pump inoperable.

Basis for SRO only

The second part of the question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
2) This question can NOT be answered by knowing information listed "above-the-line".
3) This question can NOT be answered by knowing the TS Safety Limits.
4) This question required the applicant to analyze the given conditions and make the determination that the TD CA pump is inoperable.

ILT-16-1 MNS SRO NRC Examination **QUESTION 78** 78 **B**

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	2010 MNS SRO NRC Examination NRC Q78 (Bank 2778)

Development References
REFERENCES: TS 3.7.5 (AFW System) Amendment 261/241 OP/1/A/6250/002 (Auxiliary Feedwater System) Rev 127 LEARNING OBJECTIVES: NONE

Student References Provided

SYS061 2.4.31 - Auxiliary / Emergency Feedwater (AFW) System
SYS061 GENERIC
Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)

401-9 Comments:

Remarks/Status

Q78 References

Alarm Response

Main Alarms Graphics Trends Point List Zoom Print Help

05-AUG-2015 08:47:29

CURRENT FUNCTION: ALMRESP

1.47 A 1.47 B SPDS

M1A1276	U1 CA TEMP AT CHK VLV 1CA-37		93.2	DEG F	GOOD
MODE	LO-LO	LO	HI	HI-HI	
MODE 1	N/A	N/A	200.0	220.0	PAGE 1 of 2

AUTOMATIC ACTIONS

NONE

RESPONSE

HI-HI - 1. REDUCE CA PIPING TEMPERATURE PER OP/1/A/6250/002 (AUXILIARY FEEDWATER SYSTEM) PRIOR TO REACHING THE FOLLOWING TEMPERATURE LIMITS:

- 280F, IF ALIGNED TO CA STORAGE TANK (WATER TOWER)
- 255F, IF ALIGNED TO CACST ONLY
- 220F, IF ALIGNED TO UST ONLY

2. IF ABOVE TEMPERATURE LIMITS EXCEEDED, NOTIFY SYSTEM ENGINEERING TO EVALUATE POTENTIAL FOR WATER HAMMER BEFORE STARTING CA PUMP.

HI - 1. PLACE M1A1276 ON TREND AND NOTIFY CR SRO OF ALARM.

2. NOTIFY THE NON LICENSED OPERATORS OF THE HIGH TEMPERATURE ON 1CA-37 (UI TD CA PUMP DISCH TO 1D S/G CK).

CONTINUED

PREV CANC F1=CLEAR F2= F3= F4= F5= F6=

TT025 WK= ANONYMOUS SEC LVL= 15 PRIM/BACK CPU A MODE 1 MNS 1 AIS

Q78 References

Enclosure 4.5

Reducing Turbine Driven CA Pump Piping Temperature

OP/1/A/6250/002
Page 1 of 2

1. Limits and Precautions

None

2. Initial Conditions

_____ 2.1 BW System isolated from S/Gs per OP/1/A/6100/SO-5A (B, C, D) (Draining S/G 1A, 1B, 1C, 1D).

3. Procedure

☐ 3.1 Evaluate all outstanding R&Rs that may impact performance of this procedure.

_____ SRO 3.2 Declare #1 TD CA Pump inoperable.

3.3 Close control valve on affected lines:

- _____ CV _____ • 1CA-64AB (U1 TD CA Pump Disch to 1A S/G Control)
- _____ CV _____ • 1CA-52AB (U1 TD CA Pump Disch to 1B S/G Control)
- _____ CV _____ • 1CA-48AB (U1 TD CA Pump Disch to 1C S/G Control)
- _____ CV _____ • 1CA-36AB (U1 TD CA Pump Disch to 1D S/G Control)

☐ 3.4 Monitor temperature for 15 - 30 minutes.

_____ 3.5 **IF** temperatures remain high after 15 - 30 minutes, close isolation valve on affected lines:

- _____ CV _____ • 1CA-66AC (U1 TD CA Pump Disch to 1A S/G Isol)
- _____ CV _____ • 1CA-54AC (U1 TD CA Pump Disch to 1B S/G Isol)
- _____ CV _____ • 1CA-50B (U1 TD CA Pump Disch to 1C S/G Isol)
- _____ CV _____ • 1CA-38B (U1 TD CA Pump Disch to 1D S/G Isol)

Unit 1

Q78 References

NOTE:	When opening valves 1CA-36, 48, 52, and 64 from the local panel, the controller needs to be opened 4 - 5 more turns once 100% is reached to minimize the amount that the valves drift close and back open upon returning controller back to control room (A-Remote).

3.6 **AFTER** temperatures have returned to normal, ensure open:

- ______ CV ______ 1CA-64AB (U1 TD CA Pump Disch to 1A S/G Control)
- ______ CV ______ 1CA-52AB (U1 TD CA Pump Disch to 1B S/G Control)
- ______ CV ______ 1CA-48AB (U1 TD CA Pump Disch to 1C S/G Control)
- ______ CV ______ 1CA-36AB (U1 TD CA Pump Disch to 1D S/G Control)
- ______ CV ______ 1CA-66AC (U1 TD CA Pump Disch to 1A S/G Isol)
- ______ CV ______ 1CA-54AC (U1 TD CA Pump Disch to 1B S/G Isol)
- ______ CV ______ 1CA-50B (U1 TD CA Pump Disch to 1C S/G Isol)
- ______ CV ______ 1CA-38B (U1 TD CA Pump Disch to 1D S/G Isol)

3.7 Check the following stable:

- ☐ M1A1439 (U1 CA Temp at Chk Vlv 1CA-65)
- ☐ M1A1421 (U1 CA Temp at Chk Vlv 1CA-53)
- ☐ M1A1294 (U1 CA Temp at Chk Vlv 1CA-49)
- ☐ M1A1276 (U1 CA Temp at Chk Vlv 1CA-37)

______ 3.8 **IF** increasing temperatures indicates check valve leak by, perform the following:

______ 3.8.1 Notify Engineering.

________________________ ______/______
Person Notified Date Time

______ 3.8.2 Evaluate operating CA Pumps to cool CA System piping.

3.9 Ensure "TURB" released on the following:

- ______ CA Modulating Valves Reset Train A
- ______ CA Modulating Valves Reset Train B

______ SRO 3.10 Evaluate operability of CA System.

End of Enclosure

Unit 1

Q78 References

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.5.1	-------------------------------NOTE------------------------------ Not applicable to automatic valves when THERMAL POWER is ≤ 10% RTP. --- Verify each AFW manual, power operated, and automatic valve in each water flow path, and in both steam supply flow paths to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program
SR 3.7.5.2	-------------------------------NOTE------------------------------ Not required to be performed for the turbine driven AFW pump until 24 hours after ≥ 900 psig in the steam generator. --- Verify the developed head of each AFW pump at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.7.5.3	-------------------------------NOTE------------------------------ Not applicable in MODE 4 when steam generator is relied upon for heat removal. --- Verify each AFW automatic valve that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program

(continued)

Q78 Parent Question (2010 MNS NRC Q78 (Bank 2778))

2010 MNS SRO NRC Examination QUESTION 78 2578 **B**

SYS061 A2.06 - Auxiliary / Emergency Feedwater (AFW) System

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

Back leakage of MFW ....

Given the following conditions on Unit 1:

- The unit is at 12% RTP preparing to roll the main turbine
- M1A1276 (U1 CA Temp at Chk Vlv 1CA-37) alarms on the OAC
- 1CA-37 (#1 TD CA to S/G D)

Based on the above conditions:

1. In accordance with OP/1/A/6250/002 (Auxiliary Feedwater System), what method would FIRST be used to reduce the temperature at the check valve?
2. How would this action affect the operability of the TD CA Pump?

A. 1. Close 1CA-36 AB (U1 TD CA Pump Disch to 1D S/G Control) and monitor temperature for 15 min.
   2. The U-1 TD CA Pump remains OPERABLE.

B. 1. Close 1CA-36 AB (U1 TD CA Pump Disch to 1D S/G Control) and monitor temperature for 15 min.
   2. The U-1 TD CA Pump shall be declared INOPERABLE.

C. 1. Close 1CA-38B (U1 TD CA Pump Disch to 1D S/G Isol) and start the TD CA pump aligned for recirculation to the UST.
   2. The U-1 TD CA Pump remains OPERABLE.

D. 1. Close 1CA-38B (U1 TD CA Pump Disch to 1D S/G Isol) and start the TD CA pump aligned for recirculation to the UST.
   2. The U-1 TD CA Pump shall be declared INOPERABLE.

Q78 Parent Question (2010 MNS NRC Q78 (Bank 2778))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

2010 MNS SRO NRC Examination QUESTION 78 2578 **B**

General Discussion

The consequence of the situation described would be overheating of the TD CA pump discharge piping which could lead to voiding and ultimately steam binding associated with this pump. The correct response to the alarm associated with OAC point M1A1276 is to reduce CA system piping temperature per OP/1/A/6250/002. Enclosure 4.4 of this procedure directs the operators to first close the control valve on the affected line, which in this case would be 1CA-36AB or the D S/G. If this is unsuccessful, then the pump is run in recirc to cool the discharge line but all of the remaining motor operated control valves would have to be closed first and this would only be done if the closure of the single control valve was not successful. The stem of the question asked for the FIRST action.
The operability of the TD CA pump is affected both by the closure of the Air Operated flow control valves (1CA-36 AB). Above 10% RTP, closing this valve renders the pump inoperable.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part 1 is correct and therefore plausible.

Part 2 is plausible because it the unit was below 10% RTP the action of closing the control valve would not affect the operability of the associated AFW pump. This answer is plausible because it is possible to close this valve with the unit at power without affecting operability just not at the given power level.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part 1 of the answer is plausible because this action is correct but the stem of the question asked for what method would be used First. The method described would only be employed if the closure of the control isolation was not successful but since it is a possible strategy, it is plausible.

Part 2 is plausible because it the unit was below 10% RTP the action of closing the control valve would not affect the operability of the associated AFW pump. This answer is plausible because it is possible to close this valve with the unit at power without affecting operability just not at the given power level.

Answer D Discussion

INCORRECT: See explanation above,

PLAUSIBLE: Part 1 of the answer is plausible because this action is correct but the stem of the question asked for what method would be used First. The method described would only be employed if the closure of the control isolation was not successful but since it is a possible strategy, it is plausible.

Part 2 is correct and therefore plausible.

Basis for meeting the KA

Part 2 of this question matches the 'a' part of the KA regarding "predict the impact of the following malfunctions on the AFW". The impact is whether the TD CA pump will remain operable.

Part 1 of this question matches the part 'b' of the KA regarding "using procedures to correct, control, or mitigate the consequences". The procedure in this case is OP/1/A/6250/002, Auxiliary Feedwater System, Enclosure 4.5, Reducing Turbine Driven CA Pump Piping Temperature.

Basis for Hi Cog

This question is Hi Cog because the applicant must evaluate a given set of conditions and through a multipart mental process, determine the required actions based on these conditions. The applicant must futher evaluate the impact of the actions to address the high temperature on the operability of the associated AFW pump.

Basis for SRO only

Part 1 of the question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge. Either of these methods can be used procedurally to cool the TD CA pump piping. Check valve leakage is discussed in the systems lesson plan and the methods to cooldown the TD CA pump are mentioned in general terms (i.e. "close the discharge valve or start the pump"). However, the applicant must have detailed knowledge of the OP to discrimminate which method is used FIRST. Since this is an infrequently performed evolution, the actions in the procedure are directed by the CR SRO and not handed off to an RO.
2) The question can NOT be answered by knowing immediate operator actions. None of the actions described are immediate actions.
3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs. These are detailed procedure steps from an infrequently performed OP.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

B

2010 MNS SRO NRC Examination QUESTION 78 2578

4) The question can NOT be answered solely by knowing the purpose, overal sequence of events, or overall mitigative strategy of the procedure. This is detailed knowledge of procedure step sequence not sequence of events within the procedure.
5) The question requires detailed knowledge of procedure content. Therefore, it is SRO knowledge.

Part 2 of the question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
2) This question can NOT be answered by knowing information listed "above-the-line".
3) This question can NOT be answered by knowing the TS Safety Limits.
4) This question required the applicant to analyze the given conditions and make the determination that the TD CA pump is inoperable. The applicant must then recall from memory that the unit can not enter MODE 1 with the TD CA pump INOPERABLE.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
TS 3.7.5 OP/1/A/6250/002 Auxiliary Feedwater System

Student References Provided

SYS061 A2.06 - Auxiliary / Emergency Feedwater (AFW) System
Ability to (a) predict the impacts of the following malfunctions or operations on the AFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)
Back leakage of MFW ....

401-9 Comments:

Remarks/Status
401-9 Comments: Must reference the procedure in the stem to fully meet the 2nd part of the KA. -- Resolution / Comments: Revised question 1 in the stem to read "In accordance with OP/1/A/6250/002 (Auxiliary Feedwater System), what method would FIRST be used to reduce the temperature at the check valve?" See attached file for revised question.

C

SYS076 2.2.44 - Service Water System (SWS)

SYS076 GENERIC

Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions. (CFR: 41.5 / 43.5 / 45.12)

Given the following initial conditions on Unit 1:

- Unit is in Mode 4 with a plant cooldown in progress
- "B" Train in service

Subsequently,

- Containment Pressure begins rising
- The SAFETY INJECTION ACTUATED status light on 1SI-18 is LIT
- The crew implements AP-34 (SHUTDOWN LOCA)
- The following indications are observed on 1SI-14:

Based on the conditions and indications above,

1) the ________ will overheat due to loss of RN cooling.

2) the crew will be directed to ________ to mitigate this event.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

AP-10 (NC SYTEM LEAKAGE WITHIN THE CAPACITY OF BOTH NV PUMPS)

A.
1. NC pumps
2. GO TO AP-10

B.
1. running DG
2. GO TO AP-10

C.
1. NC Pumps
2. remain in AP-34

D.
1. running DG
2. remain in AP-34

General Discussion

A Safety Injection signal from either unit will cause RN train separation on both units. After train separation, the "A" train of RN will supply the Rx Bldg Non-Essential header (NC Pump motor coolers). Each RN train will supply its Essential Header (D/G cooling water). If a "B" train ONLY SI occurs, the RN trains will be separated (RN-41B closes), BUT the "A" RN pump will NOT get a start signal. If the "B" train was in service prior to the event, there will be no RN flow to the Rx Bldg Non-Essential Header. See Figure 7.14 in the provided references.

AP-34 uses the position of NI-9A and NI-10B when determining if charging flow is adequate. If both valves are closed, AP-34 will direct the crew to GO TO AP-10 to mitigate this event. In this question one of the two valves is closed. AP-34 will direct the crew to bypass the remaining substeps and therefore remain in AP-34 to mitigate this event.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because if both NI-9A and NI-10B were closed, this would be the correct procedure direction.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the A D/G does not have cooling water due to RN train separation. However the A D/G will not start until SI is manually initiated on Train A. At that point the A RN pump will be started by the Sequencer and the A DG will have cooling water.

The second part is plausible because if both NI-9A and NI-10B were closed, this would be the correct procedure direction.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the A D/G does not have cooling water due to RN train separation. However the A D/G will not start until SI is manually initiated on Train A. At that point the A RN pump will be started by the Sequencer and the A DG will have cooling water.

The second part is correct.

Basis for meeting the K

The KA is matched because the applicant must interpret provided control room indications to determine the status of components supplied by the RN system and determine the position of safety related valves. Use of these determinations will allow appropriate procedure selection to mitigate the consequences of the event. The applicants ability to correctly diagnose the event (status of the system) and select the appropriate procedure implies that they "understand how operator actions and directives affect plant and system conditions".

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must diagnose the conditions given to determine which component is effected by a loss of RN cooling and the status of safety related valves.

Next, the applicant must analyze the conditions given to determine the correct procedure to mitigate the consequences of the event.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

The first part of the question can be answered with systems level knowledge and is therefore RO knowledge.

The second part of the question is related to procedure selection and is therefore SRO knowledge.

2) The question can NOT be answered by knowing immediate operator actions.

Neither part of the question is related to immediate operator actions.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

Because the two procedures identified in the question have the same entry conditions, the second part of the question can NOT be answered solely based on knowledge of entry conditions. The applicant must analyze the conditions given and, based on that analysis determine the appropriate procedure to be implemented. Therefore, the question is related to SRO-level procedure selection.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

This question is related to procedure selection and not knowledge of the procedure purpose, sequence of events or mitigative strategy.

5) The question requires analysis of a complex set of conditions and procedure selection based on that analysis. Therefore, it is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	MODIFIED	2008 MNS NRC SRO Examination NRC Q93 (Bank 3308) MODIFIED

Development References

REFERENCES:
AP-34 (Shutdown LOCA) Rev. 23
E-0 (Reactor Trip or Safety Injection) Rev. 34
Lesson Plan OP-MC-PSS-RN Rev. 49

LEARNING OBJECTIVES:
OP-MC-PSS-RN Objective 16

Student References Provided

SYS076 2.2.44 - Service Water System (SWS)
SYS076 GENERIC
Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions. (CFR: 41.5 / 43.5 / 45.12)

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
076G2.2.44
K/A is met.
Not at an SRO level. AP-34's stated purpose is "Provide actions for protecting the reactor core in the event of a LOCA that occurs during either Mode 3 with Cold Leg Accumulators isolated or Mode 4."
Knowing the purpose of the procedure is RO knowledge.
Therefore both parts are RO knowledge
ES-401, Page 2 of 50
You'll probably have to look deeper into AP-34 to get this to the appropriate level. Drl 11/9/15

Facility Response:
Question was re-written using procedure selection to reach the SRO level. SLM 11/24/15

Q79 References

MNS AP/1/A/5500/34 **UNIT 1**	SHUTDOWN LOCA	PAGE NO. 2 of 126 Rev. 22

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Any of the following while in Mode 3 with Cold Leg Accumulators isolated, or in Mode 4:**
  - "ICE COND LOWER INLET DOORS OPEN" alarm
  - Pzr level - GOING DOWN IN AN UNCONTROLLED MANNER
  - NC subcooling - GOING DOWN IN AN UNCONTROLLED MANNER
  - Containment floor and equipment sump level(s) - GOING UP.

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Monitor Foldout page.**	
2. **Check the following valves - OPEN:** __ • 1ND-1B (1C NC Loop to ND Pumps Isol) __ • 1ND-2AC (1C NC Loop To ND Pumps Cont Inside Isol).	__ **GO TO Step 5.**
3. **IF any of the following conditions exist, THEN GO TO AP/1/A/5500/19 (Loss Of ND Or ND System Leakage).** __ • LOCA is believed to be outside containment OR __ • Abnormal PRT conditions without indications of inputs from Pzr PORVs or safeties.	

Q79 References

MNS EP/1/A/5000/E-0 **UNIT 1**	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. **1 of 38** Rev. 34

A. Purpose

This procedure provides actions to check proper response of the automatic protection systems following manual or automatic actuation of a reactor trip or safety injection, to assess plant conditions, and to identify the appropriate recovery procedure.

B. Symptoms or Entry Conditions

1. **The following are symptoms that require a reactor trip, if one has not occurred:**
   - Any valid alarm on Reactor trip first out panel
   - 1/2 S/R channels - 10^5 CPS (below P6)
   - 1/2 I/R channels - 25% Power (below P10)
   - 2/4 P/R channels - 25% Power (below P10)
   - 2/4 P/R channels - 109% Power
   - 2/4 P/R channels - +5%/2 seconds
   - 2/4 Pzr Press channels - 2385 PSIG
   - 2/4 Pzr Press channels - 1945 PSIG (above P7)
   - 2/3 Pzr Level channels - 92% (above P7)
   - 2/4 NC Pump buses - 74% of normal voltage (5082 V) (above P7)
   - 2/4 NC Pump buses - 56 Hz (above P7)
   - 2/3 NC flow channels in 2/4 loops - 88% (above P7)
   - 2/3 NC flow channels in 1/4 loops - 88% (above P8)
   - 2/4 Loop Delta Ts - greater than OTDT setpoint (variable)
   - 2/4 Loop Delta Ts - greater than OPDT setpoint (variable)
   - 2/3 Auto-stop oil press channels - 45 PSIG (above P8)
   - 4/4 Turbine Throttle valves - Closed (above P8)
   - 2/4 S/G Level channels in any S/G - Lo-Lo (17%)
   - 1/2 Trains S/I - Actuated
   - 2/2 SSPS Trains - General warning alarm.

2. **The following are symptoms of a reactor trip:**
   - Any reactor trip annunciator - LIT
   - All rod bottom lights - LIT
   - Neutron flux - RAPIDLY GOING DOWN.

3. **The following are symptoms that require a reactor trip and safety injection, if one has not occurred:**
   - 2/4 Pzr pressure channels less than 1845 PSIG
   - 2/3 Containment pressure channels greater than 1 PSIG.

Q79 References

MNS EP/1/A/5000/E-0 **UNIT 1**	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. **2 of 38** Rev. 34

4. **The following are symptoms of a reactor trip and safety injection:**
   - Any S/I annunciator - LIT
   - NV, ND, NI pumps - ON
   - "SAFETY INJECTION ACTUATED" status light (1SI-18) - LIT
   - "LOCA SEQ ACTUATED TRAIN A(B)" status lights (1SI-14) - LIT.

NS heat exchanger wet lay up loop is on the tube (RN) side of the heat exchanger. This system is non-safety related and in case of a break in the system there are flow limiting orifices on the suction and discharge sides. This system is primarily the responsibility of the Chemistry Dept. with the exception of the isolation valves directly off the RN piping which will be Operations. The wet lay up system will normally be in service with the isolation valves open and the heat exchanger water solid. The recirc pump will be run for sampling purposes and chemical additions as necessary.

The RN **Reactor Building non-essential header** is not redundant and is isolated on an S_P (Phase B) signal, when it is being supplied from the 'A' RN header. If 'B' train is supplying the header, flow will be lost to the NCP coolers on a BO or SS. This header contains the NCP motor coolers **(Refer to Drawing 7.6)**. Loss of RN to the NCP motor cooler(s) requires the operator to trip the effected NCP(s).

Objective # 11

The RN **Auxiliary Building non-essential header** is not redundant and is isolated on an S_S signal. The components supplied by this header are: **(refer to Drawing 7.6)**

- Reciprocating Charging Pump Bearing oil cooler
- Reciprocating Charging Pump Fluid Drive oil cooler

Note: The Steam Generator Blowdown Heat Exchanger has been flanged out and "abandoned in place" for Unit #1 (NSM 12430) and Unit #2 (NSM 22430).

Due to both units alignment to the RL Header, a cross-tie is created between the units through a 6 inch line. **(Refer to drawing 7.4)**

The reason that the Auxiliary Building non-essential header supply isolation valve (RN42) is **NOT** closed during a Blackout is to allow "A" RN pump supply the Reactor Building ventilation units **(refer to Drawing 7.11)**. The "A" RN pump will have a greater NPSH since it will be supplied by the LLI. Also it is likely under Blackout conditions the RV pumps will not have power.

Due to fouling problems and repeated maintenance on the PD pump heat exchanger a decision was made to isolate the Aux. Bldg. non-essential header. As a result the normal position of 1RN-64 will be closed. When it is necessary to start/stop the PD pump 1RN -64 will be opened/closed per the NV procedure.

Auxiliary Building RV loads:

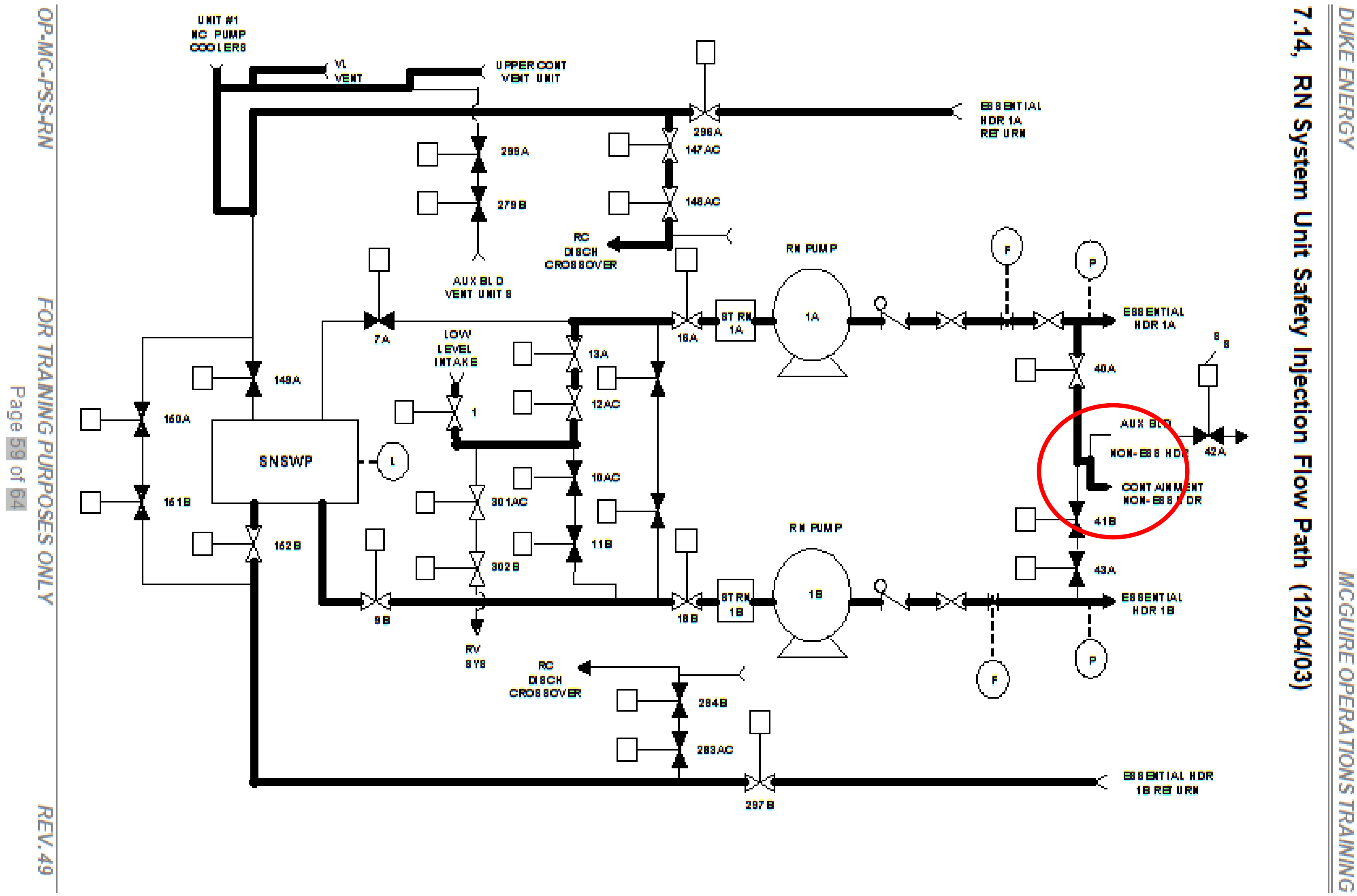
Auxiliary Building Ventilation Units

Reactor Building RV loads:

Upper containment ventilation units

Lower containment ventilation units

Q79 References



FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 3308 MNS **A**

Given the following conditions:

- A plant cooldown is in progress.
- Current conditions are:
  - NC Pressure – 1400 psig
  - NC Temperature – 440°F
  - Cold Leg Accumulators have NOT been isolated
  - "B" Train in service

An event occurs:

- NC System pressure starts to go down at approximately 2 psi per minute.
- PZR level is going down at 5% per minute.
- Containment Pressure is rising at 0.1 psig per minute.
- Only Train "B" Safety Injection has actuated.

Which ONE (1) of the following describes (1) the impact on the unit, and (2) the action that must be taken?

A. (1) NC Pumps will overheat due to loss of RN cooling.
(2) Enter E-0, Reactor Trip or Safety Injection, and initiate Train A Safety Injection to restore flow to Train A Essential Header and RB Non-Essential Header.

B. (1)The running DG will overheat due to loss of RN cooling.
(2) Enter E-0, Reactor Trip or Safety Injection, and initiate Train A Safety Injection to restore flow to Train A Essential Header and RB Non-Essential Header.

C. (1) NC Pumps will overheat due to loss of RN cooling.
(2) Enter AP-34, Shutdown LOCA, and initiate Train A Safety Injection to restore flow to Train A Essential Header and RB Non-Essential Header.

D. (1)The running DG will overheat due to loss of RN cooling
(2)Enter AP-34, Shutdown LOCA, and initiate Train A Safety Injection to restore flow to Train A Essential Header and RB Non-Essential Header.

EXAM BANK QUESTION: 3308 MNS **A**

General Discussion

A Safety Injection signal from either unit will cause RN train separation on both units. After train separation, the "A" train of RN will supply the Rx Bldg Non-Essential header (NC Pump motor coolers). Each RN train will supply its Essential Header (D/G cooling water). If a "B" train ONLY SI occurs, the RN trains will be separated (RN-41B closes), BUT the "A" RN pump will NOT get a start signal. If the "B" train was in service prior to the event, there will be no RN flow to the Rx Bldg Non-Essential Header. (PSS-RN, pg 35, 37, 51, and drawing 7.15).

AP-34 entry conditions are for LOCAs that occur in Mode 3 after the CLAs have been isolated or in Mode 4. Otherwise, E-0 would be implemented. E-0 step 5 Immediate Action directs the operator to initiate Safety Injection if one or both trains failed to auto actuate.

Answer A Discussion

A is correct.

Answer B Discussion

B is incorrect. Correct procedure to enter. The "A" D/G will not get cooling water due to the RN train separation. However, the "A" D/G will not start until Train "A" SI is initiated. At that point, the "A" RN pump will start. Do not open the RN cross-connect valves on a valid SI signal.

Answer C Discussion

C is incorrect. Credible because the procedure would be entered in Mode 4 if NC pressure was lower. Action to restore RN is correct though

Answer D Discussion

D is incorrect. Wrong procedure as in C above. Also wrong action. If both sequencers were actuated, the action could work, but not performed for valid SI

Basis for meeting the KA

KA is matched because conditions represented by the stem indicate loss of header pressure on 1 header.

Basis for Hi Cog

Basis for SRO only

SRO level because the applicant must assess plant conditions and determine procedure use based upon selected impact

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	

Development References

Student References Provided

KA	KA_desc
SYS076 A2.02	Ability to (a) predict the impacts of the following malfunctions or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45/3 / 45/13)Service water header pressure ....

SYS078 A2.01 - Instrument Air System (IAS)
Ability to (a) predict the impacts of the following malfunctions or operations on the IAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)
Air dryer and filter malfunctions ....

Given the following plant conditions:

- Both units are at 100% RTP
- A malfunction of the VI Air Dryers has resulted in rapidly decreasing VI Header pressures
- Both units have implemented AP-22 (LOSS OF VI)

In accordance with AP-22,

1) what is the MINIMUM VI Header pressure which requires implementation of Enclosure 7 (RN ALIGNMENT DURING LOSS OF VI EVENT)?

2) which of the following conditions will FIRST require the crew to initiate a manual reactor trip?

   A. Pressurizer level begins INCREASING in an uncontrolled manner
   B. S/G levels begin DECREASING in an uncontrolled manner

A. 1. 60 PSIG
   2. A

B. 1. 85 PSIG
   2. A

C. 1. 60 PSIG
   2. B

D. 1. 85 PSIG
   2. B

General Discussion

AP-22 directs the operators to align RN to the SNSWP if VI Header pressure decreases to less than 60 PSIG.

AP-22 contains a continuous action step that direct the Operators to initiate a reactor trip and implement E-0 if S/G levels are decreasing in an uncontrolled manner.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because an uncontrolled increase in Pressurizer level is an expected condition during a loss of VI and AP-22 provides specific direction to control Pressurizer level using Enclosure 10. Additionally, an automatic reactor trip will occur if Pressurizer level increases to greater than 92%. Therefore applicant could conclude that both instances require a manual reactor trip.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the pressure below AP-22 directs aligning nitrogen backup from the CLAs to the Pzr PORVs.

The second part is plausible because an uncontrolled increase in Pressurizer level is an expected condition during a loss of VI and AP-22 provides specific direction to control Pressurizer level using Enclosure 10. Additionally, an automatic reactor trip will occur if Pressurizer level increases to greater than 92%. Therefore applicant could conclude that both instances require a manual reactor trip.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the pressure below AP-22 directs aligning nitrogen backup from the CLAs to the Pzr PORVs.

The second part is correct.

Basis for meeting the K

The K/A is matched because the applicant has to "predict the impact of an Air Dryer malfunction" (i.e. reactor trip due to S/G levels decreasing in an uncontrolled manner) and use procedures to correct control mitigate the malfunction (i.e. knowledge of when Enclosure 7 must be implemented to re-align RN).

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
The pressure of 60 PSIG is not mentioned in the Instrument Air systems lesson plans. While 85 PSIG is mentioned in the systems lesson plan (Air dryer auto bypass), it is also procedurally directed to align nitrogen backup from the CLA accumulators to the Pzr PORVs at 85 PSIG. Therefore, for the first part of the question, it cannot be answered with systems knowledge alone.

For the second part of the question, the applicant could potentially discern from the CF systems lesson plan that the CF Control Valves fail closed on a loss of air and they could potentially discern from the ILE (Pzr Level Control) lesson plan that Pressurizer level will increase in an uncontrolled manner on a loss of VI (i.e. because the letdown isolation valves fail closed). However, there is nothing in a systems lesson plan that would identify which of these two events would first result in the need to initiate a manual reactor trip. Therefore, the second part of the question cannot be answered with systems knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
There are NO immediate actions associated with AP-22.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
The required knowledge is not related to AP-22 entry conditions rather knowledge of the content of AP-22.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure. This is detailed knowledge of procedure step content, not sequence of events within the procedure, or overall mitigative strategy.

5) The only place that the applicant would gain knowledge of which one of these conditions would first require a reactor trip is from detailed knowledge of AP-22. Even then, it is not clearly stated as fact in the AP. Regarding the PZR level increasing in an uncontrolled manner, the AP provides guidance for dealing with this in the form of an enclosure (e.g. Enclosure 10 - PZR LEVEL CONTROL). Related to S/G levels, the AP has the operator to "Check S/G Levels - At Programmed Level". If not, the RNO states that if S/G levels are decreasing in an uncontrolled manner to trip the reactor and go to E-0. Because the step occurs earlier in the procedure than the step to check PZR level increasing in an uncontrolled manner and the step specifically directs the applicant to trip the reactor if S/G levels are decreasing in an uncontrolled manner instead of dealing with the condition via an Enclosure, the applicant has to discern that the S/G CF control valves failing closed is the most probable of the two conditions to require a manual trip even though it is never stated anywhere other than a brief discussion of plant OE in the AP-22 Background document.

This question requires the applicant to have knowledge of diagnostic steps and decision points within the procedure which require the applicant to initiate actions based on a specific set of conditions (i.e. aligning RN AND when a reactor trip might need to be initiated). Therefore, it is SRO level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2014 MNS NRC Exam Q89 (Bank 5903)

Development References

REFERENCES:
AP-22 (Loss of VI) Rev. 36
AP-22 Background Document Rev. 23

LEARNING OBJECTIVES:
OP-MC-AP-22 Objective 5

Student References Provided

SYS078 A2.01 - Instrument Air System (IAS)

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

Air dryer and filter malfunctions ....

401-9 Comments:

Remarks/Status

Q80 References

MNS AP/1/A/5500/22 **UNIT 1**	LOSS OF VI	PAGE NO. 2 of 151 Rev. 36

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Abnormally low VI pressure**
- **VI pressure - GOING DOWN**
- **"VI COMP PNL TROUBLE" alarm**
- **"VI/VS LO PRESS" alarm**
- **"VI/VS LO LO PRESS" alarm**
- **Erratic plant instrumentation and/or control**
- **Loss of KR flow to VI compressors.**

C. Operator Actions

NOTE

- If normal VI supply is lost, the VI Blackout Header FLEX Air Tank should automatically maintain normal control of CA flow, charging flow, letdown, and SM PORVs.
- All checks of VI pressure in this AP are for the main VI header (Control Room gauge, 0VIP-5090) unless specifically requested to check VI Blackout Header FLEX Air Tank pressure.

__ 1. **IF AT ANY TIME VI pressure is less than 60 PSIG, THEN align RN PER Enclosure 7 (RN Alignment During Loss of VI Event).**

__ 2. **Announce occurrence on page.**

__ 3. **Ensure at least 2 KR pumps running.**

__ 4. **Ensure at least 2 KC pumps running.**

Q80 References

MNS AP/1/A/5500/22 **UNIT 1**	LOSS OF VI	PAGE NO. 9 of 151 Rev. 36

		ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE CF Control Valves will fail closed on low VI pressure, which may result in AMSAC actuation and Lo Lo S/G level.

		ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__	13.	**Check S/G levels - AT PROGRAMMED LEVEL.**	**<u>IF</u> S/G levels are going down in an uncontrolled manner, <u>THEN</u> perform the following:** __ a. Trip reactor. __ b. Continue with this procedure as time allows. __ c. **<u>GO TO</u>** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
__	14.	**Check VI pressure - GREATER THAN 85 PSIG.**	**Align N_2 backup from CLAs to Pzr PORVs by OPENING the following valves:** __ • 1NI-430A (Emerg N2 From CLA To 1NC-34A) __ • 1NI-431B (Emerg N2 From CLA To 1NC-32B & 36B).
__	15.	**Check fuel movement - IN PROGRESS.**	__ **<u>GO</u> <u>TO</u> Step 17.**
__	16.	**Notify fuel handling SRO to perform the actions of Enclosure 8 (Fuel Handling Crew Actions during a Loss of VI).**	
__	17.	**Check Unit Status - IN MODE 3 OR 4.**	__ **Observe Note prior to Step 20 and <u>GO TO</u> Step 20.**

Q80 References

The step also re-establishes NC temperature control, first by controlling ND bypass flow around the ND HXs via ND-18 or 33. Temperature is also adjusted by throttling KC to control ND discharge temperature. To prevent violating the KC design temperature (160ºF) at the ND Hx outlet, NC temperature is checked less than 160ºF. If not, the Data Book is referenced for KC-ND flow restrictions depending on NC temperature and KC flow is throttled as appropriate to prevent violating the KC design temperature.

The manual loaders for ND control valves are placed in open position to prevent inadvertent closure or throttling if VI is subsequently restored. The needle indication for these manual loaders is also driven by VI, so the number of turns is provided. Guidance to use five to six turns was provided by Greg Gabrielle in McGuire IAE group.

REFERENCES:
Engineering letter attached to 50.59 for AP/1(2)/A/5500/22 Rev 17(15)
PIP M-11-3844
Calc MCC-1223.11-00-0038 (KC-ND Flow Restrictions)

STEP 13:

PURPOSE:
Prompt the operators to watch S/G levels because the CF control valves fail closed on a loss of VI. If S/G levels can't be controlled, the Operator is directed to trip the reactor.

DISCUSSION:
The CF control valves use 0 – 60# valve operating air. Depending on the nature of the problem with VI and considering line losses, etc., these valves could start failing at 70# or more VI pressure as indicated in the control room. The operating philosophy regarding loss of Main Feedwater at power is to trip the reactor. This will prevent challenging the Lo-Lo S/G automatic reactor trip and will result in better initial conditions at the time of the manual trip. Refer to PIP 2-M-87-0208 where a automatic reactor trip occurred 5 min after loss of offsite power due to loss of VI to the CF valves. If the CF valves were to get to less than 25% open (for 30 sec or more) on 3 out of 4 S/Gs, an AMSAC could also be generated. For most scenarios, it's likely the operator will have manually tripped the reactor prior to this occurring.

REFERENCES:
PIP 2-M-87-0208

Q80 References

MNS AP/1/A/5500/22 **UNIT 1**	LOSS OF VI Enclosure 1 - Page 1 of 1 **Foldout**	PAGE NO. 46 of 151 Rev. 36

1. **VI Restoration local Actions:**

   - **IF** VI pressure is 90 PSIG and going down ("VI/VS LO PRESS" alarm), **THEN** ensure Step 5.d in body of this procedure has been performed.
   - **IF** VI pressure goes below 82 PSIG ("VI/VS LO-LO PRESS" alarm), **THEN** ensure Step 5.e in body of this procedure has been performed.

2. **Uncontrolled Cooldown Criteria (applies if reactor is shutdown):**

   - **IF** reactor shutdown **AND** NC temperature goes down in an uncontrolled manner, **THEN** perform Enclosure 9 (Uncontrolled NC System Cooldown).

3. **CA Flow Control Criteria (applies if any CA pump running):**

   - **IF** CA flow goes up in an uncontrolled manner, **THEN** perform the following:
     - Maintain total feed flow greater than 450 GPM until at least one S/G N/R level is greater than 11% (32% ACC).
     - Control CA flow **PER** EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 16 (CA Flow Control With Loss Of VI).

4. **Pzr Level Control Criteria:**

   - **IF** Pzr level goes up in an uncontrolled manner due to charging control valves failing open, **THEN** perform Enclosure 10 (Pressurizer Level Control).

5. **NC Pump Trip Criteria:**

   - **IF** any NC pump stator temperature reaches 311°F, **THEN** perform the following:

     a. Secure any boron dilution in progress.

     b. Trip the reactor.

     c. **WHEN** reactor tripped, **THEN** trip all NC pumps.

     d. **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), while continuing in this procedure as time and conditions allow.

6. **Low VCT Level Swapover Criteria:**

   - **IF** VCT level goes below 16% ("VCT ABNORMAL LEVEL" alarm (1AD-7, D-3) low setpoint), **THEN** swap NV pump suction to FWST **PER** Enclosure 11 (Aligning NV Pump Suction to FWST).

Q80 References

If the reactor has not already been tripped for other reasons, at 91% Pzr level, an automatic reactor trip signal will be initated.

c. CA flow control criteria – This criteria is consistent with the direction given in the step in the AP. If the CA pumps are running and a loss of VI resulted in the loss of throttling capability on the CA flow controllers, direction is given to control CA flow per the appropriate Generic Enclosure. A loss of VI will cause the flow control valves to the S/Gs to fail open. The enclosure allows use of either the MD or TD CA pumps to feed the S/Gs. CA flow to each individual S/G is then controlled by using either: the electric isolation valves controlled from the MCB, or dispatching an Operator to the CA pump room to locally throttle the control inlet isolations. (PIP M-96-02398 Loss of VI on CA concern, and PIP M-97-03311, Loss of KXA on CA concern)

d. Pzr level control criteria – On a loss of VI, NV-238 & 241 fail open and normal &excess letdown fail closed. With these failure modes, the potential exists for maximum charging with no letdown. At approximately 130 gallons/percent Pzr level, Pzr level could increase more than a percent/min with a loss of VI. Direction is given in the foldout page to perform the referenced enclosure if Pzr level goes up in an uncontrolled manner. A step in the AP also gives this direction, but this criteria is included on the foldout page to ensure appropriate actions are taken if Pzr level control is lost prior to reaching the step in the body of the procedure.

e. NC Pump Trip Criteria – RN isolates to the reactor bldg (NC pumps) on a loss of VI. A step in the AP also addresses this by directing the operator to monitor trip criteria per this foldout page item. As a foldout page item, this criteria is kept more visible to the operator to monitor continuously and presents this criteria earlier than the step in the AP for those scenarios where it may take some time to get to that step. Some scenarios may involve a reactor trip, where the crew progresses to E-0, and returns to this AP as time allows. The direction given in the foldout page includes securing any dilution in progress (prevent diluted pockets in the NC system). Direction is also given to trip the reactor, then the NC pumps, and go to E-0. If the reactor has been previously tripped and the crew has already performed E-0, then the crew would only have to trip the NC pumps.

f. Low VCT level swapover criteria – At approximately 20 gallons/percent VCT level, VCT level could decrease several percent/min with maximum charging and no letdown. Since the VCT makeup valves also fail closed on loss of VI, makeup is not available on a loss of VI. VCT level should automatically swap over to the FWST at 4% level, but normal operational philosophy is not to challenge automatic functions for equipment protection. The referenced enclosure gives guidance to align the charging pump suction to the FWST and isolate from the VCT when level gets down to 16% and align back to the VCT when level gets back up to 80%. Note these actions are constructed as continuous action steps. A wide band of VCT level is utilized to minimize the operation of the suction valves. The low setpoint of 16% maintains low VCT level alarm capability, since upon reaching it, with the subsequent re-alignment of suctions by the Operator, VCT level should increase to clear the alarm. VCT level should go up since the recirc's of the charging pumps should be putting water back to the VCT. The high level setpoint of 80% is chosen to provide a wide band to limit the operation of the suction valves.

Q80 Parent Question (2014 MNS NRC Exam Q89 (Bank 5903))

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO NRC Examination QUESTION 89 89 **A**

APE065 AA2.05 - Loss of Instrument Air
Ability to determine and interpret the following as they apply to the Loss of Instrument Air: (CFR: 43.5 / 45.13)
When to commence plant shutdown if instrument air pressure is decreasing

---

Given the following plant conditions:

- Both units are at 100% RTP
- Both units have implemented AP-22 (LOSS OF VI) due to decreasing VI Header pressures

In accordance with AP-22,:

1) what is the MINIMUM VI Header pressure below which the crew is directed to align RN per Enclosure 7 (RN ALIGNMENT DURING LOSS OF VI EVENT)?

2) which of the following conditions will FIRST require the crew to initiate a manual reactor trip?

   A. S/G levels begin DECREASING in an uncontrolled manner
   B. Pressurizer level begins INCREASING in an uncontrolled manner

A. 1. 60 PSIG
   2. A

B. 1. 85 PSIG
   2. A

C. 1. 60 PSIG
   2. B

D. 1. 85 PSIG
   2. B

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO NRC Examination QUESTION 89 89 **A**

General Discussion

AP-22 directs the operators to align RN to the SNSWP if VI Header pressure decreases to less than 60 PSIG.

AP-22 contains a continuous action step that direct the Operators to initiate a reactor trip and implement E-0 if S/G levels are decreasing in an uncontrolled manner.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the pressure below which the Air Dryers will be automatically bypassed.

The second part is correct.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because an uncontrolled increase in Pressurizer level is an expected condition during a loss of VI and AP-22 provides specific direction to control Pressurizer level using Enclosure 10. Additionally, an automatic reactor trip will occur if Pressurizer level increases to greater than 92%. Therefore applicant could conclude that both instances require a manual reactor trip.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the pressure below which the Air Dryers will be automatically bypassed.

The second part is plausible because an uncontrolled increase in Pressurizer level is an expected condition during a loss of VI and AP-22 provides specific direction to control Pressurizer level using Enclosure 10. Additionally, an automatic reactor trip will occur if Pressurizer level increases to greater than 92%. Therefore applicant could conclude that both instances require a manual reactor trip.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of what conditions require a manual reactor trip during a loss of Instrument Air.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
The knowledge required to answer this question is beyond systems level knowledge it is procedure content knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
There are NO immediate actions associated with AP-22.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
The required knowledge is not related to AP-22 entry conditions rather knowledge of the content of AP-22.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.
This is detailed knowledge of procedure step content, not sequence of events within the procedure, or overall mitigative strategy.

5) The question requires the applicant to have knowledge of diagnostic steps and decision points within the procedure which require the applicant to initiate actions based on a specific set of conditions (i.e. aligning RN AND when a reactor trip might need to be initiated).
Therefore, it is SRO level knowledge.

SYS014 2.2.25 - Rod Position Indication System (RPIS)
SYS014 GENERIC
Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)

Given the following initial conditions on Unit 2:

- A unit load increase in on hold at 35% RTP
- Control Bank D rod M-4 is at 160 steps by DRPI
- Control Bank D Group Step Counters indicate 170 steps

Subsequently,

- I&E determines that rod M-4 will not move because the lift coil disconnect switch has failed

The rod alignment limits of Tech Spec 3.1.4 (ROD GROUP ALIGNMENT LIMITS) ___(1)___ met.

In accordance with Tech Spec 3.1.7 (ROD POSITION INDICATION) Bases, ejected rod worth ___(2)___ a limit which may be violated if control or shutdown rods are operating outside their alignment limits undetected.

Which ONE (1) of the following completes the statements above?

A. 1. are
   2. is

B. 1. are NOT
   2. is

C. 1. are
   2. is NOT

D. 1. are NOT
   2. is NOT

General Discussion

The rod alignment limit per Tech Spec 3.1.4 is that all shutdown and control rod individual indicated positions are within 12 steps of the group step counter demand position.

With Control Rod M-4 at 160 steps and Control Bank D at 170 steps, the rod is misaligned by 10 steps the therefore IS within the alignment limits of the T.S.

In accordance Tech Spec 3.1.7 Basis, the ejected rod worth limit may be violated on a DBA if shutdown or control rods are operating outside their alignment limits undetected.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See axplanation above.

PLAUSIBLE:
The first part is plausible because Tech Spec Surveillance SR 3.1.4.2 requires that rods be moved ≥ 10 Steps in either direction to verify freedom of movement. If the applicant confuses this with Tech Spec number for rod misalignment, they would conclude that rod M-4 is INOPERABLE. Additionally, in accordance with the Tech Spec 3.1.7 Basis, the nominal accuracy of the DRPI system is ± 3 steps. Since rod D-4 is outside the nominal accuracy of the DRPI system, the applicant could conclude that the rod is not within alignment limits.

The second part is correct.

Answer C Discussion

INCORRECT: See axplanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because most of the discussions in the Tech Spec bases related to rod alignment limits focus on peaking factor limits and SDM limits. Therefore, the applicant could conclude that exceeding ejected rod worth limits with a misaligned rod is not a concern.

Answer D Discussion

INCORRECT: See axplanation above.

PLAUSIBLE:
The first part is plausible because Tech Spec Surveillance SR 3.1.4.2 requires that rods be moved ≥ 10 Steps in either direction to verify freedom of movement. If the applicant confuses this with Tech Spec number for rod misalignment, they would conclude that rod M-4 is INOPERABLE. Additionally, in accordance with the Tech Spec 3.1.7 Basis, the nominal accuracy of the DRPI system is ± 3 steps. Since rod D-4 is outside the nominal accuracy of the DRPI system, the applicant could conclude that the rod is not within alignment limits.

The second part is plausible because most of the discussions in the Tech Spec bases related to rod alignment limits focus on peaking factor limits and SDM limits. Therefore, the applicant could conclude that exceeding ejected rod worth limits with a misaligned rod is not a concern.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the Tech Spec 3.1.7 (Rod Position Indication) Basis.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant calculate the difference between rod M-4 individual position indication and Control Bank D Group Step Counter demand position (i.e. 10 steps).

Next the applicant must recall from memory the requirements of Tech Spec 3.1.4 related to maximum rod misalignment.

Finally, the applicant must again recall from memory the bases of Tech Spec 3.1.7.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

This question is not related to 1 hour or less Tech Specs

2) This question can NOT be answered by knowing information listed "above-the-line".

The first part of the question is "above-the-line" knowledge and is therefore RO-level knowledge.

The second part of this question is related to knowledge of Tech Spec Bases and therefore is SRO-level knowledge.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

This question is NOT related to TS Safety Limits.

4) This question requires the applicant to (application, basis)

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: Tech Spec 3.1.4 (Rod Group Alignment Limits) Tech Spec 3.1.7 (Rod Position Indication) Basis LEARNING OBJECTIVES: OP-MC-IC-EDA Objective 10

Student References Provided

SYS014 2.2.25 - Rod Position Indication System (RPIS)
SYS014 GENERIC
Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)

401-9 Comments:

Remarks/Status

Q81 References

BACKGROUND (continued)

The Bank Demand Position Indication System counts the pulses from the Rod Control System that move the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or ± 5/8 inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The DRPI System provides a highly accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center to center distance of 3.75 inches, which is 6 steps. To increase the reliability of the system, the inductive coils are connected alternately to data channel A or B. Thus creating two separate and independent channels (Data A and Data B). Also, the coils are not placed at the reflected six step increments starting at rod bottom. Because of this arrangement, the nominal accuracy of the system is +/- 3 steps indicated versus true rod position. Due to mechanical positioning of the coils on the rod position detector and expansion in containment atmosphere, another +/- 1 step is added to system accuracy making it +/- 4 steps.

If one channel fails, the DRPI will go to half accuracy. The accuracy will be - 10, + 4 steps when either channel fails. Therefore, the maximum deviation between the group demand counters and DRPI could be 10 steps, or 6.25 inches.

Gray code (A & B data from the data cabinets in containment) is sent to the DRPI equipment in the control room. The gray code is processed by the DRPI equipment and the rod position is displayed on the control board. The gray code is also sent from the DRPI equipment to the Operator Aid Computer (OAC), where it is processed by the OAC and the rod position is displayed on the OAC. The processing of the gray code by the DRPI equipment and the OAC are completely independent. Therefore, both the DRPI display and the OAC DRPI indication are considered valid indications of control rod position.

APPLICABLE SAFETY ANALYSES

Control and shutdown rod position accuracy is essential during power operation. Power peaking, ejected rod worth, or SDM limits may be violated in the event of a Design Basis Accident (Ref. 2), with control or shutdown rods operating outside their limits undetected. Therefore, the acceptance criteria for rod position indication is that rod positions must be known with sufficient accuracy in order to verify

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.7 Rod Position Indication

BASES

BACKGROUND

According to GDC 13 (Ref. 1), instrumentation to monitor variables and systems over their operating ranges during normal operation, anticipated operational occurrences, and accident conditions must be OPERABLE. LCO 3.1.7 is required to ensure OPERABILITY of the control rod position indicators to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits.

The OPERABILITY, including position indication, of the shutdown and control rods is an initial assumption in all safety analyses that assume rod insertion upon reactor trip. Maximum rod misalignment is an initial assumption in the safety analysis that directly affects core power distributions and assumptions of available SDM. Rod position indication is required to assess OPERABILITY and misalignment.

Mechanical or electrical failures may cause a control rod to become inoperable or to become misaligned from its group. Control rod inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available rod worth for reactor shutdown. Therefore, control rod alignment and OPERABILITY are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on control rod alignment and OPERABILITY are established in LCO 3.1.4, "Rod Group Alignment Limits," and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

Rod cluster control assemblies (RCCAs), or rods, are moved out of the core (up or withdrawn) or into the core (down or inserted) by their control rod drive mechanisms. The RCCAs are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control.

The axial position of shutdown rods and control rods are determined by two separate and independent systems: the Bank Demand Position Indication System (commonly called group step counters) and the Digital Rod Position Indication (DRPI) System.

Q81 References

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Rod Group Alignment Limits

LCO 3.1.4 All shutdown and control rods shall be OPERABLE, with all individual indicated rod positions within 12 steps of their group step counter demand position.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rod(s) untrippable.	A.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Be in MODE 3.	6 hours
		(continued)

Q81 References

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.4.2	Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core $\geq$ 10 steps in either direction.	In accordance with the Surveillance Frequency Control Program
SR 3.1.4.3	Verify rod drop time of each rod, from the fully withdrawn position, is $\leq$ 2.2 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with: a. $T_{avg} \geq 551°F$; and b. All reactor coolant pumps operating.	Prior to reactor criticality after each removal of the reactor head

SYS016 A2.02 - Non-Nuclear Instrumentation System (NNIS)

Ability to (a) predict the impacts of the following malfunctions or operations on the NNIS; and (b) based on those predictions, use or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5)

Loss of power supply ....

Given the following conditions on Unit 1:

- Containment Pressure Channel 3 has failed **low** due to a failed power supply
- The failed channel has **NOT** been removed from service by I&E

Based on the conditions above, the current Containment Pressure channel logic for the remaining Containment Pressure channels which will cause a **Safety Injection** actuation is ___(1)___.

In accordance with Tech Spec 3.3.2 (ESFAS INSTRUMENTATION) LCO actions, when the failed channel is removed from service, I&E will place the Containment Pressure **Hi-Hi** Bistable in ___(2)___.

Which ONE (1) of the following completes the statement above?

A. 1. 1/2
2. TRIP

B. 1. 2/2
2. TRIP

C. 1. 1/2
2. BYPASS

D. 1. 2/2
2. BYPASS

General Discussion

The normal logic for a Safety Injection actuation based on Hi Containment Pressure is 2/3 channels. With one pressure channel failed low (Channel 3), there are only two remaining channels which can initiate a Safety Injection actuation.

If the failed channel had been removed from service OR if the failed channel had failed HI prior to being removed from service, the Containment Pressure logic which would cause an SI signal would be 1/2.

However, since the failed channel failed LOW and it has not yet been removed from service (i.e. Containment Pressure Hi B/S placed in the TRIP position), it requires BOTH of the remaining channels (2/2) to cause a Safety Injection actuation.

In accordance with Tech Spec 3.3.2 (ESFAS Instrumentation), the Containment Pressure Hi-Hi Bistable will be placed in BYPASS when the channel is removed from service. The basis for this is that an inadvertent signal on any one of the remaining Containment Pressure Hi-Hi Bistables would result in and inadvertent Phase B isolation.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this would be correct if the failed channel had already been removed from service or if the channel had failed high instead of low.

The second part is plausible because when most channels are removed from service the bistables associated with the failed channel are placed in the tripped position. Even with Containment Pressure the Hi Pressure Bistable is placed in TRIP while the Hi-Hi Pressure Bistable is placed in BYPASS.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because when most channels are removed from service the bistables associated with the failed channel are placed in the tripped position. Even with Containment Pressure the Hi Pressure Bistable is placed in TRIP while the Hi-Hi Pressure Bistable is placed in BYPASS. .

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this would be correct if the failed channel had already been removed from service or if the channel had failed high instead of low.

The second part is correct.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because the conditions in the question present a loss of power to a Non-Nuclear Instrument (Containment Pressure) and the applicant must predict the impact of the failed channel on the Safety Injection logic (prior to removal from service) AND use Tech Spec 3.3.2 to CONTROL the consequences of the event.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory the logic for Safety Injection and Phase B based on Hi Containment pressure.

The applicant must then analyze the conditions given to determine the current condition and the effect on the Safety Injection logic.

Finally, the applicant must recall from memory the Tech Spec 3.3.2 requirements for removing a Containment Pressure channel from service.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs.

This knowledge required to answer this question is knowledge of Tech Spec 3.3.2 actions which are greater than 1 hour action statements.

2) This question can NOT be answered by knowing information listed "above-the-line".

The question is not related to "above-the-line" knowledge.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

This question is related to ESFAS Instrumentation and NOT TS Safety Limits.

4) This question requires the applicant to have knowledge of TS 3.3.2 actions related to removing an instrument channel from service which are "below-the-line". Therefore, it is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: Tech Spec 3.3.2 (ESFAS Instumentation) Lesson Plan OP-MC-ECC-ISE (ESFAS System) Rev. 37

Student References Provided

SYS016 A2.02 - Non-Nuclear Instrumentation System (NNIS)

Ability to (a) predict the impacts of the following malfunctions or operations on the NNIS; and (b) based on those predictions, use or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5)

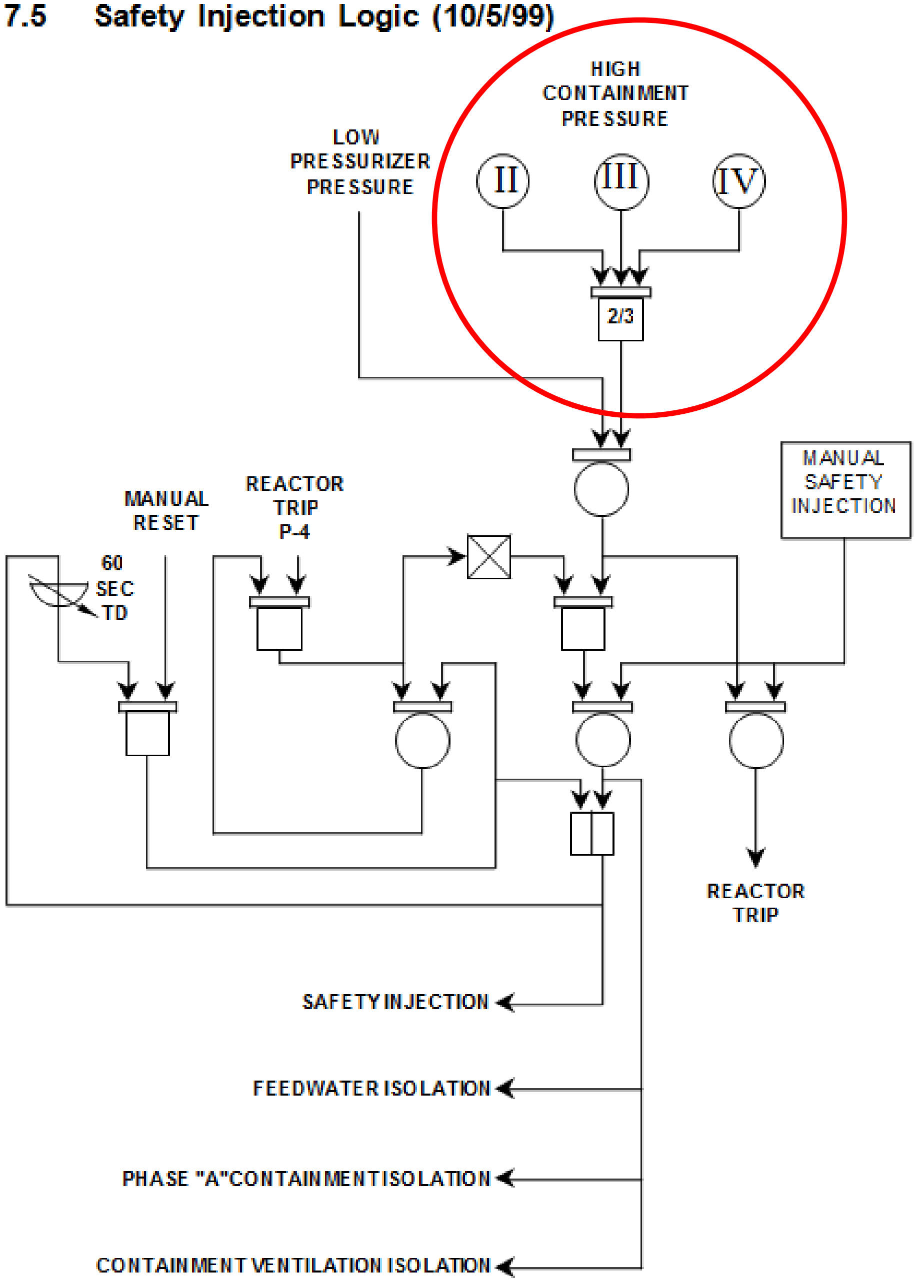
Loss of power supply ....

401-9 Comments:

Remarks/Status

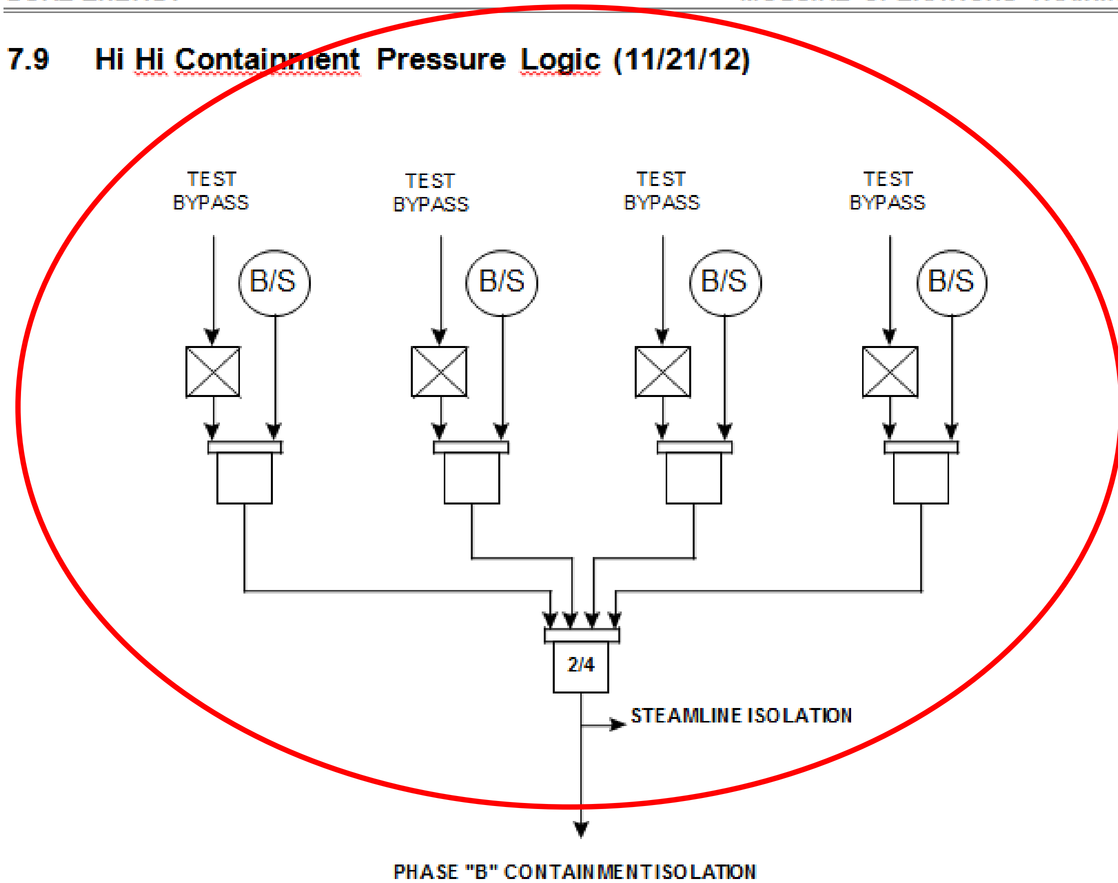
Q82 References

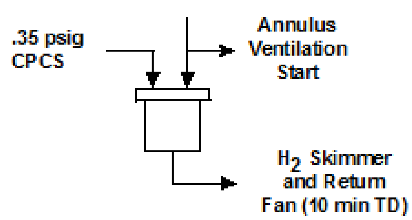
7.5 Safety Injection Logic (10/5/99)



Q82 References

7.9 Hi Hi Containment Pressure Logic (11/21/12)





Q82 References

Table 3.3.2-1 (page 1 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
1. Safety Injection						
a. Manual Initiation	1,2,3,4	2	B	SR 3.3.2.7	NA	NA
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
c. Containment Pressure - High	1,2,3	3	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≤ 1.2 psig	1.1 psig
d. Pressurizer Pressure - Low Low	1,2,3[(a)]	4	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≥ 1835 psig	1845 psig
2. Not Used						
3. Containment Isolation						
a. Phase A Isolation						
(1) Manual Initiation	1,2,3,4	2	B	SR 3.3.2.7	NA	NA
(2) Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA

(continued)

(a) Above the P-11 (Pressurizer Pressure) interlock.

Q82 References

Table 3.3.2-1 (page 2 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
3. Containment Isolation (continued)						
(3) Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
b. Phase B Isolation						
(1) Manual Initiation	1,2,3,4	1 per train, 2 trains	B	SR 3.3.2.7	NA	NA
(2) Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
(3) Containment Pressure - High High	1,2,3	4	E	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8	≤ 3.0 psig	2.9 psig
4. Steam Line Isolation						
a. Manual Initiation						
(1) System	1,2(b),3(b)	2 trains	F	SR 3.3.2.7	NA	NA
(2) Individual	1,2(b),3(b)	1 per line	G	SR 3.3.2.7	NA	NA
b. Automatic Actuation Logic and Actuation Relays	1,2(b),3(b)	2 trains	H	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
c. Containment Pressure - High High	1,2(b), 3(b)	4	E	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≤ 3.0 psig	2.9 psig
d. Steam Line Pressure						
(1) Low	1,2(b), 3(a)(b)	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≥ 755 psig	775 psig

(continued)

(a) Above the P-11 (Pressurizer Pressure) interlock.
(b) Except when all MSIVs are closed and de-activated.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One train inoperable.	C.1 -------------NOTE------------- One train may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. ----------------------------------	
	Restore train to OPERABLE status.	24 hours
	OR	
	C.2.1 Be in MODE 3.	30 hours
	AND	
	C.2.2 Be in MODE 5.	60 hours
D. One channel inoperable.	D.1 -------------NOTE------------- One channel may be bypassed for up to 12 hours for surveillance testing. ----------------------------------	
	Place channel in trip.	72 hours
	OR	
	D.2.1 Be in MODE 3.	78 hours
	AND	
	D.2.2 Be in MODE 4.	84 hours

(continued)

Q82 References

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One Containment Pressure channel inoperable.	E.1 -------------NOTE------------- One additional channel may be bypassed for up to 12 hours for surveillance testing. ------------------------------------ Place channel in bypass.	72 hours
	OR	
	E.2.1 Be in MODE 3.	78 hours
	AND	
	E.2.2 Be in MODE 4.	84 hours
F. One channel or train inoperable.	F.1 Restore channel or train to OPERABLE status.	48 hours
	OR	
	F.2.1 Be in MODE 3.	54 hours
	AND	
	F.2.2 Be in MODE 4.	60 hours
G. One Steam Line Isolation Manual Initiation - individual channel inoperable.	G.1 Restore channel to OPERABLE status.	48 hours
	OR	
	G.2 Declare associated steam line isolation valve inoperable.	48 hours

(continued)

SYS035 2.2.42 - Steam Generator System (S/GS)
SYS035 GENERIC
Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)

Given the following conditions on Unit 2:

- The unit is in MODE 5 following refueling
- Current conditions are as follows:

<u>Primary conditions:</u>

- 1A ND Hx inlet temperature 185 ºF
- 1B ND Hx inlet temperature 185 ºF
- NC pressure 250 PSIG

<u>Secondary conditions:</u>

- S/G 1A CF inlet temperature 65 ºF
- S/G 1B CF inlet temperature 62 ºF
- S/G 1C CF inlet temperature 68 ºF
- S/G 1D CF inlet temperature 60 ºF
- All S/Gs pressures are 210 PSIG

Based on the conditions above, in accordance with SLC 16.10.1 (STEAM GENERATOR PRESSURE/TEMPERATURE LIMITATION), the crew must ___(1)___ .

The basis for the limits of SLC 16.10.1 is to prevent ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. reduce S/G pressures to less than 200 PSIG within 30 minutes
2. brittle fracture of the Steam Generators

B. 1. increase S/G secondary temperatures to greater than 70°F within 1 hour
2. brittle fracture of the Steam Generators

C. 1. reduce S/G pressures to less than 200 PSIG within 30 minutes
2. an NC cooldown and subsequent reduction in shutdown margin

D. 1. increase S/G secondary temperatures to greater than 70°F within 1 hour
2. an NC cooldown and subsequent reduction in shutdown margin

General Discussion

In accordance with SLC 16.10.1 (Steam Generator Pressure/Temperature Limitation), the limits of the SLC are applicable at all times. However, the testing requirements must only be completed when either NC system temperature or secondary coolant temperature is less than 70°F.

With S/G or NC system temperatures less than 70°F (actually >55°F and <70°F), Secondary pressure must be ≤ 200 PSIG and Primary pressure ≤ 400 PSIG.

If S/G Primary or Secondary temperatures are within the bands specified in SLC 16.10.1, Primary and Secondary pressure must be within the limits specifiec for those temperature bands. If the required pressure limits are exceeded, pressure must be restored to less that the limit within 30 minutes. No allowance it provided in the SLC to increase temperature greater than 70°F so that the testing requirements are no longer required to be performed.

Consequently, for the conditions given, S/G pressures must be reduced to less than 200 PSIG within 30 minutes.

In accordance with the SLC 16.10.1 Basis the reason for the S/G Pressure/Temperature limitations is to prevent brittle fracture of the S/Gs.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because if S/G Secondary temperature were greater than 70°F, the testing requirements of SLC 16.10.1 would not have to be performed. Additionally, based on the conditions given the testing requirements of SLC 16.10.1 (TR 16.10.1.1) are required to be verified every hour.

The second part is correct.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because if flow was initiated through the S/G tubes, it would result in a cooldown of the NC system and a reduction in Shutdown Margin. However, this is not the basis for the limits of SLC 16.10.1.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because if S/G Secondary temperature were greater than 70°F, the testing requirements of SLC 16.10.1 would not have to be performed. Additionally, based on the conditions given the testing requirements of SLC 16.10.1 (TR 16.10.1.1) are required to be verified every hour.

The second part is plausible because if flow was initiated through the S/G tubes, it would result in a cooldown of the NC system and a reduction in Shutdown Margin. However, this is not the basis for the limits of SLC 16.10.1.

Basis for meeting the K

The K/A is matched because the applicant must have detailed knowledge of the requirements of SLC 16.10.1 including the Basis.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must recall from memory all of the temperature/pressure limits of SLC 16.10.1.

Next, the applicant must analyze the primary and secondary temperature and pressure conditions and associate them with the recalled memory from the first step.

Next, the applicant must determine from the analysis in the second step the appropriate actions based on the conditions.

Finally, the applicant must recall from memory the basis for the limit of SLC 16.10.1.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification

Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
The first part of the question is associated with less than 1 hour Tech Spec (SLC) actions and it therefore RO knowledge. However, the second part of the question is NOT associated will less than 1 hour actions.

2) This question can NOT be answered by knowing information listed "above-the-line".
None of the information in either part of the question is above-the-line knowledge.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.
Neither part of the question is associated with TS Safety Limits.

4) This question requires the applicant to have knowledge of the basis for SLC 16.10.1 and is therefore SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	MODIFIED	2005 CNS SRO NRC Examination NRC Q86 (Bank 490) MODIFIED

Development References

REFERENCES:
SLC 16.10.1 (Steam Generator Pressure/Temperature Limitation)

OBJECTIVES:

Student References Provided

SYS035 2.2.42 - Steam Generator System (S/GS)
SYS035 GENERIC
Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)

401-9 Comments:

Remarks/Status

075G2.1.25
K/A is met.
I agree this is probably minutia. If you like, another K/A can be chosen to replace this one. Drl 11/9/15

Facility Response:
A new KA was selected and a new question was written. SLM 11/24/15

Q83 References

16.10 STEAM AND POWER CONVERSION

16.10.1 Steam Generator Pressure/Temperature Limitation

COMMITMENT Temperatures of both reactor and secondary coolants in the steam generators shall be maintained in accordance with Table 16.10.1-1.

NOTE: If steam generator level is < 10% WR, the secondary coolant temperature limit is not applicable.

APPLICABILITY At all times.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Commitment not met.	A.1 Reduce steam generator pressure of the applicable side to within specified limits.	30 minutes
	AND	
	A.2 Perform an engineering evaluation to determine the effect of overpressurization on the structural integrity of the steam generator and determine the steam generator remains acceptable for continued operation.	Prior to increasing SG pressure above the specified limits.

TESTING REQUIREMENTS

TEST	FREQUENCY
TR 16.10.1.1 ---------------------------------NOTE--------------------------------- Only required to be performed when the temperature of either the reactor or secondary coolant is < 70 °F. -- Verify the pressure in each side of the steam generator is less than the specified limits.	1 hour

Q83 References

Table 16.10.1-1

TEMPERATURE	PRESSURE LIMIT
Reactor and secondary coolant temperature >70° F	No limitations by this SLC.
Lowest reactor or secondary coolant temperature ≥ 55 and ≤ 70° F	Primary pressure ≤ 400 psig. Secondary pressure ≤ 200 psig.
Lowest reactor or secondary coolant temperature < 55° F	Primary pressure ≤ 200 psig. Secondary pressure ≤ 200 psig.

BASES

The limitation on steam generator pressure and temperature ensures that the pressure-induced stresses in the steam generators do not exceed the maximum allowable fracture toughness stress limits. The steam generator P/T limits based on a steam generator RT_{NDT} of 0 °F and are sufficient to prevent brittle fracture.

When steam generator WR level is less than 10%, the secondary coolant temperature indications are not valid. Due to close thermal coupling of temperatures at the tube sheet, primary system temperature should be used.

REFERENCES

PIP M02-1502
MCC-1223.03-00-0049
MGMM-14512 and MGMM-14516

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 490 CNS

C

Unit 1 is in Mode 5 following refueling. All S/Gs were drained and have just been refilled with condensate water per Chemistry request.

The following conditions existed during the filling operation and have been verified to be the current conditions:

Primary conditions:

- 1A ND Hx inlet temperature 185 ºF
- 1B ND Hx inlet temperature 185 ºF
- NC pressure 218 psig

Secondary conditions:

- S/G 1A CF inlet temperature 71 ºF
- S/G 1B CF inlet temperature 72 ºF
- S/G 1C CF inlet temperature 68 ºF
- S/G 1D CF inlet temperature 71 ºF
- All S/Gs pressures are 0 psig.

Based on the reported conditions, what is the action required by Selected License Commitments and the basis for that action?

A. Reduce NC pressure to less than or equal to 200 psig within 30 minutes.
To prevent a NC cooldown and subsequent reduction in shutdown margin.

B. Increase 1C S/G secondary temperature to greater than 70 ºF within 1 hour.
To prevent a NC cooldown and subsequent reduction in shutdown margin.

C. Reduce NC pressure to less than or equal to 200 psig within 30 minutes.
To prevent a challenge to steam generator nil ductility temperature limits.

D. Increase 1C S/G secondary temperature to greater than 70 ºF within 1 hour.
To prevent a challenge to steam generator nil ductility temperature limits.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 490 CNS

C

General Discussion

Answer A Discussion

Incorrect: This is not a correct basis although under other shutdown conditions, primary cooldown could lead to inadvertent criticality (the basis of boron concentration - mode 5) correct action,

Answer B Discussion

Incorrect: Temperature increase over 1 hour will not meet the action. And wrong basis.

Answer C Discussion

Answer D Discussion

Incorrect: Temperature increase over 1 hour will not meet the action, correct basis.

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	

Development References
LessonOP-CN-CF-SG Objectives25 REFERENCESSLC 16.5-7

Student References Provided

KA	KA_desc
SYS035 2.2.42	SYS035 GENERICAbility to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)

APE015/017 2.4.45 - Reactor Coolant Pump (RCP) Malfunctions
APE015/017 GENERIC
Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3 / 45.12)

Given the following initial conditions on Unit 1:

- A Reactor startup is in progress
- Shutdown Bank rods are fully withdrawn
- Control Bank A is at 100 steps
- All NCPs are in service

Subsequently, the following indications are observed:

- OAC Point M1A0698 (1D NC PUMP LOWER RADIAL BRG TMP) alarm
- OAC Point M1A0744 (1D NC PUMP MOTOR UPPER BEARING TEMP) alarm
- OAC Point M1A0720 (1D NC PUMP MOTOR LOWER BEARING TEMP) alarm
- 1D NC pump lower radial bearing temperature = 200°F and increasing slowly
- 1D NC pump motor upper bearing temperature = 200°F and increasing slowly
- 1D NC pump motor lower bearing temperature = 180°F and increasing slowly

The crew has implemented AP-08 (REACTOR COOLANT PUMP MALFUNCTION)

Based on the conditions above,

1) the CRS will implement _______.

2) if stopping the 1D NC pump is required, the procedure flowpath will be to _______.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

AP-08 Case I (NC PUMP SEAL OR PUMP LOWER BEARING MALFUNCTION)
AP-08 Case II (NC PUMP MOTOR OR MOTOR BEARING MALFUNCTION)
E-0 (REACTOR TRIP OR SAFETY INJECTION)

A. 1. AP-08, Case I
2. stop the 1D NC pump and continue in AP-08

B. 1. AP-08, Case I
2. trip the reactor, stop 1D NC pump, and transition to E-0

C. 1. AP-08, Case II
2. stop the 1D NC pump and continue in AP-08

D. 1. AP-08, Case II
2. trip the reactor, stop 1D NC pump, and transition to E-0

General Discussion

Based on the conditions given, the crew implements AP-08 (Reactor Coolant Pump Malfunction). Because the entry conditions are met for BOTH Case 1 (NC Pump Seal or Pump Lower Bearing Malfunction) AND Case II (NC Pump Motor or Motor Bearing Malfunction), the CRS must access the conditions, prioritize the alarms and associated indications and select the appropriate case to implement.

By looking at the bearing temperature indications, the CRS will implement Case II since the pump motor upper bearing temperature is above the temperature requiring the pump be tripped.

Next, the correct procedural flowpath must be determined for stopping the NC pump.

Since the unit is in MODE 2 (i.e. Control Bank withdrawal has begun), the appropriate flowpath is to trip the reactor, stop the affected NC pump, and transition to E-0 (Reactor Trip or Safety Injection).

However, if the unit was in MODE 3 (i.e. Shutdown Banks fully withdrawn and Control Bank rods fully inserted) the appropriate flowpath would be to stop the affected NC pump and continue in AP-08.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the entry conditions for Case 1 are met and the Pump Lower Radial Bearing temperature indicates the same as the Motor Upper Bearing temperature.

The second part is plausible if the applicant determines that the unit is in MODE 3 as opposed to MODE 2. That being the case, this would be the correct action.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because the entry conditions for Case 1 are met and the Pump Lower Radial Bearing temperature indicates the same as the Motor Upper Bearing temperature.

The second part is correct and therefore plausible.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant determines that the unit is in MODE 3 as opposed to MODE 2. That being the case, this would be the correct action.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because the applicant must analyze the conditions given to prioritize the significance of the alarms presented in order to select the correct recovery procedure.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must analyze the conditions given to determine which of the alarms presented has priority with regards to mitigating procedure implementation.

Next, the applicant must again analyze the conditions given to determine the appropriate procedural flowpath.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

Neither part of the question can be answered solely by knowing systems knowledge.

2) The question can NOT be answered by knowing immediate operator actions.

There are no immediate actions associated with AP-08 and the question does test the immediate actions of E-0.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

For this question, the applicant meets the entry conditions of two different cases of the same AOP. The applicant must evaluate the conditions given and prioritize those conditions to determine which is the appropriate case to select. Therefore, the applicant cannot answer the question based soley on knowledge of entry conditions for the AOP.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

This question involves both selection of an appropriate procedure and selection of an appropriate procedure flowpath.

5) The question requires procedure selection and determination of an appropriate procedural flowpath and is therefore SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: AP-08 (Reactor Coolant Pump Malfunction) Rev. 14 LEARNING OBJECTIVES: OP-MC-AP-08 Objective 6 (SRO Only)

Student References Provided

APE015/017 2.4.45 - Reactor Coolant Pump (RCP) Malfunctions
APE015/017 GENERIC
Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3 / 45.12)

401-9 Comments:	Remarks/Status

Q84 References

MNS AP/1/A/5500/08 UNIT 1	MALFUNCTION OF NC PUMP Case I NC Pump Seal or Pump Lower Bearing Malfunction	PAGE NO. 2 of 26 Rev. 14

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **NC Pump number one seal leakoff flow going up**
- **NC Pump number one seal leakoff flow going down**
- **NC Pump number one seal outlet temperature going up**
- **NC Pump lower bearing temperature going up**
- **"NC PMP NO. 1 SEAL LO D/P" alarm.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Check abnormal NC Pump parameter - KNOWN TO BE VALID.**	__ **GO TO Enclosure 1 (Validation of NC Pump Parameters).**
2. **Check the following NC Pump parameters within operating limits:** __ • All NC Pump lower radial bearing temperatures - LESS THAN 225°F __ • All NC Pump number one seal outlet temperatures - LESS THAN 235°F __ • All NC Pump number one seal delta Ps - GREATER THAN 200 PSID.	__ **IF trip criteria valid, THEN GO TO Step 5.**
__ 3. **IF AT ANY TIME any operating limit in Step 2 exceeded, THEN GO TO Step 5.**	
__ 4. **GO TO Step 6.**	

Q84 References

MNS AP/1/A/5500/08 **UNIT 1**	MALFUNCTION OF NC PUMP Case II NC Pump Motor or Motor Bearing Malfunction	PAGE NO. 15 of 26 Rev. 14

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **NC Pump stator winding temperature going up**
- **NC Pump motor bearing temperatures going up**
- **NC Pump upper/lower oil reservoir level computer alarm.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Check abnormal NC Pump parameter - KNOWN TO BE VALID.**	__ **GO TO Enclosure 1 (Validation of NC Pump Parameters).**
2. **Check NC Pump parameters within operating limits:**	__ **IF trip criteria valid, THEN GO TO Step 5.**
__ • All NC Pump stator winding temperatures - LESS THAN 311°F	
__ • All NC Pump motor bearing temperatures - LESS THAN 195°F	
__ • All NC Pump oil reservoir level computer points - INDICATING BETWEEN (-)1.25 AND (+)1.25.	
__ 3. **IF AT ANY TIME any operating limit in Step 2 exceeded, THEN GO TO Step 5.**	
__ 4. **GO TO Step 6.**	

Q84 References

MNS AP/1/A/5500/08 **UNIT 1**	MALFUNCTION OF NC PUMP Case II NC Pump Motor or Motor Bearing Malfunction	PAGE NO. 16 of 26 Rev. 14

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Stop affected NC Pump as follows:**	
a. **IF** A or B NC Pump is the affected pump, **THEN** CLOSE associated spray valve: __ • 1NC-27C (1A NC Loop PZR Spray Control) __ • 1NC-29C (1B NC Loop PZR Spray Control).	
__ b. Check unit status - IN MODE 1 OR 2.	b. Perform the following: __ 1) Stop the affected NC Pump. 2) **IF** all NC Pumps are off, **THEN** perform the following: __ a) Secure any boron dilution in progress. __ b) **IF** in Mode 3, **THEN** immediately open Reactor Trip Breakers. __ c) **IF** the step above results in rods dropping **AND** Pzr pressure is above P-11, **THEN GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection). __ 3) **GO TO** Step 6.
__ c. Trip reactor.	
__ d. **WHEN** reactor power less than 5%, **THEN** stop affected NC Pump.	
__ e. **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
__ 6. **Announce occurrence on paging system.**	

APE027 AA2.15 - Pressurizer Pressure Control System (PZR PCS) Malfunction

Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: (CFR: 43.5 / 45.13)

Actions to be taken if PZR pressure instrument fails high ....

Given the following conditions on Unit 2:

- The unit is at 100% RTP
- A DCS malfunction causes the Selected Pressurizer Pressure 1 input to the Pressurizer Master Controller to fail **HIGH**
- In accordance with AP-11 (PRESSURIZER PRESSURE ANOMALIES), the BOP has manually closed 2NC-34A (PZR PORV) and 2NC-27C and 29C (PRESSURIZER SPRAY VALVES)
- The Pressurizer Pressure Master Controller is in MANUAL

1) In accordance with Tech Spec 3.4.11 (PRESSURIZER PORVs), in what MODES are the Pressurizer PORVs required to be OPERABLE?

2) In accordance with Tech Spec 3.4.11 Bases, is 2NC-34A **OPERABLE**?

A. 1. 1, 2, and 3 ONLY
   2. No

B. 1. 1, 2, 3, and 4
   2. No

C. 1. 1, 2, and 3 ONLY
   2. Yes

D. 1. 1, 2, 3, and 4
   2. Yes

General Discussion

In accordance with Tech Spec 3.4.11, the Pressurizer PORVs are required to be OPERABLE in MODES 1, 2, and 3.

In accordance with Tech Spec 3.4.11 Bases, the Pressurizer PORVs must be capable of being manually opened to relieve pressure. The actions taken by the crew have removed the automatic opening capability of 2NC-34A. However, since it can still be opened manually, it remains OPERABLE.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant concludes that the Pressurizer PORV must be capable of opening automatically to perform its intended function. This is reasonable since automatic operation of the Pressurizer PORVs is discussed in the Tech Spec 3.4.11 basis as part of the PORVs ability to prevent a Reactor Trip on high pressure during continuous rod withdrawal events. However automatic operation is not required to perform its intended Tech Spec function.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because Pressurizer PORVs support the LTOP system in MODE 4. Therefore, the applicant could conclude the Pressurizer PORVs are required to be OPERABLE in MODES 1-4. While this is technically true, it is covered by two separate Technical Specifications.

The second part is plausible if the applicant concludes that the Pressurizer PORV must be capable of opening automatically to perform its intended function. This is reasonable since automatic operation of the Pressurizer PORVs is discussed in the Tech Spec 3.4.11 basis as part of the PORVs ability to prevent a Reactor Trip on high pressure during continuous rod withdrawal events. However automatic operation is not required to perform its intended Tech Spec function.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because Pressurizer PORVs support the LTOP system in MODE 4. Therefore, the applicant could conclude the Pressurizer PORVs are required to be OPERABLE in MODES 1-4. While this is technically true, it is covered by two separate Technical Specifications.

The second part is correct.

Basis for meeting the K

The K/A is matched because the applicant is required to "interpret" the effect of actions taken during a Pressurizer pressure instrument (Selected Pressurizer Pressure) failing high to determine if those actions have rendered other equipment inoperable.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

Neither part of the question is related to Tech Spec actions required in 1 hour or less.

2) This question can NOT be answered by knowing information listed "above-the-line".

The first part of the question is "above-the-line" knowledge and is therefore RO-level knowledge.

The second part of the question is related to knowledge of the Tech Spec Bases and is therefore not "above-the-line" knowledge.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

This question is related to Tech Spec 3.4.11 (Pressurizer PORVs) and is NOT related to TS Safety Limits.

4) This question requires the applicant to possess knowledge only found in the Tech Spec 3.4.11 Bases. Therefore, it is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	NEW	

Development References
REFERENCES: Lesson Plan OP-MC-PS-IPE Rev 4E AP-11 (Pressurizer Pressure Anomolies) Rev. 12 Tech Spec 3.4.11 (Pressurizer PORVs) Tech Spec 3.4.11 Bases LEARNING OBJECTIVES: OP-MC-PS-IPE Objective 14

Student References Provided

APE027 AA2.15 - Pressurizer Pressure Control System (PZR PCS) Malfunction

Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: (CFR: 43.5 / 45.13)

Actions to be taken if PZR pressure instrument fails high ....

401-9 Comments:

Remarks/Status

Q85 References

control signals are developed using a Median Select Second Highest algorithm. The Selected pressurizer pressure signal is displayed on the pressurizer pressure recorder.

2.2 Pressurizer Pressure Control Signals

Objective #3

Refer to Drawing 7.3, Composite Pressurizer Pressure Control. The Pressure Control Signals are developed using a Median Select Second Highest Algorithms receiving input from the available pressurizer pressure channels. Selected Pressurizer Pressure 1, inputs to the Pressurizer Master Controller (heaters, sprays, Low/Hi Press Dev. Annunciators, & PORV NC-34A), the MCB Recorder, and the Low Pressure Interlock for PORV's NC-32B and NC-36B(2185 psig). Selected Pressurizer Pressure 2, inputs the pressure signal to PORV's NC 32B and NC-36B (lift setpoint) 2335 psig, the High pressure alarm (setpoint 2310 psig) and the Low Pressure Interlock for NC-34A (setpoint 2185 psig).

2.3 Pressurizer Pressure Master Controller

The Pressurizer Pressure Master Controller (Soft Panel Only) compares actual pressure (Median Select 2nd Highest) with a reference pressure. The reference pressure is entered on the graphic soft controller. Refer to Drawing 7.13, PZR Pressure Control DCS Graphic. Using the PZR PRESS MASTER Pop-up on the PZR Pressure Control Graphic, the operator will depress the "A" button and using the "Increase/Decrease" pushbuttons underneath can adjust the setpoint to the desired value. The range of the Master controller is 1700 to 2335 psig with the normal setpoint being 2235 psig. The difference between actual pressure and reference pressure generates a pressure error. Depending on the size and polarity of the error, the Pressurizer Pressure Master will cause various control functions to actuate in attempts to restore actual pressure back to the reference value.

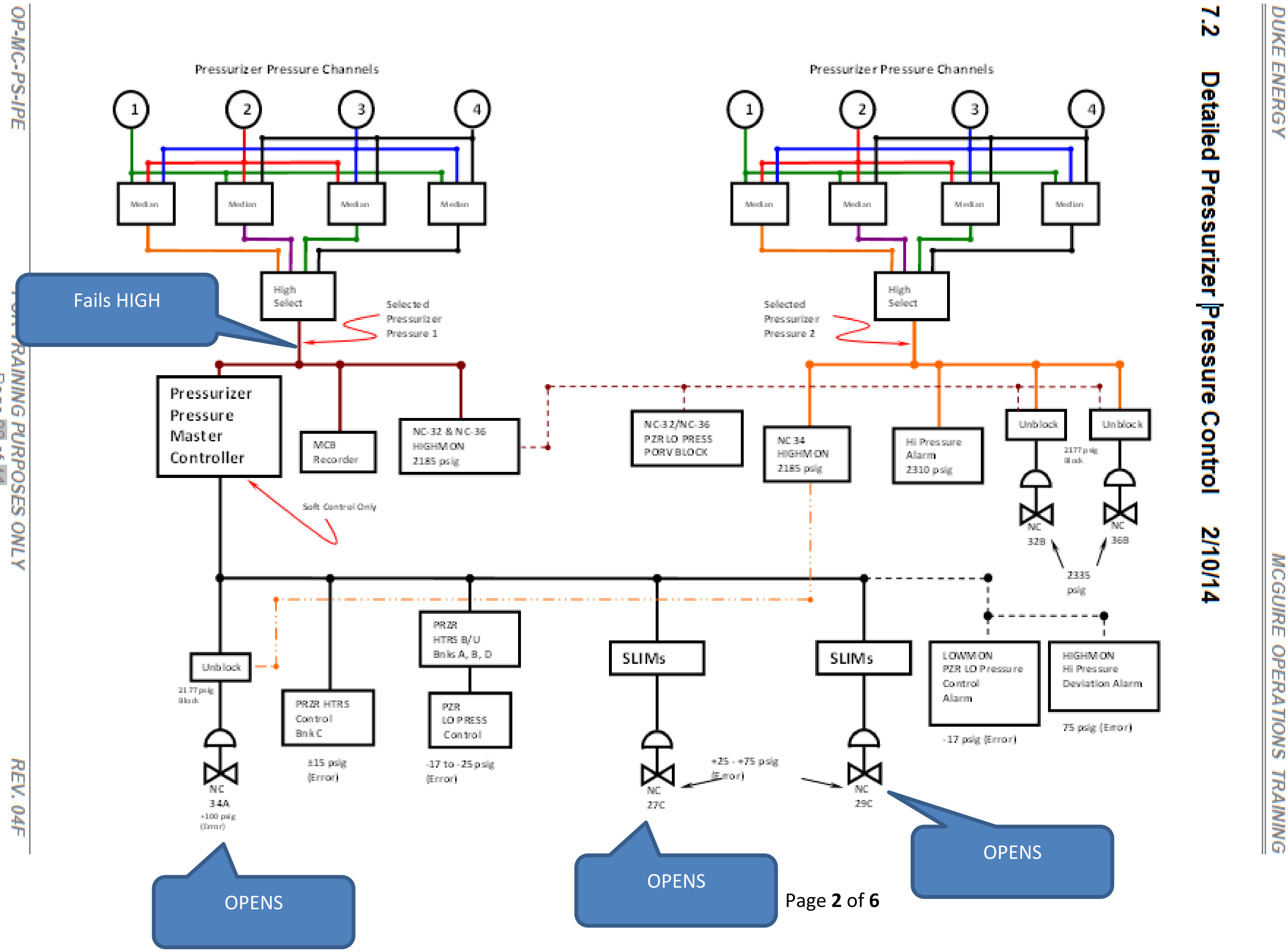
2.3.1 Signal Conditioning

The output of the Actual vs Setpoint comparison is conditioned by a proportional/integral circuit. The proportional part of the circuit generates an output equal to the amount of offset (actual minus reference). The integral part of the circuit boosts the output in the direction of the offset, **depending on how long** the offset exists. The intention of the integral function is to return the controlled parameter to (or close to) the desired setpoint.

Objective #7

The integral function can come into play during steady state operation. During normal operation if a set of backup heater are turned on, (normally NOT required to make up for ambient losses), pressure will start to slowly increase. With no integral, the pressure would increase to 2260 psig, with a corresponding controller output of 25 psig (Error) where sprays would begin to open. **With the integral**, as soon as pressure increased above 2235 psig, the output would begin to be boosted to more than just the amount attributable to the offset. The result is the output would reach 25 psig (Error) prior to pressure getting to 2260 psig, and the output would continue to be boosted, even

Q85 References



Q85 References

MNS AP/2/A/5500/11 UNIT 2	PRESSURIZER PRESSURE ANOMALIES	PAGE NO. 2 of 9 Rev. 12

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Pzr pressure going down in an uncontrolled manner**
- **Pzr pressure going up in an uncontrolled manner**
- **Any Pzr PORV failed open**
- **Any Pzr spray valve failed open**
- **"PZR PORV DISCH HI TEMP" alarm**
- **"PRT HI TEMP" alarm.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 1. **Check Pzr pressure - HAS GONE DOWN.**	___ **GO TO Step 15.**
___ 2. **Check Pzr PORVs - CLOSED.**	**Perform the following:** ___ a. CLOSE PORVs. ___ b. **IF** PORV will not close, **THEN** CLOSE affected PORV isolation valve.
___ 3. **Check Pzr spray valves - CLOSED.**	___ **CLOSE Pzr spray valve(s).**

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

---NOTE---
Separate Condition entry is allowed for each PORV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more PORVs inoperable and capable of being manually cycled.	A.1 Close and maintain power to associated block valve.	1 hour
B. One or two PORVs inoperable and not capable of being manually cycled.	------------------NOTE------------------ Required Actions B.1 and B.2 are not applicable to a PORV made inoperable by Required Action C.2. ---	
	B.1 Close associated block valves.	1 hour
	AND	
	B.2 Remove power from associated block valves.	1 hour
	AND	
		(continued)

Q85 References

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

BASES

BACKGROUND

The pressurizer is equipped with two types of devices for pressure relief: pressurizer safety valves and PORVs. The PORVs are air operated valves that are controlled to open at a specific set pressure when the pressurizer pressure increases and close when the pressurizer pressure decreases. The PORVs may also be manually operated from the control room.

Block valves, which are normally open, are located between the pressurizer and the PORVs. The block valves are used to isolate the PORVs in case of excessive leakage or a stuck open PORV. Block valve closure is accomplished manually using controls in the control room. A stuck open PORV is, in effect, a small break loss of coolant accident (LOCA). As such, block valve closure terminates the RCS depressurization and coolant inventory loss.

The PORVs and their associated block valves may be used by plant operators to depressurize the RCS to recover from certain transients if normal pressurizer spray is not available. Additionally, the series arrangement of the PORVs and their block valves permit performance of surveillances on the valves during power operation.

The PORVs may also be used for feed and bleed core cooling in the case of multiple equipment failure events that are not within the design basis, such as a total loss of feedwater.

The PORVs, their block valves, and their controls are powered from the vital buses that normally receive power from offsite power sources, but are also capable of being powered from emergency power sources in the event of a loss of offsite power. Three PORVs and their associated block valves are powered from two separate safety trains (Ref. 1).

The plant has three PORVs, each having a relief capacity of 210,000 lb/hr at 2335 psig. The functional design of the PORVs is based on maintaining pressure below the Pressurizer Pressure—High reactor trip setpoint following a step reduction of 50% of full load with steam dump. In addition, the PORVs minimize challenges to the pressurizer safety valves and also may be used for low temperature overpressure protection (LTOP). See LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System."

Q85 References

APPLICABLE SAFETY ANALYSES

Plant operators employ the PORVs to depressurize the RCS in response to certain plant transients if normal pressurizer spray is not available. For the Steam Generator Tube Rupture (SGTR) event, the safety analysis assumes that manual operator actions are required to mitigate the event. A loss of offsite power is assumed to accompany the event, and thus, normal pressurizer spray is unavailable to reduce RCS pressure. The PORVs are assumed to be used for manual RCS depressurization, which is one of the steps performed to equalize the primary and secondary pressures in order to terminate the primary to secondary break flow and the radioactive releases from the affected steam generator.

The PORVs are assumed to operate in safety analyses for events that result in increasing RCS pressure for which departure from nucleate boiling ratio (DNBR) criteria are critical. By assuming PORV automatic actuation, the primary pressure remains below the high pressurizer pressure trip setpoint; thus, the DNBR calculation is more conservative. Events that assume this condition include uncontrolled bank withdrawal at power, uncontrolled bank withdrawal from subcritical, and single rod withdrawal at power (Ref. 2).

Pressurizer PORVs satisfy Criterion 3 of 10 CFR 50.36 (Ref. 3).

LCO

The LCO requires the PORVs and their associated block valves to be OPERABLE for manual operation to mitigate the effects associated with an SGTR.

By maintaining two PORVs and their associated block valves OPERABLE, the single failure criterion is satisfied. Three PORVs are required to be OPERABLE to meet RCS pressure boundary requirements. The block valves are available to isolate the flow path through either a failed open PORV or a PORV with excessive leakage. Satisfying the LCO helps minimize challenges to fission product barriers.

APPLICABILITY

In MODES 1, 2, and 3, the PORV and its block valve are required to be OPERABLE to limit the potential for a small break LOCA through the flow path. The most likely cause for a PORV small break LOCA is a result of a pressure increase transient that causes the PORV to open. Imbalances in the energy output of the core and heat removal by the secondary system can cause the RCS pressure to increase to the PORV opening setpoint. The most rapid increases will occur at the higher operating power and pressure conditions of MODES 1 and 2.

ILT-16-1 MNS SRO NRC Examination **QUESTION 86** 86 **A**

EPE029 EA2.09 - Anticipated Transient Without Scram (ATWS)
Ability to determine or interpret the following as they apply to a ATWS : (CFR 43.5 / 45.13)
Occurrence of a main turbine/reactor trip ....

Given the following initial conditions on Unit 1:

- The unit is at 30% RTP
- NC pump 1C trips due to an error during I&E testing

Subsequently,

- A lockout occurs on 1A Busline due to a fault
- The Reactor Trip breakers remain closed

Based on the conditions above,

1) an ATWS _______ in progress.

2) the crew will _______.

Which ONE (1) of the following completes the statements above?

PROCEDURE LEGEND:

Technical Specification 3.4.4 (RCS LOOPS MODES 1 & 2)

REFERENCE PROVIDED

A. 1. is
2. manually trip the turbine to conserve SG inventory

B. 1. is
2. manually trip the turbine to generate a redundant reactor trip signal

C. 1. is NOT
2. restart 1C NC pump within 6 hours to comply with TS 3.4.4

D. 1. is NOT
2. place the unit in MODE 3 within 6 hours to comply with TS 3.4.4
.

General Discussion

For the conditions given, because the 1C NC pump has tripped prior to 1A Busline Lockout, a slow transfer of 1TA and 1TC will occur. The slow transfer will result in an underfrequency condition on 1TA and 1TC which will cause all four NC pumps to trip. This results in a reactor trip signal. Since the reactor trip breakers remain closed, an ATWS condition exists.

One of the actions required for the ATWS condition is to manually trip the main turbine to converse inventory in the SGs. The worse case ATWS scenario is a failure of the reactor to trip coincident with a loss of heat sink.

Had the 1B or 1D NC pump tripped prior to the 1A Busline Lockout, a fast transfer of the 1TA and 1TC busses would have occurred, no underfrequency condition would have occurred, and the remaining NC pumps would still be running. Therefore, an ATWS condition would not exist. However, since the unit would be in MODE 1 with less than 4 NC loops in service, at shutdown to MODE 3 within 6 hours would be required IAW TS 3.4.4. Additionally, if power was less than 25% RTP, the NC pump could be restarted and the actions of TS 3.4.4 would not be required.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is correct.

Part (2) is plausible because tripping the turbine would in fact provide a redundant reactor trip signal.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is plausible if the applicant concludes conditions are met for a fast transfer of 1TA and 1TC. If that were the case the auto-swap would occur and no ATWS condition would exist.

Part (2) is plausible if the applicant concludes that a fast transfer of 1TA and 1TC has occurred (i.e., no ATWS is in progress) and does NOT recall the requirement that a Reactor Coolant Pump cannot be started with power greater than 25% RTP. If so, the applicant would conclude that restarting the NC pump is possible and that after the pump is started (i.e. the loop returned to service) the LCO requirements of TS 3.4.4 would be met. In other words, if a fast transfer had occurred and power was less than 25% RTP, this would be the correct answer.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is plausible if the applicant concludes conditions are met for a fast transfer of 1TA and 1TC. If that were the case the auto-swap would occur and no ATWS condition would exist.

Part (2) is plausible if the applicant concludes that a fast transfer of 1TA and 1TC has occurred. If a fast transfer of 1TA and 1TC had occurred the Reactor should NOT trip and an ATWS would not be in progress. Consequently, since a Reactor Coolant Pump cannot be started with power greater than 25% RTP, this would be the correct action.

Basis for meeting the K

This K/A is matched because the applicant is being asked to evaluate (interpret) a set of plant conditions and determine whether or not an ATWS has occurred. He is then asked about actions contained in the ATWS EOP (Immediately tripping the main turbine) and the reason for that action.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must analyze the conditions given to determine if a reactor trip should have occurred.

The applicant must then recall from memory the action to be taken and the reason for that action based on the results of the analysis from the first part of the question.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

Part 1 of the question can be answered with system knowledge and is therefore RO-level knowledge.

2) The question can NOT be answered by knowing immediate operator actions.

The question cannot be answered solely by knowing immediate actions. While A2 and C2 are related to the immediate actions of FR-S.1, the applicant must be able to select between those actions and the actions in B2 and D2. Additionally, the only way the applicant could select between A2 and C2 would be to know the reason for performing that action which can only be gained by detailed knowledge of the FR-S.1 Background documents. That is NOT expected knowledge for ROs.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

The the question is related to procedure actions and NOT procedure entry conditions.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

This is detailed knowledge of procedure content related to knowing the plant shutdown requirements.

5) The question also requires the applicant to assess given plant conditions and determine whether or not an ATWS has actually occurred and then selecting a given action that is contained in the correct procedure to mitigate the event and the basis for that action. Therefore, it is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	2011 MNS NRC Exam Q84 (Bank 4434)

Development References
REFERENCES: (OMP) 4.3 (Use of Abnormal and Emergency Procedures) Rev. 40 FRP-S.1 (ATWS) Rev 14 Lesson Plan OP-MC-EP-FRS (ATWS) Background Document Rev. 12 LEARNING OBJECTIVES: OP-MC-EP-FRS Objective 7

Student References Provided
Tech Spec 3.4.4. (RCS Loops Modes 1 & 2)

EPE029 EA2.09 - Anticipated Transient Without Scram (ATWS)

Ability to determine or interpret the following as they apply to a ATWS : (CFR 43.5 / 45.13)

Occurrence of a main turbine/reactor trip ....

401-9 Comments:

Remarks/Status

Q86 References

7.9 ATWS

An ATWS (Anticipated Transient Without Scram) is defined in 10 CFR 50.62 as an anticipated operational occurrence followed by the failure of the reactor trip portion of the protective system. An anticipated operational occurrence is defined in 10 CFR 50, Appendix A, as those conditions of normal operation which are expected to occur one or more times during the life of the nuclear power unit and include but are **NOT** limited to loss of power to all NC pumps, tripping of the turbine generator, isolation of the main condenser and loss of all offsite power. Clearly, to have an ATWS there must be transient followed by a failure of the reactor trip breakers.

Instrument failures, by themselves, are **NOT** necessarily transients. For example, if one channel of Power Range Nuclear Instrument was out of service for preventive maintenance (bistable in tripped condition) and if another Power Range Nuclear Instrument channel failed, a reactor trip signal would be generated. **IF** the reactor failed to trip, this would be a failure of the reactor trip breakers and the automatic trip features of the reactor protection system and **NOT** an ATWS event. Obviously, the control operators would have to recognize and check that the channel failure was indeed a channel failure by checking the other two channels in this example. This would, however, force OPS to shutdown the affected unit to at least Hot Standby per Tech Specs.

7.10 Adverse Containment Setpoints

Many setpoints in the EPs are presented in a dual format with a second setpoint enclosed in parentheses. This second setpoint is used to account for the additional error in the setpoint due to the containment environment following a high-energy line break. The setpoint in parentheses will be used whenever containment pressure has exceeded 3 psig.

Q86 References

MNS EP/1/A/5000/FR-S.1 **UNIT 1**	RESPONSE TO NUCLEAR POWER GENERATION/ATWS	PAGE NO. 2 of 29 Rev. 15

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

CAUTION **NC pumps should not be tripped with Reactor power greater than 5%.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. **Check Reactor Trip:**	**Perform the following:**
__ • All rod bottom lights - LIT	__ a. Trip the reactor.
__ • Reactor trip and bypass breakers - OPEN	__ b. **IF** reactor will not trip, **THEN** manually insert rods.
__ • I/R power - GOING DOWN.	
2. **Check Turbine Trip:**	**Perform the following:**
__ • All throttle valves - CLOSED.	__ a. Trip turbine.
	b. **IF** turbine will not trip, **THEN** perform the following:
	__ 1) Place turbine in manual.
	__ 2) CLOSE governor valves in fast action.
	3) **IF** governor valves will not close, **THEN** CLOSE the following valves:
	__ • All MSIVs
	__ • All MSIV Bypass Valves.
__ 3. **Monitor Foldout page.**	
4. **Check proper CA pump status:**	
__ a. MD CA pumps - ON.	__ a. Start pumps.
__ b. Check N/R Level in at least 3 S/Gs - GREATER THAN 17%.	__ b. Ensure TD CA pump is running.

Q86 References

STEP 2 Check Turbine Trip: (IMMEDIATE ACTION)

PURPOSE: To ensure that the turbine is tripped.

BASIS: The turbine is tripped to prevent an uncontrolled cooldown of the RCS due to steam flow that the turbine would require. For an ATWS event where a loss of normal feedwater has occurred, analyses have shown that a turbine trip is necessary (within 30 seconds) to maintain S/G inventory. For other ATWS events, manual tripping of the turbine may yield a higher system pressure than would otherwise occur. However, this action has been determined to be necessary due to the analytical results discussed earlier. Since there are many initiating ATWS events and some that require immediate mitigating actions, diagnosis of the initiating event would not be feasible and separate guidance for different ATWS events would complicate training and could delay timely performance of necessary operator actions.

If the turbine will not trip, a turbine runback (manual lowering of load) at maximum rate will also reduce steam flow in a delayed manner. If the turbine stop valves cannot be closed by either trip or runback, the MSIVs and MSIV bypass valves should be closed.

STEP 3 Monitor foldout page.

PURPOSE: Remind the operators to monitor the Foldout Page.

BASIS: The Foldout Page contains three items:

1. Transfer to Cold Leg Recirculation if FWST low level is reached. This operator action is required no matter what EP is in effect to ensure the transfer is accomplished without delay.
2. CA Suction Source Monitoring.
3. Criteria for isolating and unisolating the NV Pump Recirculation Isolation Valves (NV-150 and NV-151).

STEP 4 Check proper CA pump status:

PURPOSE: To ensure proper CA pump status.

BASIS: The MD CA pumps start automatically on an S/I signal and S/G low level to provide feed to the S/Gs for decay heat removal. If S/G levels drop below 17%, the TD CA pump will also automatically start to supplement the MD pumps.

STEP 5 Initiate emergency boration of NC System:

Direct manner of adding negative reactivity to the core. The intended boration path here is the most direct one available, not requiring S/I initiation, but using the normal NV pump(s). Charging flow is verified to be greater than emergency boration flow to ensure emergency boration flow is going into the NC System. Several means of rapid boration are listed in the procedure in order of preference.

Q86 References

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops—MODES 1 and 2

LCO 3.4.4 Four RCS loops shall be OPERABLE and in operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of LCO not met.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.4.1 Verify each RCS loop is in operation.	In accordance with the Surveillance Frequency Control Program

C

2011 MNS SRO NRC Examination QUESTION 84 84

EPE007 EA2.04 - Reactor Trip

Ability to determine or interpret the following as they apply to a reactor trip: (CFR 41.7 / 45.5 / 45.6)

If reactor should have tripped but has not done so, manually trip the reactor and carry out actions in ATWS EOP

Given the following initial conditions on Unit 1:

- The unit is operating at 30% RTP
- NC pump 1C trips due to mis-operation during I&E testing
- Subsequently, a lockout occurs on 1A Busline due to a fault
- The Reactor Trip breakers remain closed

1) Which ONE (1) of the following describes the plant response?

2) For the conditions described above what actions are required and the basis for those procedure actions?

A. 1. 1TA and 1TC auto-swap.
2. Restart 1C NC pump within 6 hours to comply with TS 3.4.4 (RCS Loops Modes 1 & 2).

B. 1. 1TA and 1TC auto-swap.
2. Place the unit in MODE 3 within 6 hours to comply with TS 3.4.4 (RCS Loops Modes 1 & 2).

C. 1. An ATWS is in progress.
2. Manually trip the turbine to conserve SG inventory.

D. 1. An ATWS is in progress.
2. Manually trip the turbine to generate a redundant reactor trip signal.

Q86 Parent Question (2011 MNS NRC Exam Q84 (Bank 4434))

2011 MNS SRO NRC Examination QUESTION 84 84 **C**

General Discussion

For the conditions given, because the 1C NC pump has tripped prior to 1A Busline Lockout, a slow transfer of 1TA and 1TC will occur. The slow transfer will result in an underfrequency condition on 1TA and 1TC which will cause all four NC pumps to trip. This results in a reactor trip signal. Since the reactor trip breakers remain closed, and ATWS condition exists.

One of the actions required for the ATWS condition is to manually trip the main turbine to converse inventory in the SGs. The worse case ATWS scenario is a failure of the reactor to trip coincident with a loss of heat sink.

Had the 1B or 1D NC pump tripped prior to the 1A Busline Lockout, a fast transfer of the 1TA and 1TC busses would have occurred, no underfrequency condition would have occurred, and the remaining NC pumps would still be running. Therefore, an ATWS condition would not exist. However, since the unit would be in MODE 1 with less than 4 NC loops in service, at shutdown to MODE 3 within 6 hours would be required IAW TS 3.4.4.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is plausible if the applicant concludes conditions are met for a fast transfer of 1TA and 1TC. If that were the case the auto-swap would occur and no ATWS condition would exist.

Part (2) Plausible because if the pump were restarted, the unit would be in compliance with TS 3.4.4. However, since reactor power is greater than 25% RTP, restarting the NC pump is not allowed.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is plausible if the applicant concludes conditions are met for a fast transfer of 1TA and 1TC. If that were the case the auto-swap would occur and no ATWS condition would exist.

Part (2) Plausible because if a fast transfer of 1TA and 1TC occurred, this would be the correct action.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

Part (1) is correct.

Part (2) is plausible because tripping the turbine would provide a redundant reactor trip signal.

Basis for meeting the KA

This K/A is matched because the applicant is being asked to evaluate (interpret) a set of plant conditions and determine whether or not an ATWS has occurred. He is then asked about actions contained in the ATWS EOP (Immediately tripping the main turbine) and the reason for that action.

Basis for Hi Cog

This question is Hi Cog because the applicant must evaluate a given set of conditions and through a multipart mental process, determine the required actions based on these conditions evaluate the required actions and the reason for that action.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):
1) The question can NOT be answered solely by knowing systems knowledge.
2) The question can NOT be answered by knowing immediate operator actions. Neither of the actions described are immediate actions.
3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure. This is detailed knowledge of procedure content related to knowing the plant shutdown requirements.
5) The question also requires the applicant to assess given plant conditions and determine whether or not an ATWS has actually occurred and then selecting a given action that is contained in the correct procedure to mitigate the event and the basis for that action.

C

2011 MNS SRO NRC Examination QUESTION 84 84

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
(OMP) 4.3 (Use of Abnormal and Emergency Procedures) Page 10 of 35 FRP S.1 (ATWS) Background Document Pg 25 of 69

Student References Provided

EPE007 EA2.04 - Reactor Trip

Ability to determine or interpret the following as they apply to a reactor trip: (CFR 41.7 / 45.5 / 45.6)

If reactor should have tripped but has not done so, manually trip the reactor and carry out actions in ATWS EOP

....

401-9 Comments:

Remarks/Status
401-9 Comment: EDITORIAL. B2 is a true statement therefore it could be argued as correct on an appeal. Need to make sure that it is totally incorrect. RESOLUTION: Only part of B2 is true. The action to trip the turbine is correct. However, during an ATWS the reason for tripping the turbine is not to generate a redundant Reactor Trip signal. It is to conserve inventory in the SGs. Therefore, B2 is not true. HCF 5/15/11

EPE038 2.2.22 - Steam Generator Tube Rupture (SGTR)
EPE038 GENERIC
Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)

Given the following conditions on Unit 1:

- The unit is at 100% RTP
- 1EMF-33 (CONDENSER AIR EJECTOR EXHAUST) is INOPERABLE
- The crew is performing PT/1/A/4150/001 B (REACTOR COOLANT LEAKAGE CALCULATION)
- During the surveillance, S/G Primary-to-Secondary leakage was determined to be:

S/G	Leakage (GPD)
1A	125
1B	50
1C	75
1D	40

Based on the conditions above,

1) in accordance with PT/1/A/4150/001 B, the preferred method to evaluate whether the requirements of Technical Specification Surveillance SR 3.4.13.2 (Primary-to-Secondary Leakage) are met is ________.

2) Primary-to-Secondary leakage ________ within the limits of Technical Specification 3.4.13 (RCS OPERATIONAL LEAKAGE).

Which ONE (1) of the following completes the statements above?

COMPONENT LEGEND:

1EMF-71 thru 74 (N16 LEAKAGE)

A. 1. grab sample results
2. is

B. 1. grab sample results
2. is NOT

C. 1. 1EMF-71 thru 74 indications
2. is

D. 1. 1EMF-71 thru 74 indications
2. is NOT

General Discussion

In accordance with PT/1/A/4150/001B (Reactor Coolant Leakage Calculation), if the unit is in MODE 1 greater than 40% RTP and 1EMF-33 is INOPERABLE or the OAC is unavailable, the procedure directs using 1EMF-71 thru 74 indications to evaluate primary-to-secondary leakage.

The Technical Specification 3.4.13 (RCS Operational Leakage) limits for primary-to-secondary leakage are:

≤ 135 GPD through any one S/G and ≤ 389 GPD total through all S/Gs

Since the highest leakage through any single S/G is 125 GPD and the total leakage through all S/Gs is 290 GPD, primary-to-secondary leakage IS within the limits of Technical Specification 3.4.13.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this would be the method used (based on the conditions given) if the unit was less than 40% RTP OR if ANY of the N-16 monitors were INOPERABLE.

The second part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this would be the method used (based on the conditions given) if the unit was less than 40% RTP OR if ANY of the N-16 monitors were INOPERABLE.

The second part is plausible because S/G 1A is close to the limit for leakage through a single S/G. Additionally, if the applicant confuses the leakage limits for a single S/G with the total leakage limit, they would conclude that primary-to-secondary leakage is NOT within limits since total leakage exceeds the limit for a single S/G.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because S/G 1A is close to the limit for leakage through a single S/G. Additionally, if the applicant confuses the leakage limits for a single S/G with the total leakage limit, they would conclude that primary-to-secondary leakage is NOT within limits since total leakage exceeds the limit for a single S/G.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of the Tech Spec Surveillance requirements and leakage limits of Tech Spec 3.4.13 related to primary-to-secondary leakage (i.e. S/G Tube leak).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must analyze the data given to determine the total leakage through all S/Gs.

Next, the applicant must recall from memory the leakage limits of Tech Spec 3.4.13 (RCS Operational Leakage).

Next, the applicant must evaluate the individual leakages and the total leakage calculated earlier again the recalled leakage limits.

Finally, the applicant must recall the surveillance requirements for evaluating primary-to-secondary leakage from the surveillance.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

Neither part of the question is related to systems knowledge. However, the second part of the question is "above-the-line" Tech Spec knowledge and is therefore RO knowledge.

2) The question can NOT be answered by knowing immediate operator actions.

Neither part of the question is related to procedure immediate actions.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

Neither part of the question is related to procedure entry conditions.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

This is detailed knowledge of procedure steps and procedure usage.

5) The question requires the applicant to evaluate the conditions given and select between two options in the procedure for evaluating primary-to-secondary leakage. Therefore, the question involves both procedure assessment AND selection and as such is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: PT/1/A/4150/001B (Reactor Coolant Leakage Calculation) Rev. 93 Technical Specification 3.4.13 (RCS Operational Leakage) LEARNING OBJECTIVES: NONE

Student References Provided

EPE038 2.2.22 - Steam Generator Tube Rupture (SGTR)
EPE038 GENERIC
Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)

401-9 Comments:

Remarks/Status

Q87 References

Enclosure 13.1

NC Leakage Calculation Using OAC

1.26 Determine Primary to Secondary Leakage by performing the following:

_____ 1.26.1 **IF** in Mode 1 **AND** 1EMF33 is operable **AND** OAC is available, record OAC point M1P0188 (Primary to Secondary Leakrate, 5 Minute Running Average): ________________ gpd [3]

_____ 1.26.2 **IF** in Mode 1 greater than or equal to 40% RTP **AND** 1EMF33 is **NOT** operable **OR** OAC is unavailable, record indication on the following:

- 1EMF71: ________________ gpd
- 1EMF72: ________________ gpd
- 1EMF73: ________________ gpd
- 1EMF74: ________________ gpd

_____ 1.26.2.1 **IF** any N-16 EMF inoperable, perform the following:

_____ A. Notify Secondary Chemistry to provide Primary to Secondary leakage.

__________________________ ______/______
Person Notified Date Time

☐ B. Record Primary to Secondary leakage as determined by Secondary Chemistry: ________________ gpd [3]

☐ C. Record date and time Primary to Secondary leakage was determined (provided by Secondary Chemistry):

___________ / ___________
Date Time

[3] This value is a total primary to secondary leakage of all four S/Gs. A value of less than or equal to 135 gpd conservatively implies leakage through any one S/G is less than or equal to 135 gpd.

Unit 1

Q87 References

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE;

d. 389 gallons per day total primary to secondary LEAKAGE through all steam generators (SGs); and

e. 135 gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS Operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time of Condition A not met. OR Pressure boundary LEAKAGE exists. OR Primary to secondary LEAKAGE not within limits.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

Q87 References

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.13.1 -	----------------------------NOTES------------------------------ 1. Not required to be performed until 12 hours after establishment of steady state operation. 2. Not applicable to primary to secondary LEAKAGE. --- Verify RCS Operational LEAKAGE is within limits by performance of RCS water inventory balance.	---------NOTE------- Only required to be performed during steady state operation ---------------------- In accordance with the Surveillance Frequency Control Program
SR 3.4.13.2	-----------------------------NOTE------------------------------- Not required to be performed until 12 hours after establishment of steady state operation. --- Verify primary to secondary LEAKAGE is ≤ 135 gallons per day through any one SG and ≤ 389 gallons per day total through all SGs.	In accordance with the Surveillance Frequency Control Program

ILT-16-1 MNS SRO NRC Examination QUESTION 88 88 **D**

EPE011 2.2.38 - Large Break LOCA
EPE011 GENERIC
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

In accordance with Tech Spec 3.6.6 (CONTAINMENT SPRAY SYSTEM) Bases:

1) the Containment Spray System is designed to work in conjunction with the Ice Condensers to limit peak Containment Pressure and peak Containment Temperature during a Design-Basis ________,

AND

2) a Design-Basis LOCA will result in peak Containment ________.

Which ONE (1) of the following completes the statements above?

A. 1. LOCA ONLY
2. pressure

B. 1. Steam Line Break ONLY
2. temperature

C. 1. LOCA OR Steam Line Break
2. temperature

D. 1. LOCA OR Steam Line Break
2. pressure

General Discussion

In accordance with the Containment Spray System Design Basis:

"The Containment Spray System provides containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values."

The Containment Spray System is by definition an integral part of the Containment Cooling System.

In accordance with TS 3.6.6 (Containment Spray System) basis, the Containment Spray System is designed to limit containment pressure during a DBA LOCA or SLB. However, no two DBAs are assumed to occur simultaneously or consecutively.

In accordance with TS 3.6.6 Basis, peak Containment pressure is reached on a Design-Basis LOCA and peak Containment temperature is reached on a Design-Basis Steam Break Accident.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because both DBAs are considered during the analysis. However, they are considered to occur separately, not simultaneously or consecutively.

Part 2 is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because both DBAs are considered during the analysis. However, they are considered to occur separately, not simultaneously or consecutively.

Part 2 is plausible because peak containment temperature occurs during a DBA SLB.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is correct.

Part 2 is plausible because peak containment temperature occurs during a DBA SLB.

Answer D Discussion

CORRECT. See explanation above.

Basis for meeting the K

The K/A is matched because the applicant must have knowledge of the basis of Tech Spec 3.6.6 as it relates to the mitigation of a Large Break LOCA.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
The question does not relate to less than 1 hour Tech Specs

2) This question can NOT be answered by knowing information listed "above-the-line".
This is not related to above the line knowledge in Tech Specs.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.
This question is not related to Tech Spec Safety Limits.

4) This question requires the applicant to have knowledge of the Tech Spec Basis. Specifically, it requires the applicant to have knowledge of the Design-Basis capability of the Containment Spray System related to the occurrence of specific Design-Basis accidents. It is therefore SRO-only knowledge.

ILT-16-1 MNS SRO NRC Examination **QUESTION 88** 88 **D**

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2014 MNS NRC Exam Q77 (Bank 5892)

Development References
REFERENCES: Tech Spec 3.6.6 (CONTAINMENT SPRAY SYSTEM) Basis LEARNING OBJECTIVES: OP-MC-ECC-NS Objective 13

Student References Provided

EPE011 2.2.38 - Large Break LOCA
EPE011 GENERIC
Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)

401-9 Comments:

Remarks/Status
058G2.1.27 K/A is not really met. Ideally, the question should deal with AP-7 aspects and how it supports the function of the dc system. I'm not certain this is possible. You really have two very casually related questions here. I would support a K/A change if you desire it. Drl 11/10/15 Facility Response: A new KA was selected and a new question was written. SLM 11/24/15

Q88 References

BASES

BACKGROUND (continued)

For the hypothetical double-ended rupture of a Reactor Coolant System pipe, the pH of the sump solution (and, consequently, the spray solution) is raised to approximately 7.9 within one hour of the onset of the LOCA. The resultant pH of the sump solution is based on the mixing of the RCS fluids, ECCS injection fluid, and the melted ice which are combined in the sump. The alkaline pH of the containment sump water minimizes the evolution of iodine and the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to the fluid.

Containment Spray is manually initiated from the Control Room by opening the Containment Spray System (CSS) Pump discharge valves and starting the CSS Pump. The CSS is typically not activated until an RWST Low-Low level alarm is received. This alarm signals the operator to manually align the ECCS to the recirculation mode and manually initiate containment spray. The CSS maintains an equilibrium temperature between the containment atmosphere and the recirculated sump water. Operation of the CSS in the recirculation mode is controlled by the operator in accordance with emergency operation procedures.

The RHR spray operation is initiated manually, when required by the emergency operating procedures, after the Emergency Core Cooling System (ECCS) is operating in the recirculation mode. The RHR sprays are available to supplement the Containment Spray System, if desired, in limiting containment pressure. This additional spray capacity would typically be used after the ice bed has been depleted and in the event that containment pressure rises above a predetermined limit. The Containment Spray System is an ESF system. It is designed to ensure that the heat removal capability required during the post accident period can be attained.

The operation of the Containment Spray System, together with the ice condenser, is adequate to assure pressure suppression subsequent to the initial blowdown of steam and water from a DBA. During the post blowdown period, the Air Return System (ARS) is automatically started. The ARS returns upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in containment and to continue circulating heated air and steam through the ice condenser, where heat is removed by the remaining ice.

BACKGROUND (continued)

The Containment Spray System limits the temperature and pressure that could be expected following a DBA. Protection of containment integrity limits leakage of fission product radioactivity from containment to the environment.

APPLICABLE SAFETY ANALYSES

The limiting DBAs considered relative to containment OPERABILITY are the loss of coolant accident (LOCA) and the steam line break (SLB). The DBA LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. No two DBAs are assumed to occur simultaneously or consecutively. The postulated DBAs are analyzed, in regard to containment ESF systems, assuming the loss of one ESF bus, which is the worst case single active failure, resulting in one train of the Containment Spray System, the RHR System, and the ARS being rendered inoperable (Ref. 2).

The DBA analyses show that the maximum peak containment pressure results from the LOCA analysis, and is calculated to be less than the containment design pressure. The maximum peak containment atmosphere temperature results from the SLB analysis and was calculated to be within the containment environmental qualification temperature during the DBA SLB. The basis of the containment environmental qualification temperature is to ensure the OPERABILITY of safety related equipment inside containment (Ref. 3).

The Containment Spray System actuation modeled in the containment analysis is based on the time associated with reaching the RWST Low Level Setpoint and operator action prior to achieving full flow through the containment spray nozzles. A delayed response time initiation provides conservative analyses of peak calculated containment temperature and pressure responses. The Containment Spray System total response time is composed of operator action, system startup time, and time for the piping to fill.

For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the ECCS cooling effectiveness during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures in accordance with 10 CFR 50, Appendix K (Ref. 4).

Q88 Parent Question (2014 MNS NRC Q77 (Bank 5892))

ILT-30 MNS SRO NRC Examination QUESTION 77 77 **A**

SYS022 2.1.28 - Containment Cooling System (CCS)
SYS022 GENERIC
Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

In accordance with Tech Spec 3.6.6 (CONTAINMENT SPRAY SYSTEM) Basis,:

1) the Containment Spray System is designed to work in conjunction with the Ice Condensers to limit peak Containment Pressure and peak Containment Temperature during a Design-Basis ________,

AND

2) a Design-Basis LOCA will result in peak Containment ________.

Which ONE (1) of the following completes the statements above?

A. 1. LOCA OR Steam Line Break
   2. pressure

B. 1. LOCA OR Steam Line Break
   2. temperature

C. 1. LOCA ONLY
   2. pressure

D. 1. Steam Line Break ONLY
   2. temperature

FOR REVIEW ONLY - DO NOT DISTRIBUTE

ILT-30 MNS SRO NRC Examination QUESTION 77 77 A

General Discussion

In accordance with the Containment Spray System Design Basis:

"The Containment Spray System provides containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values."

The Containment Spray System is by definition an integral part of the Containment Cooling System.

In accordance with TS 3.6.6 (Containment Spray System) basis, the Containment Spray System is designed to limit containment pressure during a DBA LOCA or SLB. However, no two DBAs are assumed to occur simultaneously or consecutively.

In accordance with TS 3.6.6 Basis, peak Containment pressure is reached on a Design-Basis LOCA and peak Containment temperature is reached on a Design-Basis Steam Break Accident.

Answer A Discussion

CORRECT. See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is correct.

Part 2 is plausible because peak containment temperature occurs during a DBA SLB.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because both DBAs are considered during the analysis. However, they are considered to occur separately, not simultaneously or consecutively.

Part 2 is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
Part 1 is plausible because both DBAs are considered during the analysis. However, they are considered to occur separately, not simultaneously or consecutively.

Part 2 is plausible because peak containment temperature occurs during a DBA SLB.

Basis for meeting the K

The K/A is matched because the applicant demonstrates a knowledge of the function of the "purpose and function" of the Containment Cooling System (i.e. Containment Spray System) by demonstrating a knowledge of the Containment Spray System Design-Basis capability.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
The question does not relate to less than 1 hour Tech Specs

2) This question can NOT be answered by knowing information listed "above-the-line".
This is not related to above the line knowledge in Tech Specs.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.
This question is not related to Tech Spec Safety Limits.

4) This question requires the applicant to have knowledge of the Tech Spec Basis. Specifically, it requires the applicant to have knowledge of the Design-Basis capability of the Containment Spray System related to the occurrence of specific Design-Basis accidents. It is therefore SRO-only knowledge.

ILT-16-1 MNS SRO NRC Examination **QUESTION 89** 89 **C**

WE11 EA2.1 - Loss of Emergency Coolant Recirculation
Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation)
(CFR: 43.5 / 45.13)
Facility conditions and selection of appropriate procedures during abnormal and emergency operations.

Given the following sequence of events on Unit 1:

- A LOCA has occurred inside Containment
- The crew has transitioned from ES-1.3 (TRANSFER TO COLD LEG RECIRC) to ECA-1.1 (LOSS OF EMERGENCY COOLANT RECIRC)
- Containment pressure is currently 3.2 PSIG and lowering slowly

In accordance with ECA-1.1, while attempting to establish recirculation flow the crew will cool the core by ___(1)___.

While performing ECA-1.1, if a RED Path occurs on Core Cooling the crew ___(2)___ transition to FR-C.1 (RESPONSE TO INADEQUATE CORE COOLING).

Which ONE (1) of the following completes the statements above?

A. 1. aligning the NC system for Feed and Bleed
   2. will

B. 1. aligning the NC system for Feed and Bleed
   2. will NOT

C. 1. dumping steam from intact Steam Generators
   2. will

D. 1. dumping steam from intact Steam Generators
   2. will NOT

General Discussion

In accordance with ECA-1.1, NC system cooling is provided by dumping steam from intact S/Gs to the Main Condenser (if it is available) or to atmosphere. For the example given, a Main Steam Line Isolation has occurred. Therefore, the MSI signal must be reset before dumping steam to cooldown the NC system is available. However, the MSI signal can be reset even with Containment pressure greater than 3.0 PSIG.

If a RED Path occurs on Core Cooling while in ECA-1.1, the crew WILL transition to FR-C.1 (Response to Inadequate Core Cooling). The reason for this is that the crew transitioned to ECA-1.1 from ES-1.3 (Transfer to Cold Leg Recirc) when they were unable to establish Cold Leg Recirc. And, all transitions from ES-1.3 to ECA-1.1 have a step prior to the transition to commence monitoring CSFSTs.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because NC system Feed and Bleed is using in other procedures in the EOP network (i.e. ECA-0.0, FR-H.1). Additionally, because a Main Steam Isolation has occurred, the applicant may conclude that dumping steam is not an option. Especially since Containment pressure is still above 3.0 PSIG (MSI setpoint).

The second part is correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because NC system Feed and Bleed is using in other procedures in the EOP network (i.e. ECA-0.0, FR-H.1). Additionally, because a Main Steam Isolation has occurred, the applicant may conclude that dumping steam is not an option. Especially since Containment pressure is still above 3.0 PSIG (MSI setpoint).

The second part is plausible if the applicant does not recall the step in ES-1.3 prior to the transition to ECA-1.1 which directs the crew to commence monitoring CSFSTs. Also plausible since some Emergency procedures (ES-1.3 Transfer to Cold Leg Recirc and ECA-1.3 Containment Sump Blockage) require monitoring CSF status trees for information only.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant does not recall the step in ES-1.3 prior to the transition to ECA-1.1 which directs the crew to commence monitoring CSFSTs. Also plausible since some Emergency procedures (ES-1.3 Transfer to Cold Leg Recirc and ECA-1.3 Containment Sump Blockage) require monitoring CSF status trees for information only.

Basis for meeting the K

The K/A is match because the applicant is presented with conditions were ECA-1.1 (Loss of Emergency Coolant Recirc) has been implemented and they must determine based on given conditions if transition to FR-C.1 is allowed shouldf the RED Path conditions for Core Cooling be met.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must recall from memory the methods of cooling the NC system allowed by ECA-1.1.

Next , the applicant must evaluate the conditions given to determine how the crew entered ECA-1.1 to determine if CSFST monitoring has been implemented.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
Neither of the questions can be answered soleY by systems knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
There are no immediate actions associated with ES-1.3, ECA-1.1, or FR-C.1.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs. None of the EOPs in this question are direct-entry EOPs.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure. As it relates to the first part of the question, knowledge of the fact that initiating a cooldown to cold shutdown is part of the overall mitigating strategy of ECA-1.1, knowledge of the specifics of how that cooling is accomplished is not part of the mitigating strategy. In the second part of the question the requisite knowledge is related to procedure selection/transition and is therefore not part of the purpose, sequence of events, or overall mitigative strategy of the procedure.

5) The question requires the applicant to have sufficiently detailed knowledge of the associated procedure to allow them to make a correct decision regarding procedure transition. The applicant must know that prior to all transitions from ES-1.1 that lead to ECA-1.1, there is a step which directs implementation of the Critical Safety Function Status Trees (CSFSTs). This level of detailed procedure knowledge related to procedure transitions is not expected of ROs. Consequently, the knowledge required to answer this question is SRO level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	ILT 2013 PreAudit 2 SRO Examination AUDIT Q81 (Bank 4911)

Development References
REFERENCES: ES-1.3 (Transfer to Cold Leg Recirc) Rev. 27 ECA-1.1 (Loss of Emergency Coolant Recirc) Rev. 16 LEARNING OBJECTIVES:

Student References Provided

WE11 EA2.1 - Loss of Emergency Coolant Recirculation

Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation)

(CFR: 43.5 / 45.13)

Facility conditions and selection of appropriate procedures during abnormal and emergency operations.

401-9 Comments:

Remarks/Status

Q89 References

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE After the Low Pressure Steamline Isolation signal is blocked, maintaining steam pressure negative rate less than 2 PSIG per second will prevent a Main Steam Isolation.

13. **Initiate NC System cooldown to Cold Shutdown as follows:**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
a. Check condenser available as follows: __ • MSIV on intact S/G(s) - OPEN __ • "C-9 COND AVAILABLE FOR STEAM DUMP" status light (1SI-18) - LIT.	__ a. **GO TO** RNO for Step 13.d.
__ b. Check "STEAM DUMP SELECT" - IN STEAM PRESSURE MODE.	b. Perform the following to place steam dumps in steam pressure mode: __ 1) Place "STM PRESS CONTROLLER" in manual. __ 2) Adjust "STM PRESS CONTROLLER" output to equal "STEAM DUMP DEMAND" signal. __ 3) Place "STEAM DUMP SELECT" in steam pressure mode.
__ c. **WHEN** "P-12 LO-LO TAVG" status light (1SI-18) lit, **THEN** place steam dumps in bypass interlock.	

MNS EP/1/A/5000/ECA-1.1 **UNIT 1**	LOSS OF EMERGENCY COOLANT RECIRC	PAGE NO. **12 of 109** Rev. 16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
13. (Continued)	
__ d. Dump steam to condenser from intact S/Gs while maintaining cooldown rate in NC T-Colds as close as possible without exceeding 100°F in an hour.	d. Perform the following: __ 1) Ensure NC System depressurized to less than 1955 PSIG using Pzr spray or PORV as required. __ 2) Ensure Low Pressure Steamline Isolation is blocked. __ 3) Maintain NC pressure less than 1955 PSIG. __ 4) Ensure Main Steam Isolation reset. __ 5) Ensure SM PORVs reset. __ 6) Dump steam using all intact S/G(s) SM PORVs while maintaining cooldown rate in NC T-Colds as close as possible without exceeding 100°F in an hour.

(RNO continued on next page)

Q89 References

MNS EP/1/A/5000/ES-1.3 **UNIT 1**	TRANSFER TO COLD LEG RECIRC	PAGE NO. 2 of 25 Rev. 27

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Have STA monitor Foldout page.**	
NOTE • CSF procedures should not be implemented until directed by this procedure. • Double 3-way communication is not required.	
2. **Check at least one of the following alarms - LIT:** __ • "CONT SUMP LEVEL GREATER THAN 2.5 FT" on 1AD-14 - LIT OR __ • "CONT SUMP LEVEL GREATER THAN 2.5 FT" on 1AD-15 - LIT.	**IF both alarms are dark, THEN perform the following:** __ a. Reset S/I. __ b. Reset Sequencer. __ c. Ensure ND pumps are off. __ d. IF either ND pump continues to run, THEN have another licensed operator perform Enclosure 2 (Contingency if ND Pump Will Not Stop) while continuing in this RNO. e. IF LOCA inside containment has occurred, THEN perform the following: __ 1) Do not start ND pump until at least one sump level alarm is lit. __ 2) GO TO Step 3. __ f. Enable power disconnect and CLOSE 1FW-27A (Unit 1 FWST to ND Pumps Isol). __ g. EP/1/A/5000/F-0 (Critical Safety Function Status Trees) may now be implemented. __ h. GO TO EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirc).

MNS EP/1/A/5000/ES-1.3 **UNIT 1**	TRANSFER TO COLD LEG RECIRC	PAGE NO. 4 of 25 Rev. 27

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4. **Align ND System for recirc as follows:**	
a. Check the following valves - OPEN: __ • 1NI-185A (1A ND Pump Suction From Cont Sump Isol) __ • 1NI-184B (1B ND Pump Suction From Cont Sump Isol).	a. Perform the following: __ 1) Place control permissive in "BYPASS" and OPEN affected valve(s). __ 2) **IF** valve opening, **THEN** wait up to 30 seconds to allow valve to open. __ 3) **IF** valve is closed **OR** intermediate, **THEN** stop associated ND pump.
__ b. Enable power disconnect and CLOSE 1FW-27A (Unit 1 FWST to ND Pumps Isol).	
c. Check the following valves - CLOSED: __ • 1ND-19A (1A ND Pump Suction From FWST or NC Isol) __ • 1ND-4B (1B ND Pump Suction From FWST or NC Isol).	__ c. CLOSE valves.
__ d. Check any ND pump - ON.	d. Perform the following: __ 1) **IF** any ND pump is aligned to sump, **AND** is available to start after adequate sump level exists, **THEN GO TO** Step 5. 2) **IF** no ND pump is available, **OR** no ND pump can be aligned for Cold Leg Recirc, **THEN** perform the following: __ a) EP/1/A/5000/F-0 (Critical Safety Function Status Trees) may now be implemented. __ b) **GO TO** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirc).

Q89 References

MNS EP/1/A/5000/ES-1.3 **UNIT 1**	TRANSFER TO COLD LEG RECIRC	PAGE NO. 5 of 25 Rev. 27

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 5. **Check "FWST LEVEL LO-LO" alarm (20 inches) - LIT.**	**Perform the following:** **CAUTION** **The following step takes priority over any other EP guidance.** __ a. **WHEN** "FWST LEVEL LO-LO" alarm setpoint (20 inches) is reached, **THEN** immediately **GO TO** Step 6 to align NV and NI pumps to Cold Leg Recirc. __ b. Ensure this page is flagged to complete later. __ c. **GO TO** Step 7.
6. **WHEN "FWST LEVEL LO-LO" alarm (20 inches) is lit, THEN align NV and NI Systems for Cold Leg Recirc as follows:** __ a. Ensure STA continues to monitor foldout page.	

NOTE CSF procedures should not be implemented until directed by this procedure.

b. Check at least one of the following alarms - LIT: __ • "CONT SUMP LEVEL GREATER THAN 2.5 FT" on 1AD-14 - LIT OR __ • "CONT SUMP LEVEL GREATER THAN 2.5 FT" on 1AD-15 - LIT.	b. **IF** both alarms are dark, **THEN** perform the following: __ 1) Trip all NV and NI pumps. __ 2) EP/1/A/5000/F-0 (Critical Safety Function Status Trees) may now be implemented. __ 3) **GO TO** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirc).

EXAM BANK QUESTION: 4911 CNS

C

While operating in EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation) due to a LOCA outside containment:

1) What is the method used to cool the core while attempting to restore recirculation flow?
2) IF a RED path occurs on Core Cooling while in ECA-1.1, will EP/1/A/5000/FR-C.1 (Response to Inadequate Core Cooling) be implemented?

A. 1) Align for feed and bleed
   2) Yes

B. 1) Align for feed and bleed
   2) No

C. 1) Dump steam to the condenser to cooldown to Cold Shutdown
   2) Yes

D. 1) Dump steam to the condenser to cooldown to Cold Shutdown
   2) No

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 4911 CNS

C

General Discussion

EP-022-D

Answer A Discussion

Answer B Discussion

Answer C Discussion

Answer D Discussion

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	

Development References

Student References Provided

KA	KA_desc
WE11 2.4.21	WE11 GENERICKnowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12)

APE005 AA2.04 - Inoperable/Stuck Control Rod

Ability to determine and interpret the following as they apply to the Inoperable / Stuck Control Rod: (CFR: 43.5 / 45.13)

Interpretation of computer in-core TC map for inoperable/stuck rod location …..

Given the following conditions on Unit 1:

- The unit is at 60% RTP
- A unit load increase is on hold due to a potentially stuck Control Bank D rod
- The incore thermocouple map indicates the following:

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1						576		572		576					
2			546		599		611		603		605				
3				610				624				BAD		569	
4			605		615				609				617		
5		602				625				616				614	
6	563		611				611				626		623		568
7		602		606				617				620			
8	561				612		634		572				626		
9		619				611				613				614	
10	548		610				606				613				574
11				627				BAD				605		614	
12			612		599				608				597		
13				620		619				576		602		562	
14			540		628		613		608		614				
15						BAD		622		580					

1. Based on the indications above, which Control Bank D rod is stuck?

2. What surveillances (if any) are required per Technical Specification 3.1.4 (ROD GROUP ALIGNMENT LIMITS) to allow continued power operation in MODE 1?

A. 1. Rod D-12
   2. RCCA Movement Test

B. 1. Rod D-12
   2. $F^N_{\Delta H}(X,Y)$ and $F_Q(X,Y,Z)$

C. 1. Rod M-4
   2. RCCA Movement Test

D. 1. Rod M-4
   2. $F^N_{\Delta H}(X,Y)$ and $F_Q(X,Y,Z)$

General Discussion

Based on the map provided, ROD D12 is the correct rod (temperature is depressed in this area and higher in opposite side of core.

Based on one rod being outside group alignment limits (All other Control Bank D rods should be within 12 steps because rod withdrawl would be halted when D-12 as soon as d-12 is identified as stuck) , the crew will verify SDM and has 2 hours to get to <=75% per TS 3.1.4- B.2.2. Once < 75% power operation may continue as long as surveillance is done for Fq and Fdelta h within 72 hours. The assumption is that by reducing power, the adverse affects on AFD and QPTR due to the misaligned rod are not as severe and will be of such magnitude that peaking factors are within limits, but this has to be verified by doing a flux map with incore detectors within 72 hours.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible in that the RCCA Movement Test is one of surveillances performed in accordance with Tech Spec 3.1.4 the verify control rod operability (i.e. freedom of movement). The applicant could easily confuse the RCCA Movement Test with the requirement of the Tech Spec 3.1.4 Action Statement which actually directs the crew to perform surveillances 3.2.1.1 and 3.2.2.1.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because upon initial inspection, the temperatures near each control rod in question are not significantly different that other CET locations in the vicinity of the rod. If the applicant does not realize that the two rods are in similar locations on opposite sides of the core, and compare their temperatures to each other, they could conclude that either of the two rods was misaligned.

The second part is plausible in that the RCCA Movement Test is one of surveillances performed in accordance with Tech Spec 3.1.4 the verify control rod operability (i.e. freedom of movement). The applicant could easily confuse the RCCA Movement Test with the requirement of the Tech Spec 3.1.4 Action Statement which actually directs the crew to perform surveillances 3.2.1.1 and 3.2.2.1.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because upon initial inspection, the temperatures near each control rod in question are not significantly different that other CET locations in the vicinity of the rod. If the applicant does not realize that the two rods are in similar locations on opposite sides of the core, and compare their temperatures to each other, they could conclude that either of the two rods was misaligned.

The second part is correct.

Basis for meeting the K

The K/A is matched because it requires the applicant to interpret an incore thermocouple map to determine which rod is misaligned.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, it requires the applicant to analyze the provided incore thermocouple map to determine the location of the the misaligned control rod.

Next, the applicant must recall from memory the Technical Specification requirements related to a misaligned control rod and the requirements which must be met for continued operation.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs
Verification of SDM is a 1 hour Tech Spec. Reducing power to less than or equal to 75% RTP is a 2 hour Tech Spec. The surveillances (3.2.1.1 and 3.2.2.1) are required within 72 hours. Therefore, the question cannot be answered with knowledge of less than 1 hour Tech Specs.

2) This question can NOT be answered by knowing information listed "above-the-line".
This question is related to Tech Spec 3.1.4 surveillance requirements which is "below-the-line" knowledge.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.
This question is not related to Tech Spec Safety Limits.

4) This question requires the applicant to have knowledge of Tech Spec surveillance requirements which is below the line knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	MODIFIED	2008 CNS SRO NRC Retake Examination NRC Q82 (Bank 1782) MODIFIED

Development References

REFERENCES:
Tech Spec 3.1.4 (Rod Group Alignment Limits)
PT/1/A/4600/001 (RCCA Movement Test)

LEARNING OBJECTIVES:
NONE

Student References Provided

APE005 AA2.04 - Inoperable/Stuck Control Rod
Ability to determine and interpret the following as they apply to the Inoperable / Stuck Control Rod: (CFR: 43.5 / 45.13)
Interpretation of computer in-core TC map for inoperable/stuck rod location …..

401-9 Comments:

Remarks/Status

Q90 Parent Question (2008 CNS SRO Retake Q82 (Bank 1782) MODIFIED

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One rod not within alignment limits.	B.1 Restore rod to within alignment limits.	1 hour
	OR	
	B.2.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	OR	
	B.2.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.2.2 Reduce THERMAL POWER to ≤ 75% RTP.	2 hours
	AND	
	B.2.3 Verify SDM is within the limit specified in the COLR.	Once per 12 hours
	AND	
	B.2.4 Perform SR 3.2.1.1.	72 hours
	AND	
	B.2.5 Perform SR 3.2.2.1.	72 hours
	AND	
	B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.	5 days

(continued)

SURVEILLANCE REQUIREMENTS

---NOTE---

During power escalation at the beginning of each cycle, THERMAL POWER may be increased until an equilibrium power level has been achieved, at which a power distribution map is obtained.

SURVEILLANCE	FREQUENCY
SR 3.2.1.1 Verify $F^M_Q(X,Y,Z)$ is within steady state limit.	Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which $F^M_Q(X,Y,Z)$ was last verified AND In accordance with the Surveillance Frequency Control Program

(continued)

Q90 Parent Question (2008 CNS SRO Retake Q82 (Bank 1782) MODIFIED

SURVEILLANCE REQUIREMENTS

---NOTE---

During power escalation at the beginning of each cycle, THERMAL POWER may be increased until an equilibrium power level has been achieved, at which a power distribution map is obtained.

SURVEILLANCE	FREQUENCY
SR 3.2.2.1 Verify $F^M_{\Delta H}(X,Y)$ is within steady state limit.	Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which $F^M_{\Delta H}(X,Y)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program

(continued)

Q90 Parent Question (2008 CNS SRO Retake Q82 (Bank 1782) MODIFIED

EXAM BANK QUESTION: 1782 CNS **D**

Unit 1 is operating at 98% power. A surveillance test per PT/1/A/4600/001 (RCCA Movement Test) is in progress. As Control Bank D was being moved, one control rod in Control Bank D slipped to 120 steps withdrawn and stopped. This is an incore thermocouple map one minute later.

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1						576		572		576					
2			546		599		611		603		605				
3				605				624				BAD		569	
4			597		602				609				617		
5		602				625				616				614	
6	563		611				611				626		623		568
7		602		606				617				620			
8	561				612		634		572				626		
9		619				611				613				614	
10	548		610				606				613				574
11				627				BAD				610		614	
12			612		599				608				622		
13				620		619				576		626		562	
14			540		628		613		608		614				
15						BAD		622		580					

1. Which single rod has slipped into the core to 120 steps withdrawn?
2. In addition to reducing power to less than 75% and verifying SDM, what other surveillances (if any) are <u>required</u> per Technical Specification 3.1.4 (Rod Group Alignment Limits) to allow continued power operation in Mode 1?

A. Rod D-12; no additional surveillances are required

B. Rod M-4; no additional surveillances are required

C. Rod D-12; $F^N_{\Delta H}(X,Y)$ and $F_Q(X,Y,Z)$

D. Rod M-4; $F^N_{\Delta H}(X,Y)$ and $F_Q(X,Y,Z)$

Q90 Parent Question (2008 CNS SRO Retake Q82 (Bank 1782) MODIFIED

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 1782 CNS D

General Discussion

changed "DROPPED TO STUCK IN KA. Wrong KA per Frank
Based on the map provided, ROD M4 is the correct rod (temperature is depressed in this area and higher in opposite side of core.
Based on one rod being outside group alignment limits (H-8 should be within 12 steps because rod withdrawl would be halted when it did not move) , the crew has 2 hours to get to <=75% per TS 3.1.4- B.2.2. Once < 75% power operation may continue as long as surveillance is done for Fq and Fdelta h within 72 hours. The assumption is that by reducing power, the adverse affects on AFD and QPTR due to the misaligned rod are not as severe and will be of such magnitude that peaking factors are within limits, but this has to be verified by doing a flux map with incore detectors within 72 hours.

Answer A Discussion

Plausible that rod D-12 is the affected rod (located in control bank D), but should see by map evaluation that D4 and M12 have similar indications and are at similar locations in the core, and therefore show that D12 is not misaligned.
2nd part is incorrect, but plausible, because with power required to be </= 75% power, misaligned rod affect on AFD and QPTR is not as pronounced (i.e. power peaks are reduced) and therefore could be thought to not require any additional surveillance.

Answer B Discussion

First part is correct: Based on the map provided, ROD M4 is the indicated rod that slipped to 120 swd (temperature is depressed in this area and higher in opposite side of core).
2nd part is plausible because with power required to be </= 75% power, misaligned rod affect on AFD and QPTR is not as pronounced (i.e. power peaks are reduced) and therefore could be thought to not require any additional surveillance.

Answer C Discussion

Plausible that rod D-12 is the affected rod (located in control bank D), but should see by map evaluation that D4 and M12 have similar indications and are at similar locations in the core, and therefore show that D12 is not misaligned.
2nd part is correct, because Tech Specs requires Fq and Fdelta h be monitored within 72 hours of having a misaligned rod if we chose to continue operation below 75%.

Answer D Discussion

CORRECT: Based on the map provided, ROD M4 is the indicated rod that slipped to 120 swd (temperature is depressed in this area and higher in opposite side of core). Tech Specs requires Fq and Fdelta h be monitored within 72 hours of having a misaligned rod if we chose to continue operation below 75%.

Basis for meeting the KA

Question requires interpretation of incore TC map for a stuck CR.

Basis for Hi Cog

Student must evaluate core map to determine which rod is misaligned based on temperature profile and apply Tech Spec knowledge.

Basis for SRO only

Required knowledge of TS bases.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	

Development References	Student References Provided
TS 3.1.4 and basis PT/1/A/4600/001	

KA	KA_desc
APE005 AA2.04	Ability to determine and interpret the following as they apply to the Inoperable / Stuck Control Rod: (CFR: 43.5 / 45.13)Interpretation of computer in-core TC map for inoperable/stuck rod location .....

APE024 2.1.7 - Emergency Boration

APE024 GENERIC

Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)

Given the following conditions on Unit 2:

- The unit is currently in MODE 5
- Source Range Nuclear Instrument count rates begin increasing
- The CRS suspects an inadvertent dilution is in progress
- Boric Acid Tank (BAT) temperature is 68°F
- The crew implements AP-038 (EMERGENCY BORATION AND RESPONSE TO INADVERTENT DILUTION)
- 2NV-265B (U2 NV PUMP BORIC ACID SUP ISOL) will NOT open

In accordance with AP-038, the crew will **FIRST** attempt to establish emergency boration by ___(1)___.

In accordance with S.L.C. 16.9.14 (Borated Water Sources – Shutdown), based on tank temperature, the Boric Acid Tank (BAT) is ___(2)___.

Which ONE (1) of the following completes the statements above?

COMPONENT LEGEND:

2NV-269 (UNIT 2 NV PUMP BORIC ACID SUPPLY ISOL (EMERGENCY BORATION VALVE))
2NV-267A (BORIC ACID TO BLENDER CONTROL)

A. 1. locally opening 2NV-269 and then opening 2NV-267A
2. INOPERABLE

B. 1. aligning the NV pump suction to the FWST
2. INOPERABLE

C. 1. locally opening 2NV-269 and then opening 2NV-267A
2. OPERABLE

D. 1. aligning the NV pump suction to the FWST
2. OPERABLE

General Discussion

Based on the conditions given, because the crew has implemented AP-038, they will first attempt to establish emergency boration by manually bypassing 2NV-265B. If the crew was emergency borating IAW FR-S.1, they would not attempt to bypass 2NV-265B and would align the NV pump suction to the FWST. Additionally, in AP-038 aligning the NV pump suction to the FWST is the second choice if 2NV-265B cannot be opened.

In accordance with S.L.C. 16.9.14 (Borated Water Sources - Shutdown), the minimum temperature for BAT operability is 65°F. Therefore, because the BAT temperature is 68°F, it remains OPERABLE.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because the minimum temperature for operability of the FWST is 70°F, which is the alternate source of water for Emergency Boration. If the applicant confuses the FWST operability requirements with the BAT operability requirements, they would conclude that this is a correct answer.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the SECOND choice in AP-038 for an emergency boration flowpath if 2NV-265B cannot be opened. Additionally, if the applicant confuses the Emergency Boration steps in FR-S.1 with AP-038, they would conclude that this is the correct response.

The second part is plausible because the minimum temperature for operability of the FWST is 70°F, which is the alternate source of water for Emergency Boration. If the applicant confuses the FWST operability requirements with the BAT operability requirements, they would conclude that this is a correct answer.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible because this is the SECOND choice in AP-038 for an emergency boration flowpath if 2NV-265B cannot be opened. Additionally, if the applicant confuses the Emergency Boration steps in FR-S.1 with AP-038, they would conclude that this is the correct response.

The second part is correct.

Basis for meeting the K

The K/A is matched because the applicant must make "operational judgements" regarding the alignment of emergency boration (based on conditions given) and BAT OPERABILITY (based on temperature indication).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must analyze the conditions given to determine that the operability of the BAT is at risk.

Next, the applicant must recall from memory the operability requirements of SLC 16.9.14 for both the BAT and the FWST.

The applicant must then associate the two pieces of information to determine the correct response.

The applicant must also recall from memory the procedure step requirements of AP-038.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

Neither part of this question can be answered solely by knowing systems knowledge. The first part is related to knowledge of use of alternate means of establishing emergency boration (procedurally directed based on conditions). The second part is related to surveillance requirements for flowpath operability.

2) The question can NOT be answered by knowing immediate operator actions.

There are no immediate actions for AP-038.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

The knowledge required for the first part of the question is related to determining the appropriate actions to be taken within the body of the procedure based on conditions and not procedure entry conditions.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

This is detailed knowledge of procedure step actions within the body of the procedure and selection of the appropriate actions based on conditions.

5) The question requires the applicant to select the appropriate steps in the body of the procedure to mitigate the consequences of the event. Therefore, it is SRO knowledge.

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs.

The second part of the question is related to S.L.C. requirements for determining flowpath operability.

2) This question can NOT be answered by knowing information listed "above-the-line".

S.L.C. surveillance requirements from the basis section of the S.L.C.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

Related to boration flowpath S.L.C. and not TS Safety Limits.

4) The second part of this question requires the applicant to recall S.L.C. Surveillance requirements for determining boration flowpath operability. Therefore, it is SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: AP-038 (Emergency Boration) Rev. 10 FR-S.1 (Response to Nuclear Power Generation/ATWS) Rev. 12 S.L.C. 16.9.14 (Borated Water Sources - Shutdown) Rev. 22 LEARNING OBJECTIVES: OP-MC-PS-NV-DCS Objective 16

Student References Provided

APE024 2.1.7 - Emergency Boration

APE024 GENERIC

Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)

401-9 Comments:	Remarks/Status

Q91 References

MNS AP/2/A/5500/38 **UNIT 2**	EMERGENCY BORATION AND RESPONSE TO INADVERTENT DILUTION	PAGE NO. 6 of 19 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. **Initiate emergency boration:**	
__ a. Check 2A or 2B NV pump - AVAILABLE.	a. **IF** NI pump being used to provide required boron injection flowpath, **THEN** perform the following: 1) Ensure the following valves OPEN: __ • 2NI-100B (FWST To NI Pumps) __ • 2NI-162A (NI Pumps Cold Leg Isol). 2) **IF** 2A NI pump available, **THEN** perform the following: a) Ensure the following valves OPEN: __ • 2NI-103A (A NI Pump Suct From FWST) __ • 2NI-118A (Train A NI To Cold Leg Isol). __ b) Start 2A NI pump. 3) **IF** 2B NI pump available, **THEN** perform the following: a) Ensure the following valves OPEN: __ • 2NI-135B (B NI Pump Suct From FWST) __ • 2NI-150B (Train B NI To Cold Leg Isol). __ b) Start 2B NI pump. 4) **WHEN** emergency boration no longer required, **THEN** perform the following: __ a) Stop running NI pump. __ b) Align above NI valves to original position. __ c) **IF AT ANY TIME** emergency boration is required, **THEN RETURN TO** Step 12.a. __ 5) **GO TO** Step 23.

Q91 References

MNS AP/2/A/5500/38 **UNIT 2**	EMERGENCY BORATION AND RESPONSE TO INADVERTENT DILUTION	PAGE NO. 7 of 19 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. (Continued)	
__ b. Check NV pump - ON.	b. Perform the following: __ 1) Ensure suction flow path aligned. 2) Ensure the following valves are OPEN: __ • 2NV-150B (NV Pumps Recirculation) __ • 2NV-151A (NV Pumps Recirculation). __ 3) CLOSE 2NV-238 (Charging Line Flow Control). __ 4) Start NV pump.
c. Check the following boric acid system components - AVAILABLE. __ • Boric Acid Storage Tank __ • Boric Acid Transfer pump.	c. Align NV pump suction to the FWST as follows: 1) OPEN the following valves: __ • 2NV-221A (NV Pumps Suct From FWST) __ • 2NV-222B (NV Pumps Suct From FWST). 2) CLOSE the following valves: __ • 2NV-141A (VCT Outlet Isol) __ • 2NV-142B (VCT Outlet Isol). __ 3) **GO TO** Step 15.

Q91 References

MNS AP/2/A/5500/38 UNIT 2	EMERGENCY BORATION AND RESPONSE TO INADVERTENT DILUTION	PAGE NO. 8 of 19 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. (Continued)	
__ d. OPEN 2NV-265B (Boric Acid To NV Pumps).	d. Perform the following: __ 1) Dispatch operator to OPEN 2NV-265B (aux bldg, 733+3, JJ-57, near chemical addition tank). 2) **IF** 2NV-265B cannot be opened, **THEN** perform the following: __ a) Dispatch operator to unlock and OPEN 2NV-269 (Unit 2 NV Pump Boric Acid Supply Isol (Emergency Boration Valve)) (aux bldg, 733+4, JJ-58, near chemical addition tank). __ b) OPEN 2NV-267A (Boric Acid To Blender Control). __ 3) Do not continue until 2NV-265B or 2NV-269 flowpath above is aligned.
__ e. Ensure a boric acid transfer pump is running.	
f. Check boration flow using one of the following methods: __ • **IF** 2NV-265B is open, **THEN** check "EMERGENCY BORATION FLOW" - ESTABLISHED. OR __ • **IF** 2NV-269 is open, **THEN** check "BORIC ACID FLOW" on chart recorder 2MNVCR5450 - ESTABLISHED.	f. Perform the following: __ 1) Start second boric acid transfer pump. 2) **IF** boration flow cannot be established, **THEN** align NV pump suction to FWST as follows: a) OPEN the following valves: __ • 2NV-221A (NV Pumps Suct From FWST) __ • 2NV-222B (NV Pumps Suct From FWST). b) CLOSE the following valves: __ • 2NV-141A (VCT Outlet Isol) __ • 2NV-142B (VCT Outlet Isol). __ c) **GO TO** Step 15.

Q91 References

MNS EP/2/A/5000/FR-S.1 **UNIT 2**	RESPONSE TO NUCLEAR POWER GENERATION/ATWS	PAGE NO. 3 of 28 Rev. 12

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Initiate emergency boration of NC System as follows:**	
__ a. Ensure one NV pump - ON.	__ a. Place PD pump in service **PER** EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 17 (PD Pump Startup).
b. Align boration flowpath as follows:	
__ 1) OPEN 2NV-265B (Boric Acid To NV Pumps).	
__ 2) Start both boric acid transfer pumps.	
__ 3) Check emergency boration flow - GREATER THAN 30 GPM.	3) **IF** NV pump suction is aligned to VCT, **THEN** align to FWST as follows: __ a) OPEN 2NV-221A (NV Pumps Suct From FWST). __ b) OPEN 2NV-222B (NV Pumps Suct From FWST). __ c) CLOSE 2NV-141A (VCT Outlet Isol). __ d) CLOSE 2NV-142B (VCT Outlet Isol).

Q91 References

16.9 AUXILIARY SYSTEMS

16.9.14 Borated Water Sources (Shutdown)

COMMITMENT One of the following borated water sources shall be OPERABLE:

a. A boric acid tank (BAT), or

b. The refueling water storage tank.

APPLICABILITY MODE 4 with any RCS cold leg temperature $\leq$ 300°F,
MODES 5 and 6.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required borated water source inoperable.	A.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2 Suspend positive reactivity additions.	Immediately

TESTING REQUIREMENTS

TEST	FREQUENCY
TR 16.9.14.1 Verify the refueling water storage tank solution temperature is $\geq$ 70°F when the outside air temperature is < 70°F.	24 hours
TR 16.9.14.2 Verify the boron concentration of the required borated water source is within the limits specified in the COLR.	7 days
	(continued)

Q91 References

TESTING REQUIREMENTS (continued)

TEST	FREQUENCY
TR 16.9.14.3 Verify the borated water volume of the required borated water source is within the limits specified in the COLR.	7 days
TR 16.9.14.4 Verify the boric acid tank solution temperature is ≥ 65°F when the boric acid storage tank is a required source.	7 days

BASES

The borated water sources ensure that negative reactivity control is available during each mode of facility operation.

In Mode 4 with any RCS cold leg temperature below 300 °F, and in Modes 5 and 6, one borated water source is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting core alterations and positive reactivity changes in the event the single borated water source becomes inoperable. The boration capability of one borated water source, in association with a flow path and charging pump, is sufficient to provide SDM of 1.3% delta k/k in Mode 4 and 1.0% delta k/k in Modes 5 and 6 after xenon decay and cooldown to 68° F.

The SLC commitment values are presented in the Core Operating Limits Report (COLR) as: (1) the minimum boron concentrations and minimum volumes necessary to attain and maintain SDM in the boric acid tank or the refueling water storage tank, (2) the minimum contained volumes in the boric acid tank or the refueling water storage tank, and (3) a curve specifying the minimum contained volume in the boric acid tank near EOC. The minimum contained water volume is based on the required volume to maintain shutdown margin, an allowance for water not available because of discharge line location and additional margin. The additional margin term includes allowances for instrument uncertainty, vortexing and a margin term consisting of at least 5% of the volume necessary for SDM. The COLR specified volumes and boron concentrations satisfy SDM requirements during Mode 4 with any RCS cold leg temperature below 300 °F and in Modes 5 and 6.

<u>Boric Acid Tank Requirements for Maintaining SDM</u>

Required volume for maintaining SDM	Presented in the COLR
Unusable volume (to maintain full suction pipe)	4,199 gallons
Additional margin	4,100 gallons

<u>Refueling Water Storage Tank Requirements for Maintaining SDM</u>

Required volume for maintaining SDM	Presented in the COLR
Unusable volume (to maintain full suction pipe)	16,000 gallons
Additional margin	23,500 gallons

Q91 References

BASES (continued)

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 7.5 and 9.5 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

REFERENCES

None

WE08 2.1.7 - Pressurized Thermal Shock

WE08 GENERIC

Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)

Given following conditions on Unit 1:

0800 A Reactor trip occurred from 100% RTP due to a large steam break

1045 The steam break has been isolated and the unit stabilized with the following conditions:

- o NC system temperature = 240°F
- o NC system pressure = 1000 PSIG

Based on the conditions above,

1) as part of the subsequent recovery actions, the crew ________ perform an NC system soak.

2) after NC system pressure is reduced, the next cooldown performed will be at a MAXIMUM rate of ________ per hour.

Which ONE (1) of the following completes the statements above? (**CONSIDER EACH QUESTION SEPARATELY**)

A. 1. will
2. 50°F

B. 1. will
2. 100°F

C. 1. will NOT
2 50°F

D. 1. will NOT
2. 100°F

General Discussion

For the conditions given, when the crew implements the CSFSTs, they will implement FR-P.1. They will progress through the procedure and after NC system pressure is reduced to minimize subcooling, the crew WILL perform an NC system soak.

Following the soak, according to EP/1/A/5000/FR-P.1, the operator will be directed to cooldown with the following limits: Maintain NC pressure and T-Colds within the "ACCEPTABLE OPERATING REGION" of Enclosure 3 (Post-Soak Cooldown Limit), and maintain cooldown rate in NC cold legs less than 50°F in any 60 minute period. According to EP-FRP, the basis for the post-soak cooldown restrictions is to avoid challenging vessel integrity.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible because if the applicant concludes that FR-P.2 should be implemented as opposed to P.1, the allowable cooldown limit would be 100°F/hr. Additionally, if the applicant does correctly determines that FR-P.1 should be entered but erroneously determines that the cooldown from the steam break was less than 100°F in 60 minutes, the crew would transition from P.1 to the procedure and step in effect and the allowable cooldown limit would become the Tech Spec limit of 100°F/hr.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that FR-P.2 should be implemented as opposed to P.1. FR-P.2 does not perform a soak even though it meets the same requirements for a soak as P.1 (i.e. greater than a 100°F cooldown in 60 minutes).

The second part is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is plausible if the applicant concludes that FR-P.2 should be implemented as opposed to P.1. FR-P.2 does not perform a soak even though it meets the same requirements for a soak as P.1 (i.e. greater than a 100°F cooldown in 60 minutes).

The second part is plausible because if the applicant concludes that FR-P.2 should be implemented as opposed to P.1, the allowable cooldown limit would be 100°F/hr. Additionally, if the applicant does correctly determines that FR-P.1 should be entered but erroneously determines that the cooldown from the steam break was less than 100°F in 60 minutes, the crew would transition from P.1 to the procedure and step in effect and the allowable cooldown limit would become the Tech Spec limit of 100°F/hr.

Basis for meeting the K

The K/A is matched because it requires the applicant to make operational judgements based on existing plant conditions (i.e. determining whether a "soak" will be performed and selection of the appropriate cooldown rate).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First the applicant must analyze the conditions given to determine the appropriate Functional Restoration Procedure to be implemented.

Next, the applicant must analyze the condtion given to determine if an NC system "soak" is required.

Finally, the applicant must recall from memory the allowable cooldown limits based on the procedure implemented and the magnitude of the cooldown from the steam break.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in NUREG-1021 Rev. 10, ES-401 Attachment 2 "Clarification Guidance for SRO-only Questions" for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.

While knowledge of T.S. Limits on heatup and cooldown is knowledge required of an RO, knowledge of heatup and cooldown limits which are based on specific plant conditions or implementation of specfic procedures or sections of procedures is considered SRO knowledge.

2) The question can NOT be answered by knowing immediate operator actions.

There are no immediate actions associated with FR-P.1 or FR-P.2.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.

While there is an element of knowledge related to EOP entry conditions, the applicant must perform a detailed analysis of the conditions give to determine the correct FRP and must then recall from memory whether the selected FRP contains requirements to perform a soak. Therefore, it can NOT be answered based solely on EOP entry conditions.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.

The steps for the mitigative strategy for FR-P.1 are:
- a. Stop NC system Cooldown
- b. Terminate SI if Criteria Satisfied
- c. Depressurize NC System to Minimize Pressure Stress
- d. Establish Normal Operating Conditions and Stable NC System Conditions
- e. Soak if Necessary Prior to Further Restricted Cooldown

While knowledge of the existence of a step in the mitigating strategy to perform a Soak and subsequent Cooldown would be RO knowledge, details of the requirements which must be met to require a soak and the associated cooldown limit after the soak is considered SRO level knowledge.

5) The question requires detailed knowledge of procedure content relative to selection of appropriate actions within the body of the procedure (i.e. whether or not to perform a soak and the appropriate cooldown rate after the soak is complete. Therefore, it is SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References

REFERENCES:
FR-P.1 (Response to Imminent Pressurized Thermal Shock) Rev. 14
Lesson Plan OP-MC-EP-FRP (Response to Imminent Pressurized Thermal Shock Condition) Rev. 12
FR.P.2 (Response to Anticipated Pressurized Thermal Shock) Rev. 4

LEARNING OBJECTIVES:
OP-MC-EP-FRP Objective 6

Student References Provided

WE08 2.1.7 - Pressurized Thermal Shock

WE08 GENERIC

Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)

401-9 Comments:

Remarks/Status

Q92 References

MNS EP/1/A/5000/FR-P.1 **UNIT 1**	RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITION	PAGE NO. **30 of 42** Rev. 14

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
25. **Check adequate NC System depressurization as follows:**	__ **Observe Note prior to Step 17 and <u>RETURN</u> <u>TO</u> Step 17.**
__ • NC subcooling based on core exit T/Cs - LESS THAN 10°F	
OR	
__ • NC System pressure - LESS THAN 72 PSIG.	
26. **Determine if NC System soak is required as follows:**	
__ a. Cooldown rate in NC System cold legs - GREATER THAN 100°F IN ANY 60 MINUTE PERIOD.	__ a. **<u>GO</u> <u>TO</u>** Step 27.
b. Perform all of the following:	
__ 1) Do not cool down NC System until temperature has been stable for 60 minutes.	
__ 2) Do not raise NC pressure during that time.	
__ 3) Perform actions of other procedures in effect which do not cooldown or raise NC System pressure until the NC System temperature soak has been completed.	
4) **<u>WHEN</u>** NC System 60 minutes soak is complete, **<u>THEN</u>** cooldown may be initiated with the following limits:	
__ • Maintain NC pressure and T-Colds within the "ACCEPTABLE OPERATING REGION" of Enclosure 3 (Post-Soak Cooldown Limit).	
__ • Maintain cooldown rate in NC cold legs less than 50°F in any 60 minute period.	

Q92 References

MNS EP/1/A/5000/FR-P.2 **UNIT 1**	RESPONSE TO ANTICIPATED PRESSURIZED THERMAL SHOCK CONDITION	PAGE NO. 9 of 19 Rev. 4

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4. **Determine if additional NC System cooldown restrictions are required as follows:**	
__ a. Cooldown rate based on NC T-Colds - GREATER THAN 100°F IN ANY 60 MINUTE PERIOD.	__ a. Additional cooldown restrictions are not required. **RETURN TO** procedure and step in effect.
b. NC System cooldown is permitted in subsequent procedures with the following restrictions:	
__ 1) Maintain NC pressure and T-Colds within the limits of Enclosure 2 (NC System Cold Leg Temperature Cooldown Limit).	
__ 2) Maintain cooldown rate based on NC T-Colds less than 100°F in any 60 minute period.	
__ 5. **RETURN TO procedure and step in effect.**	

END

WE16 EA2.2 - High Containment Radiation

Ability to determine and interpret the following as they apply to the (High Containment Radiation)
(CFR: 43.5 / 45.13)

Adherence to appropriate procedures and operation within the limitations in the facility*s license and amendments.

Given the following conditions on Unit 1:

- Chemistry has confirmed two leaking fuel rods
- A Large Break LOCA occurs
- ES-1.2 (POST LOCA COOLDOWN AND DEPRESSURIZATION) has been implemented
- All Red and Orange Paths have been addressed
- 1EMF-51A = 39 R/Hr
- Pressurizer level = 0%
- The CRS is currently considering implementing Yellow Path procedures

Based on the conditions above, the CRS will direct the crew to _______.

Which ONE (1) of the following completes the statement above?

PROCEDURE LEGEND:

FR-I.3 (RESPONSE TO VOIDS IN THE REACTOR VESSEL)
FR-Z.3 (RESPONSE TO HIGH CONTAINMENT RADIATION LEVEL)

A. transition from ES-1.2 to FR-I.3

B. remain in ES-1.2 and implement FR-I.3 concurrently

C. transition from ES-1.2 to FR-Z.3

D. remain in ES-1.2 and implement FR-Z.3 concurrently

General Discussion

In accordance with OMP 4-3 (Use of Emergency and Abnormal Procedures and FLEX Support Guidelines), implementation of YELLOW PATH Functional Restoration Procedures is NEVER required. Implementation is optional based on the discretion of the Control Room Supervisor. Consequently, FRPs are implemented concurrently with the optimal recovery procedure and transition from the optimal recovery procedure to the YELLOW PATH FRP is NOT appropriate.

Based on the conditions given, and having knowledge of the FRPs, the appropriate procedure to enter would be the Containment FRP (as it is a higher priority FRP). Additionally, the CRS should realize that in a Large Break LOCA scenario voiding in the Rx Vessel Head area is expected and will be dealt with by the optimal recovery procedure (in this case ES-1.2).

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because under most circumstances, when an FRP is implemented, transition is made to the FRP and it is NOT implemented concurrently. Also, if the applicant confuses Inventory with Integrity (i.e. I.3), they would logically select I.3 over Z.3 believing it had a higher priority.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because implementing a Yellow Path FRP concurrently with the optimal recovery procedure is correct implementation methodology as described in OMP 4-3. Also, if the applicant confuses Inventory with Integrity (i.e. I.3), they would logically select I.3 over Z.3 believing it had a higher priority.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
This answer is plausible because under most circumstances, when an FRP is implemented, transition is made to the FRP and it is NOT implemented concurrently. Also, selection of FR-Z.3 is correct.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of the implementation of a procedure related to High Containment Radiation (i.e. Yellow Path FRP).

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, it requires the applicant to analyze the conditions given to determine which FRP has priority.

Second, it requires the applicant to recall from memory the procedural requirement for implementation of Yellow Path FRPs.

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(5) (Assessment and selection of procedures):

1) The question can NOT be answered solely by knowing systems knowledge.
The question has no tie to systems level knowledge.

2) The question can NOT be answered by knowing immediate operator actions.
There are no immediate actions associated with the procedures referenced by this question.

3) The question can NOT be answered solely by knowing entry conditions for AOP or direct entry conditions for EOPs.
While this question involves knowledge of Yellow Path FRP entry conditions, it also requires the applicant to have knowledge of EOP rules of usage (OMP 4-3). Knowledge of the rules of usage related to implementation of Yellow Path FRPs is considered SRO knowledge. Therefore, the applicant can NOT answer the question with knowledge of Yellow Path FRP entry conditions alone.

4) The question can NOT be answered solely by knowing the purpose, overall sequence of events, or overall mitigative strategy of the procedure.
This question is related to implementation of an EOP procedure that requires the applicat to determine if a procedure transition is required or if the procedure must be implemented concurrently.

5) The question requires detailed knowledge EOP implementation requirements. Therefore, it is SRO knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	MNS ILT Bank Q30888 (Q5836)

Development References

REFERENCES:
F-0 (Critical Safety Function Status Trees)
Lesson Plan OP-MC-EP-F0
OMP 4-3 (Use of Emergency and Abnormal Procedures and FLEX Support Guidelines) Rev 42

LEARNING OBJECTIVES:
OP-MC-EP-F0 Objective 3

Student References Provided

WE16 EA2.2 - High Containment Radiation
Ability to determine and interpret the following as they apply to the (High Containment Radiation)
(CFR: 43.5 / 45.13)
Adherence to appropriate procedures and operation within the limitations in the facility*s license and amendments.

401-9 Comments:

Remarks/Status

401-9 Early submittal comments:
WE16EA2.2
K/A is met drl 11/10/15

Q93 References

7.16.1.7 Yellow Path

A yellow path does **NOT** require immediate operator attention. Frequently, it is indicative of an off-normal and/or temporary condition which will be restored to normal status by actions already in progress. In other cases, the yellow status might provide an early indication of a developing red or orange condition. The operator is allowed to decide whether or **NOT** to implement any yellow path procedure.

Implementation of a yellow path function restoration guideline is based on operator judgment when it is determined that adequate time exists to implement it. In other words, the operator does **NOT** have to implement a yellow path guideline if a judgment has been made that it is inappropriate based on available time or current plant state; and if an event of higher priority is in progress, the operator should attend to the more important matters prior to implementing a yellow path function restoration guideline. In the prioritization scheme in the EPs, the Optimal Recovery procedures (including applicable foldout pages) have priority over the yellow path function restoration procedures. The yellow path procedure can be considered as a supplementary set of actions that were provided to address one parameter being in an off-normal state. The controlling guideline in effect is the Optimal Recovery procedure that the operator is in when he decides that he has enough time to perform the yellow path procedure actions. **While performing the actions of the yellow path, continuous actions or foldout page items of the optimal recovery procedure in effect are still applicable and should be monitored by the operator.** This concurrent procedure usage should **NOT** cause the operator any difficulties since yellow path procedures are only performed when adequate time exists.

For example, if the operator is in ES-1.1 (Safety Injection Termination) and decides to implement FR-H.5 because of low SG level and NC subcooling is lost while in FR-H.5, the operator should terminate FR-H.5 and implement the action of the ES-1.1 foldout page to re-initiate S/I flow.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 5836 MNS **D**

Given the following conditions on Unit 1:

- Chemistry has confirmed two leaking fuel rods
- A Large Break LOCA occurs
- ES-1.2 (POST LOCA COOLDOWN AND DEPRESSURIZATION) has been implemented
- All Red and Orange Paths have been addressed
- 1EMF-51A = 39 R/Hr
- Pressurizer level = 0%
- The SRO is currently considering implementing Yellow Path procedures.

Which ONE (1) of the following describes the appropriate procedure implementation based on the conditions above?

PROCEDURE LEGEND:

FR-I.3 (RESPONSE TO VOIDS IN THE REACTOR VESSEL)
FR-Z.3 (RESPONSE TO HIGH CONTAINMENT RADIATION LEVEL)

A. Transition from ES-1.2 to FR-I.3.

B. Remain in ES-1.2 and implement FR-I.3 concurrently.

C. Transition from ES-1.2 to FR-Z.3.

D. Remain in ES-1.2 and implement FR-Z.3 concurrently.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

EXAM BANK QUESTION: 5836 MNS D

General Discussion

Answer A Discussion

Answer B Discussion

Answer C Discussion

Answer D Discussion

Basis for meeting the KA

Basis for Hi Cog

Basis for SRO only

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	BANK	MNS Exam Bank Q30888

Development References
References: F-0 (Critical Safety Function Status Trees) Lesson Plan OP-MC-EP-F0 OMP 4-3 (Use of Abnomral and Emergency Procedures) Learning Objectives: OP-MC-EP-F0 Objective 3

Student References Provided

KA	KA_desc
GEN2.4 2.4.6	Emergency Procedures / PlanKnowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)
GEN2.1 2.1.23	Conduct of OperationsAbility to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)
GEN2.1 2.1.20	Conduct of OperationsAbility to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)
WE16 EA2.1	Ability to determine and interpret the following as they apply to the (High Containment Radiation) (CFR: 43.5 / 45.13)Facility conditions and selection of appropriate procedures during abnormal and emergency operations.

GEN2.1 2.1.35 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7)

Given the following conditions on Unit 1:

- The unit is in MODE 6 with core alterations in progress
- It is determined that a Fuel Handling interlock must be bypassed to insert the next fuel assembly into the core
- The interlock which must be bypassed is NOT specified in a procedure

In accordance with AD-NS-ALL-1001 (CONDUCT OF REFUELING), which individual(s) listed below is/are allowed to approve bypassing the interlock?

1. Refueling SRO
2. Reactor Engineering
3. Shift Manager - Operations

A. 1 ONLY

B. 1 AND 2 ONLY

C. 1 AND 3 ONLY

D. 1, 2, AND 3

General Discussion

In accordance with AD-NS-ALL-1001 (Conduct of Refueling) , the duties of the Refueling SRO Responsible for Fuel Handling include approving the bypassing of fuel handling interlocks when bypassing that interlock is NOT specified in a procedure.

During refueling, is the responsibiliity of the SM to "maintains awareness of any activities that could impact ongoing fuel handling evolutions and ensures appropriate FRS personnel are aware of these activities AND maintains ultimate responsibility for the safety of the reactor core and fuel stored on site."

One of the responsibilities of Reactor Engineering during refueling is to "assist in solving fuel handling related problems".

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because the Reactor Engineering has responsibility for the majority of all fuel movement activities as defined in AD-NS-ALL-1001. The Fuel Handling SRO is correct.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

This answer is plausible because SM has numerous oversight functions during fuel handling as defined in AD-NS-ALL-0101. two of those responibilities are to maintains awareness of any activities that could impact ongoing fuel handling evolutions and ensures appropriate FRS personnel are aware of these activities AND maintains ultimate responsibility for the safety of the reactor core and fuel stored on site. Based on the magnitude of those responsibilities, the applicant could conclude that it is the responsibility of the SM-Operations to approve bypassing refueling interlocks. The Fuel Handling SRO is correct.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The Fuel Handling SRO is correct. The SM - Operations is plausible because the SM has numerous oversight functions during fuel handling as defined in AD-NS-ALL-0101. two of those responsibilities are to maintains awareness of any activities that could impact ongoing fuel handling evolutions and ensures appropriate FRS personnel are aware of these activities AND maintains ultimate responsibility for the safety of the reactor core and fuel stored on site. Based on the magnitude of those responsibilities, the applicant could conclude that it is the responsibility of the SM-Operations to approve bypassing refueling interlocks. Reactor Engineering is plausible because the Reactor Engineering has responsibility for the majority of all fuel movement activities as defined in AD-NS-ALL-1001. Additionally, one of the responsibilities of Reactor Engineering is to "assist in fuel handling related problems". Since this is typically the condition under which bypassing refueling interlocks would be needed. The applicant could conclude that because of this responsibility that it would be the responsibility of Reactor Engineering to approve bypassing interlocks.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of the SRO responsibilities during refueling.

Basis for Hi Cog

Basis for SRO only

SRO level because knowledge of SRO responsibilities during refueling is 10CFR55.43 (b) item 6/7 specific

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2012 MNS SRO Audit Q94 (Bank 4442)

Development References

REFERENCES:
AD-NS-ALL-1001 (Conduct of Refueling

Student References Provided

LEARNING OBJECTIVES:: OP-MC-FH-FC Objectives 2 and 5 Learning Objective: NONE

GEN2.1 2.1.35 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7)

401-9 Comments:	Remarks/Status

Q94 References

CONDUCT OF REFUELING	AD-NS-ALL-1001
	Rev. 2
	Page 13 of 25

4.11 Refueling SRO

1. Ensures fuel handling procedures are performed as written.
2. Ensures all refueling personnel adhere to STAR self-checking techniques, procedure use and adherence, communication standards, concurrent verification, and independent verification.
3. Maintains an understanding of the need for, and approval of, all contingency actions required, according to approved procedure (ENG, MNT, OPS) guidance for operating all fuel handling equipment and tooling (Manipulator Cranes, Fuel Transfer Systems, Tooling, etc.).
4. Directs Reactor Building activities during performance of Abnormal Procedures.
5. Ensures no activities occur that adversely affect reactivity control.
6. Ensures FME controls are implemented.
7. Ensures all housekeeping standards are maintained.
8. [PWR] Ensures approved safety practices are followed during operation of the Manipulator Crane.
9. Suspends all refueling operations anytime it appears that refueling operations are not being performed correctly or safely.

4.12 Refueling SRO Responsibilities for Fuel Handling

1. Observes fuel handling activities anytime Core Alterations are being performed.
2. Provides oversight of fuel handling activities anytime Core Alterations are being performed.
3. Maintains station on the refueling bridge any time fuel assemblies are being moved in the Reactor Vessel.
4. Maintains SRO License or SRO license limited to fuel handling.
5. Maintains a working knowledge of procedures, Technical Specifications, and SLCs associated with fuel handling and command immediate action as required.
6. Approves use of fuel handling bypass interlocks when not specified by an approved procedure.
7. Approves alternate fuel assembly moves as recommended (with procedure guidance) by Reactor Engineering. [7.3.4]

Q94 References

CONDUCT OF REFUELING	AD-NS-ALL-1001
	Rev. 2
	Page 8 of 25

4.4 Reactor Engineering (continued)

25. Provides qualified reviewer functions for procedures related to fuel handling equipment and activities.

26. Assists in development of procedures for non-routine fuel handling equipment (fuel cleaner, stud runners, hydra-nuts, etc.).

27. Assists in solving fuel handling related problems.

28. Incorporates Operating Experience into fuel handling equipment preventive maintenance program and researches industry standards for equipment and tooling upgrades.

29. Maintains fuel handling equipment drawings and manuals (documents).

30. Reviews and revises fuel handling PM program.

31. Ensures necessary spare parts are available for fuel handling equipment.

32. Ensures fuel handling equipment PMs and any pre-operational checkouts are performed prior to refueling.

4.5 Radiation Protection (RP), Chemistry, and Decontamination Support

1. Provides Radiation Protection support to ensure refueling activities are radiologically safe and sufficient.

2. Provides Chemistry support for sampling and analysis.

3. Coordinates and conducts Radiation Work Permit (RWP) briefs.

4. Coordinates development of ALARA work plan for refuel project.

5. Verifies RP management has ensured all RP postings are in place prior to start of fuel movement.

CONDUCT OF REFUELING	AD-NS-ALL-1001
	Rev. 2
	Page 12 of 25

4.8 Fleet Reactor Services Technicians (continued)

7. Perform procedures related to SNM inventory control related to fuel.

8. Support special projects as needed.

9. Establish and maintain housekeeping, material condition, and FME controls of all fuel handling areas.

4.9 Shift Manager (SM)

1. Ensures SROs/ROs are aware of all fuel handling activities in progress or planned.

2. Maintains awareness of any activities that could impact ongoing fuel handling evolutions and ensures appropriate FRS personnel are aware of these activities.

3. Ensures appropriate response and notifications to any abnormal fuel handling event and verify any Technical Specification/SLCs implications.

4. Maintains ultimate responsibility for the safety of the reactor core and fuel stored on site.

5. Ensures the IPTE Briefing is performed prior to core unload and reload. [7.3.3]

4.10 Control Room SRO and RO

1. Monitors the Nuclear Instrumentation during core alterations.

2. Implements any responses required by Abnormal Procedures.

3. Logs, verifies, and maintains Technical Specification and Selected License Commitments (SLCs) for Core Alterations, and other Technical Specifications and Selected License Commitments (SLCs) for Reactor and Spent Fuel Building activities.

4. Maintains awareness of all fuel and component handling activities in Spent Fuel and Reactor Buildings.

5. Maintains awareness of core configuration during core alterations.

6. Ensures reactivity monitoring is performed during refueling.

7. Maintains an awareness of all dry cask storage (ISFSI) activities in the Spent Fuel Buildings or yard.

Q94 Parent Question

2012A MNS SRO Audit Examination QUESTION 94 94 **A**

GEN2.1 2.1.41 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of the refueling process. (CFR: 41.2 / 41.10 / 43.6 / 45.13)

Given the following conditions on Unit 1:

- The unit is in MODE 6 with core alterations in progress
- It is determined that a Fuel Handling interlock must be bypassed to insert the next fuel assembly into the core
- The interlock which must be bypassed is NOT specified in a procedure

In accordance with NSD-414 (Fuel Handling), which individual(s) listed below is/are allowed to approve bypassing the interlock?

1. Fuel Handling SRO
2. Reactor Engineering
3. Operations Shift Manager

A. 1 ONLY

B. 1 AND 2 ONLY

C. 1 AND 3 ONLY

D. 1, 2, AND 3

2012A MNS SRO Audit Examination QUESTION 94

94

A

General Discussion

In accordance with NSD 414 (Fuel Handling) AND OMP 2-2 (Conduct of Operations):
"Fuel Handling SRO may approve use of fuel handling bypass interlocks as necessary when NOT specified by an approved procedure."
In accordance with NSD 414, the responsibilities of the OSM include:
During fuel movement, fuel receipt, special projects, and dry cask storage:

1. Ensure SRO's/RO's are cognizant of all fuel handling activities in progress or planned.
2. Maintain awareness of any activities that could impact fuel handling activities and ensure appropriate fuel handling personnel are aware of these activities.
3. Ensure appropriate response and notifications to any abnormal fuel handling event and verify any Technical Specification implications.
4. Has ultimate responsibility for the safety of the reactor core and fuel stored on site.
5. Ensure the 91-01 Briefing is performed prior to core reload.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: This answer is plausible because the Reactor Engineering has responsibility for the majority of all fuel movement activities as defined in NSD 414. The Fuel Handling SRO is correct.

Answer C Discussion

INCORRECT: This answer is plausible because OSM has numerous oversight functions during fuel handling as defined in NSD 414. The Fuel Handling SRO is correct.

Answer D Discussion

INCORRECT: This answer is plausible because the Reactor Engineering has responsibility for the majority of all fuel movement activities as defined in NSD 414 and the OSM has numerous oversight functions during fuel handling as defined in NSD 414. The Fuel Handling SRO is correct.

Basis for meeting the KA

The K/A is matched because the item evaluates a decision by refueling SROs.

Basis for Hi Cog

Basis for SRO only

SRO level because knowledge of SRO responsibilities during refueling is 10CFR55.43 (b) item 6/7 specific

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2011 MNS NRC Q95 (Bank 4442)

Development References	Student References Provided
NSD 414 (Fuel Handling) OMP 2-2 (Conduct of Operations) Lesson Plan OP-MC-FH-FC Section 1.2 and 2.2 Learning Objectives: OP-MC-FH-FC Objectives 2 and 5	

GEN2.1 2.1.41 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of the refueling process. (CFR: 41.2 / 41.10 / 43.6 / 45.13)

401-9 Comments:	Remarks/Status

GEN2.1 2.1.40 - GENERIC - Conduct of Operations
Conduct of Operations
Knowledge of refueling administrative requirements. (CFR: 41.10 / 43.5 / 45.13)

Regarding Tech Spec 3.7.12 (FUEL HANDLING VENTILATION EXHAUST SYSTEM (FHVES) and its Bases,

1) the VF System ________ required to be OPERABLE and in operation in the Filter Mode when the cask is moved using the 125 -Ton Overhead Crane with the rollup door closed?

2) a total system failure could result in the atmospheric release from the fuel handling building exceeding the 10 CFR ________ limits at the site exclusion area boundary in the event of a fuel handling accident.

PROCEDURE LEGEND:

10 CFR PART 20 (STANDARDS FOR PROTECTION AGAINST RADIATION)
10 CFR PART 100 (REACTOR SITE CRITERIA)

Which ONE (1) of the following completes the statements above?

A. 1. is
2. 20

B. 1. is
2. 100

C. 1. is NOT
2. 20

D. 1. is NOT
2. 100

General Discussion

Tech Spec 3.7.12 (Fuel Handling Ventilation Exhaust Sytem) requires the VF system to be OPERABLE and in operation in Filter Mode when irradiated fuel is being moved in the fuel handling building. In order to determine what constitutes evolutions requiring the FHVES to be OPERABLE, the applicant must recall from T.S. 3.7.12 basis the evolutions defined there which are considered "fuel movements". One of the evolutions defined there is:

"Movement of a loaded dry storage cask in the fuel handling building with the 125 ton overhead crane. This specifically excludes the movement of a loaded cask into or out of the fuel handling building when the fuel handling building roll-up door is raised."

Normally, Tech Spec equipment operability of this nature would fall within the required knowledge of a Reactor Operator. However, the quoted knowledge above is only found in the Tech Spec 3.7.12 Basis document, is necessary to be able to determine equipment operability under the given conditions, and is what makes Part 1 of this question SRO-level knowledge.

In accordance with the Tech Spec 3.7.12 Bases, the FHVES is designed to prevent exceeding the limits of 10 CFR 100 in the event of a fuel handling accident.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part correct.

The second part is plausible because could conclude that, based on the title of 10 CFR 20, it covers all potential radiation exposures on site. This is additionally plausible since the title of 10 CFR 100 does not contain anything regarding radiation exposure.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part plausible because if the movement were a loaded cask being moved into or out of the fuel handling building with the roll-up door RAISED, the FHVES would NOT be required to be operable.

The second part is plausible because could conclude that, based on the title of 10 CFR 20, it covers all potential radiation exposures on site. This is additionally plausible since the title of 10 CFR 100 does not contain anything regarding radiation exposure.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part plausible because if the movement were a loaded cask being moved into or out of the fuel handling building with the roll-up door RAISED, the FHVES would NOT be required to be operable.

Second part correct.

Basis for meeting the K

The KA is matched because it requires the applicant to have knowledge of the magnitude of a potential offsite release relative to the basis for offsite dose limits during a design basis fuel handling incident.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

2) This question can NOT be answered solely by knowing information listed "above-the-line".

3) This question can NOT be answered by knowing the TS Safety Limits or their bases. This question is not related to TS Safety Limits.

4) This question requires the applicant to recall information from the TS basis. In order to determine the correct response, the applicant must be able to determine what constitutes evolutions requiring the FHVES to be OPERABLE. To do so, the applicant must recall from T.S. 3.7.12 basis, the evolutions defined there which are considered "fuel movements". One of the evolutions defined there is:

"Movement of a loaded dry storage cask in the fuel handling building with the 125 ton overhead crane. This specifically excludes the movement of a loaded cask into or out of the fuel handling building when the fuel handling building roll-up door is raised."

The only way this knowledge is learned is through study of the TS 3.7.12 Basis. Therefore, it is SRO knowledge.

The second part of the question is also from the TS Basis and is therefore SRO-only knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2012 MNS SRO Q90 (Bank 5775)

Development References
REFERENCES: Tech Spec 3.7.12 (Fuel Handling Ventilation Exhaust Sytem) Tech Spec 3.7.12 Basis LEARNING OBJECTIVES: OP-MC-FH-FC Objective 7

Student References Provided

GEN2.1 2.1.40 - GENERIC - Conduct of Operations

Conduct of Operations

Knowledge of refueling administrative requirements. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:

Remarks/Status

Q95 References

B 3.7 PLANT SYSTEMS

B 3.7.12 Fuel Handling Ventilation Exhaust System (FHVES)

BASES

BACKGROUND

The FHVES filters airborne radioactive particulates from the area of the fuel pool following a fuel handling accident. The FHVES, in conjunction with other normally operating systems, also provides environmental control of temperature and humidity in the fuel pool area.

The FHVES is composed of both a supply and exhaust section. The supply portion consists of a 100% capacity air handling unit containing water cooling coils, hot water heating coils, roughing filters, and associated ductwork and dampers. The exhaust portion consists of a 100% capacity filter train, two 50% capacity exhaust fans, and associated ductwork and dampers. The exhaust fans were originally each 100% capacity but have been modified to 50% capacity fans in order to meet the required intake and exhaust flowrate. The filter train contains a prefilter, high efficiency particulate air (HEPA) filter, and carbon filters of the gasketless design. The system is required to be in operation in filtered mode any time irradiated fuel is being moved in the fuel handling building.

The prefilters remove any large particles in the air, and any entrained water droplets present, to prevent excessive loading of the HEPA filters and carbon adsorbers.

The FHVES is discussed in the UFSAR, Sections 9.4 and 15.7 (Refs. 1 and 2 respectively) because it may be used for normal, as well as post accident, atmospheric cleanup functions.

A fuel handling accident can occur as a result of either dropping an irradiated fuel assembly that is being moved, or by dropping other equipment onto an irradiated fuel assembly in storage. As such, the FHVES is required to be OPERABLE and in operation in filtered mode to alleviate the consequences of a fuel handling accident during the following evolutions:

1. Movement of irradiated fuel in the fuel handling building;
2. Movement of loads in excess of 100 lbs. over irradiated fuel in the fuel handling building. This can include equipment and/or

Q95 References

BACKGROUND (continued)

new fuel assemblies that are being moved over irradiated fuel stored in the fuel pool; and

3. Movement of a loaded dry storage cask in the fuel handling building with the 125 ton overhead crane. This specifically excludes the movement of a loaded cask into or out of the fuel handling building when the fuel handling building roll-up door is raised.

APPLICABLE SAFETY ANALYSES

The FHVES design basis is established by the consequences of the limiting Design Basis Accident (DBA), which is a fuel handling accident. The analysis of the fuel handling accident, given in Reference 2, assumes that all fuel rods in an assembly are damaged. The DBA analysis of the fuel handling accident assumes that the FHVES is in operation in filtered mode. The accident analysis accounts for the reduction in airborne radioactive material provided by this filtration system. The amount of fission products available for release from the fuel handling building is determined for a fuel handling accident. These assumptions and the analysis follow the guidance provided in Regulatory Guide 1.25 (Ref. 3).

The FHVES satisfies Criterion 3 of 10 CFR 50.36 (Ref. 4).

LCO

The FHVES is required to be OPERABLE and in operation in filtered mode when irradiated fuel is being handled in the fuel handling building. Total system failure could result in the atmospheric release from the fuel handling building exceeding the 10 CFR 100 (Ref. 5) limits in the event of a fuel handling accident.

The FHVES is considered OPERABLE when the individual components necessary to control exposure in the fuel handling building are OPERABLE. The FHVES is considered OPERABLE when its associated:

a. Two exhaust fans are OPERABLE;

b. Supply fan is OPERABLE;

c. HEPA filter and carbon adsorber are not excessively restricting flow, and are capable of performing their filtration function; and

d. Ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

Q95 Parent Question

C

2012 MNS SRO NRC Examination QUESTION 90 90

APE036 AA2.03 - Fuel Handling Incidents
Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: (CFR: 43.5 / 45.13)
Magnitude of potential radioactive release ....

Loading of a Dry Storage Cask is complete, the cask lid has been welded shut, and the crew is preparing to move the cask to the Vertical Concrete Cask (VCC).

1) Per Tech Spec 3.7.12 (Fuel Handling Ventilation Exhaust System (FHVES)), is the VF System required to be OPERABLE and in operation in the Filter Mode when the cask is moved using the 125 -Ton Overhead Crane with the rollup door closed?

2) Per Tech Spec 3.7.12 Bases, total system failure could result in the atmospheric release from the fuel handling building exceeding the ______ limits in the event of a fuel handling accident.

A. 1. No
   2. 10 CFR 100

B. 1. No
   2. 10 CFR 50

C. 1. Yes
   2. 10 CFR 100

D. 1. Yes
   2. 10 CFR 50

2012 MNS SRO NRC Examination QUESTION 90 | 90 | **C**

General Discussion

Tech Spec 3.7.12 (Fuel Handling Ventilation Exhaust Sytem) requires the VF system to be OPERABLE and in operation in Filter Mode when irradiated fuel is being moved in the fuel handling building.

In accordance with the Tech Spec 3.7.12 Bases, the FHVES is designed to prevent exceeding the limits of 10 CFR 100 in the event of a fuel handling accident.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part plausible if the applicant does not associate the movement of a dry cask with the movement of irradiated fuel.

Second part correct.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part plausible if the applicant does not associate the movement of a dry cask with the movement of irradiated fuel.

The second part is plausible because 10 CFR 50 is mentioned in the basis for Tech Spec 3.7.12 related to the requirement to have Tech Specs associated with the FHVES system.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part correct.

The second part is plausible because 10 CFR 50 is mentioned in the basis for Tech Spec 3.7.12 related to the requirement to have Tech Specs associated with the FHVES system.

Basis for meeting the KA

The KA is matched because it requires the applicant to have knowledge of the magnitude of a potential offsite release relative to the basis for offsite dose limits during a design basis fuel handling incident.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

2) This question can NOT be answered solely by knowing information listed "above-the-line".

3) This question can NOT be answered by knowing the TS Safety Limits or their bases. This question is not related to TS Safety Limits.

4) This question requires the applicant to recall information from the TS basis. Therefore, it is SRO-level knowledge.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	NEW	

C

2012 MNS SRO NRC Examination QUESTION 90

90

Development References
References: Tech Spec 3.7.12 (Fuel Handling Ventilation Exhaust Sytem) Learning Objectives: OP-MC-FH-FC Objective 7

Student References Provided

APE036 AA2.03 - Fuel Handling Incidents
Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: (CFR: 43.5 / 45.13)
Magnitude of potential radioactive release ....

401-9 Comments:

Remarks/Status

GEN2.2 2.2.21 - GENERIC - Equipment Control

Equipment Control

Knowledge of pre- and post-maintenance operability requirements. (CFR: 41.10 / 43.2)

Given the following conditions on Unit 1:

- The 1A Annulus Ventilation (VE) train has been placed in service for a test run after fan lubrication
- During the test run, Annunciator 0AD-12 / F-2 (1A VE Filter Hi Temp) alarms due to a malfunction of the filter heater

Based on the conditions above, it is expected that 1A VE heaters ___(1)___ automatically trip.

In accordance with Technical Specification 3.6.10 (Annulus Ventilation System (AVS)) Bases, if the 1A VE heaters are subsequently tagged for repairs, the 1A Annulus Ventilation train is ___(2)___.

Which ONE (1) of the following completes the statements above?

A. 1. will
   2. OPERABLE

B. 1. will NOT
   2. OPERABLE

C. 1. will
   2. INOPERABLE

D. 1. will NOT
   2. INOPERABLE

General Discussion

Per OP/0/A/6100/010P (Annunciator Response for HVAC Panel 0AD-12) ,the preheaters automatically de-energize if the charcoal filter reaches 220°F, (which also causes the VE Filter Hi Temp annunciator (0AD-12, F/2). The VE fans will not trip until Filter temperature reaches 325°F (annunciator VE Filter Fire; 0AD-12, F/3).

In accordance with Tech Spec 3.6.10, if an AVS heater becomes INOPERABLE, it must be returned to service within 7 days. However, in accordance with the Tech Spec 3.6.10 Background Document if the heaters become INOPERABLE between periodic surveillance tests, it does NOT affect the OPERABILITY of the AVS train.

Answer A Discussion

CORRECT: See explanation above.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because the applicant could conclude that the heaters will not trip until the Filter Fan trips (at 325°F).

Second part is correct.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is correct.

Second part is plausible because if the heaters were inoperable at the time the periodic VE System Operability test was due, it would make the VE system INOPERABLE since the surveillance requirements of PT/1/A/4450/003A (Annulus Ventilation System Train A Operability Test) could not be met. The operability test requires the fan be run for 10 minutes with the heaters on.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because the applicant could conclude that the heaters will not trip until the Filter Fan trips (at 325°F).

Second part is plausible because if the heaters were inoperable at the time the periodic VE System Operability test was due, it would make the VE system INOPERABLE since the surveillance requirements of PT/1/A/4450/003A (Annulus Ventilation System Train A Operability Test) could not be met. The operability test requires the fan be run for 10 minutes with the heaters on.

Basis for meeting the K

The KA is matched because the applicant is given a set of conditions where there is a high temperature in an Annulus Ventilation Filter train due to a malfunctioning heater. The applicant must use Tech Specs (procedures) to mitigate the consequences of the malfunction by determining operability of the system, which would then result in the appropriate actions to be taken.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

2) This question can NOT be answered by knowing information listed "above-the-line".

This is knowledge of LCO action times and information from the TS Basis.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

From TS 3.6.10 (AVS).

4) This question requires the applicant to recall information from the TS basis. Therefore, it is SRO-level knowledge.

ILT-16-1 MNS SRO NRC Examination **QUESTION 96** 96 **A**

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2012 MNS NRC Q83 (Bank 5767)

Development References
REFERENCES: Tech Spec 3.6.10 (AVS) Tech Spec 3.6.10 Basis Lesson Plan OP-MC-CNT-VE (Annulus Ventilation System) Rev. 27A LEARNING OBJECTIVES: OP-MC-CNT-VE Objectives 8 and 13

Student References Provided

GEN2.2 2.2.21 - GENERIC - Equipment Control

Equipment Control

Knowledge of pre- and post-maintenance operability requirements. (CFR: 41.10 / 43.2)

401-9 Comments:

Remarks/Status

Q96 References

3.6 CONTAINMENT SYSTEMS

3.6.10 Annulus Ventilation System (AVS)

LCO 3.6.10 Two AVS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AVS train inoperable.	A.1 Restore AVS train to OPERABLE status.	7 days
B. One or more AVS train(s) heater inoperable.	B.1 Restore AVS train(s) heater to OPERABLE status. OR B.2 Initiate action in accordance with Specification 5.6.6.	7 days 7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

B 3.6 CONTAINMENT SYSTEMS

B 3.6.10 Annulus Ventilation System (AVS)

BASES

BACKGROUND

The AVS is required by 10 CFR 50, Appendix A, GDC 41, "Containment Atmosphere Cleanup" (Ref. 1), to ensure that radioactive materials that leak from the primary containment into the reactor building (secondary containment) following a Design Basis Accident (DBA) are filtered and adsorbed prior to exhausting to the environment.

The containment has a secondary containment called the reactor building, which is a concrete structure that surrounds the steel primary containment vessel. Between the containment vessel and the reactor building inner wall is an annulus that collects any containment leakage that may occur following a loss of coolant accident (LOCA) or rod ejection accident. This space also allows for periodic inspection of the outer surface of the steel containment vessel.

The AVS establishes a negative pressure in the annulus between the reactor building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment. Reactor building OPERABILITY is required to ensure retention of primary containment leakage and proper operation of the AVS.

The AVS consists of two separate and redundant trains. Each train includes a heater, mechanical demister, a prefilter/ moisture separator, upstream and downstream high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of radioiodines, and a fan. Ductwork, valves and/or dampers, and instrumentation also form part of the system. The heaters and mechanical demisters function to reduce the moisture content of the airstream to less than 70% relative humidity. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case of failure of the main HEPA filter bank. Only the upstream HEPA filter and the charcoal adsorber section are credited in the analysis. The system initiates and maintains a negative air pressure in the reactor building annulus by means of filtered exhaust ventilation of the reactor building annulus following receipt of a Phase B isolation signal. The system is described in Reference 2.

The prefilters remove large particles in the air, and the moisture separators remove entrained water droplets present, to prevent excessive loading of the HEPA filters and charcoal absorbers. Heaters are included

ACTIONS (continued)

36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.10.1

Operating each AVS train from the control room with flow through the HEPA filters and activated carbon adsorbers ensures that all trains are OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, fan or motor failure, or excessive vibration can be detected for corrective action. Operation with the heaters on for ≥ 10 continuous hours eliminates moisture on the adsorbers and HEPA filters. Experience from filter testing at operating units indicates that the 10 hour period is adequate for moisture elimination on the adsorbers and HEPA filters.

Inoperable heaters are addressed by Required Actions B.1 and B.2. The inoperability of heaters between required performances of this surveillance does not affect OPERABILITY of each AVS train. Operability of the heaters is demonstrated by the heater power dissipation test per SR 3.6.10.2.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.6.10.2

This SR verifies that the required AVS filter testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The AVS filter tests are in accordance with Regulatory Guide 1.52 (Ref. 5) with exceptions as noted in the UFSAR. The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, heater power dissipation, and the physical properties of the activated charcoal (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.6.10.3

The automatic startup on a Containment Phase B Isolation signal ensures that each AVS train responds properly. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Contol Board. Manual start and seal in capabilities are not allowed during a Blackout event.

The annulus is protected against excessive negative pressure buildup by means of a Low-Low pressure trip. The fan will trip if a Low-Low Pressure (- 7 inches WG) is sensed and that train is running in the exhaust mode in AUTO. VEPT 5440 is the "A" train wide range pressure transmitter which will trip the "A" fan and VEPT 5450 is the "B" train wide range pressure transmitter which will trip the "B" fan. **The fan will restart automatically when the Low-Low Pressure clears and its reset setpoint is reached. The Low-Low Pressure controls are bypassed when the fan switch is placed in the "ON" position.**

The fans will trip, if any of eight Carbon Bed (charcoal filter) fire detection temperatures switches indicate temperatures above 325°F. This also generates a HVAC Panel alarm (VE FILTER FIRE - > 325°F). If the fans are not running they will not start until the fire detection signal clears.

HVAC Control Panel annunciators indicate VE system trouble. Low airflow alarm circuits will activate these annunciators (A(B) VE Fan Low Flow). Main Control Board HVAC system trouble annunciator alarms will be received any time a HVAC Control Panel annunciator is in alarm.

2.2. Filter Trains

Objective #9

There are two (2) complete and independent filter trains. At the front of the filter section a moisture eliminator removes entrained water droplets from the air stream. The filter package is made up of individual sections which are: Prefilter - Absolute - Carbon - Absolute. Each Filter section has a D/P meter indication on the Control Room HVAC panel.

A Moisture Eliminator removes entrained water droplets from the air stream. Prefilters remove large particles. These are low efficiency filters and they remove about 3.7% of atmospheric dust.

Objective #8

Preheaters heat the incoming air to maintain humidity < 70%. This increases charcoal bed efficiency. **There are two (2) preheaters per train that automatically energize when the fan starts. If the preheaters do not operate during a LOCA, offsite dose may increase. If the charcoal bed reaches 220°F, a HVAC Panel alarm (VE FILTER HI TEMP - >220°F) will be received and the preheaters will de-energize.**

A RESET pushbutton is provided to reset the preheater if power had been interrupted. **The VE TRAIN PREHEAT HI TEMP RESET light ON, indicates that the heaters are in automatic. (refer to Drawing 7.2 and 7.3)**

Q96 Parent Question (2012 MNS NRC Q83 (Bank 5767))

C

2012 MNS SRO NRC Examination QUESTION 83 83

SYS027 A2.01 - Containment Iodine Removal System (CIRS)
Ability to (a) predict the impacts of the following malfunctions or operations on the CIRS; and (b) based on those predictions, use Procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)
High temperature in the filter system ....

Given the following conditions on Unit 1:

- PT/1/A/4450/003 A (Annulus Ventilation System Train A Operability Test) is being performed.
- During the test, Annunciator 0AD-12 / F-2 (1A VE Filter Hi Temp) alarms
- The 1A VE Filter temperature is 222 °F
- The cause of the high temperature is a malfunction of the filter heater

1) What automatic action(s) is(are) expected as a result of this alarm?

2) In accordance with Technical Specification 3.6.10 (Annulus Ventilation System (AVS)) Bases, with the heater INOPERABLE, the 1A Annulus Ventilation train is ____________.

Which ONE (1) of the following completes the statements above?

A. 1. 1A Heaters trip ONLY
   2. INOPERABLE

B. 1. 1A Heaters AND 1A VE Fan trip
   2. INOPERABLE

C. 1. 1A Heaters trip ONLY
   2. OPERABLE

D. 1. 1A Heaters AND 1A VE Fan trip
   2. OPERABLE

General Discussion

Per OP/0/A/6100/010P (Annunciator Response for HVAC Panel 0AD-12) ,the preheaters automatically de-energize if the charcoal filter reaches 220 F, (which also causes the VE Filter Hi Temp annunciator (0AD-12, F/2). The VE fans will not trip until Filter temperature reaches 325 F (annunciator VE Filter Fire; 0AD-12, F/3).

In accordance with Tech Spec 3.6.10, if an AVS heater becomes INOPERABLE, it must be returned to service within 7 days. However, in accordance with the Tech Spec 3.6.10 Background Document an INOPERABLE heater does NOT affect the OPERABILITY of the AVS train.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is correct.

Second part is plausible because the heaters are listed in the TS Background document as equipment that is part of the AVS train.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because the VE Fan will trip on filter bed high temperature. However they will not trip until temperature increases to 325 F.

Second part is plausible because the heaters are listed in the TS Background document as equipment that is part of the AVS train.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

First part is plausible because the VE Fan will trip on filter bed high temperature. However they will not trip until temperature increases to 325 F.

Second part is correct.

Basis for meeting the KA

The KA is matched because the applicant is given a set of conditions where there is a high temperature in an Annulus Ventilation Filter train due to a malfunctioning heater. The applicant must use Tech Specs (procedures) to mitigate the consequences of the malfunction by determining operability of the system, which would then result in the appropriate actions to be taken.

Basis for Hi Cog

Basis for SRO only

This question meets the following criteria for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for screening questions linked to 10CFR55.43(b)(2) (Tech Specs):

1) This question can NOT be answered by knowing less than 1 hour Tech Specs

2) This question can NOT be answered by knowing information listed "above-the-line".

This is knowledge of LCO action times and information from the TS Basis.

3) This question can NOT be answered by knowing the TS Safety Limits or their bases.

From TS 3.6.10 (AVS).

4) This question requires the applicant to recall information from the TS basis. Therefore, it is SRO-level knowledge.

FOR REVIEW ONLY - DO NOT DISTRIBUTE

C

2012 MNS SRO NRC Examination QUESTION 83

83

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	NEW	

Development References
References: Tech Spec 3.6.10 (AVS) Tech Spec 3.6.10 Background Document Learning Objectives: OP-MC-CNT-VE Objectives 8 and 13

Student References Provided

SYS027 A2.01 - Containment Iodine Removal System (CIRS)
Ability to (a) predict the impacts of the following malfunctions or operations on the CIRS; and (b) based on those predictions, use Procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13)
High temperature in the filter system ....

401-9 Comments:

Remarks/Status

GEN2.2 2.2.6 - GENERIC - Equipment Control

Equipment Control

Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13)

Given the following conditions on Unit 1:

- The unit startup is in progress
- A site level Operating Procedure (OP) is to be performed on back-shift
- The OATC identifies that a technical change to the procedure is needed because it cannot be performed as written
- The change is to be processed as a TEMPORARY change since Procedure Group support is NOT available

In accordance with AD-DC-ALL-0201 (DEVELOPMENT AND MAINTENANCE OF CONTROLLED PROCEDURE MANUAL PROCEDURES),

1) the lowest level of approval for the change to the procedure is the ________.

2) temporary changes to FLEET level technical procedures ________ allowed.

Which ONE (1) of the following completes the statements above?

A. 1. Assistant Operations Manager - Shift
 2. are NOT

B. 1. Assistant Operations Manager - Shift
 2. are

C. 1. Shift Manager - Operations
 2. are NOT

D. 1. Shift Manager - Operations
 2. are

General Discussion

In accordance with AD-DC-ALL-0201, since the change involves a change in technical content, procedure group support is not immediately available, and since the procedure cannot be performed as written, the change should be processed as a Temporary Change.

The Temporary Change requires approval of the Shift Manager.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part 1 is plausible because the AOM - Shift has overall responsibility for day-to-day operations on shift.

Part 2 is plausible if the applicant fails to recall that, in addition to ALL administrative procedures, temporary changes also do not apply to FLEET technical procedures.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part 1 is plausible because the only difference between a Restricted Change and Temporary Change is that for a Restricted Change the alterations to the procedure are dependent upon specific plant conditions.

Part 2 is correct.

Answer C Discussion

CORRECT: See explanation above.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE: Part 1 is correct.

Part 2 is plausible if the applicant fails to recall that, in addition to ALL administrative procedures, temporary changes also do not apply to FLEET technical procedures.

Basis for meeting the K

The KA is matched because the applicant must have knowledge of the Fleet Procedure requirements regarding changes to technical procedures.

Basis for Hi Cog

Basis for SRO only

This question meets the following examples for an SRO only question as described in the Clarification Guidance for SRO-only Questions Rev 1 dated 03/11/2010 for questions linked to 10CFR55.43(b)(3) (Facility licensee procedures required to obtain authority for design and operating changes in the facility):

* Processes for changing the plant or plant procedures

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	NEW	

Development References

REFERENCES:
AD-DC-ALL-0201 (Development and Maintenance of Controlled Procedure Manual Procedures) Rev. 12

LEARNING OBJECTIVES:
NONE

Student References Provided

GEN2.2 2.2.6 - GENERIC - Equipment Control
Equipment Control
Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13)

401-9 Comments:	Remarks/Status

Q97 References

3.0 DEFINITIONS (continued)

49. **Temporary Procedure:** A Procedure used to implement a one-time change (e.g., Engineering Change, project).

50. **Temporary Procedure Change:** A change to the current revision of a Technical Procedure that has the following attributes: {7.1.11} [7.3.20]

    - Not a Change of Intent
    - Necessary to support timely continuation of an activity when the Procedure cannot be performed as written
    - Expires within a specified timeframe
    - Evaluated for permanent incorporation

51. **Validation Review (PRRV):** A review performed to determine that trained personnel can follow the actions specified in the Procedure and ensure the instructions can be performed by the individual for which the Procedure was written. {7.1.6}

52. **Working Copy:** Copy of the current revision of a Controlled Document obtained from EDMS or a controlled file which includes consideration of unincorporated Engineering Changes (EDs) (e.g. 'ECPEND' minor revisions, EC sketches and markups).

53. **Writer's Manual Quality Review (PRRQ):** A review to verify minimum standards of quality of the new Procedure or revision.

4.0 RESPONSIBILITIES

4.1 <u>All Personnel</u>

1. Initiate Procedure Revision Requests (PRRs) for Procedure deficiencies.

2. Provide sufficient information in PRRs including supporting information, and reason for the change in accordance with Section 5.4.

3. Initiate Corrective Action Program items in accordance with AD-PI-ALL-0100, Corrective Action Program, for Procedure deficiencies that are conditions adverse to quality or significant conditions adverse to quality.

4. Complete assigned Procedure reviews by required due dates or obtain extension.

5. Verify qualifications for tasks requiring qualification.

Q97 References

5.10.4 Editorial Revision Publishing (continued)

g. If publishing a site Procedure, then ensure site DCRM publishes the Procedure.

h. Verify PRR status is 'Completed' to enable Procedure review and approval records package transmittal in accordance with AD-DC-ALL-0002, Records Management.

5.11 Temporary Procedure Changes

5.11.1 Temporary Procedure Change Preparation

1. The Temporary Procedure Change process is used to make temporary changes to site Technical Procedures. This process is not applicable to site Administrative, fleet Administrative, or fleet Technical Procedures.

2. The Temporary Procedure Change process can be utilized when one of the following conditions exists:

   - Plant conditions are different from the expected conditions for which the Procedure was written and are expected to return to normal.

     OR

   - Errors or omissions exist in the Procedure.

3. During working hours, initiator will consult the Sponsor or Approval Authority to validate the appropriateness of the Temporary Procedure Change versus a Technical Procedure Revision, Non-Technical Revision, or Field Editorial Correction.

4. If the needed change is to be addressed as a Field Editorial Correction, then go to AD-HU-ALL-0004, Procedure and Work Instruction Use and Adherence, for pen and ink changes.

5. Obtain a copy of the title page of the current Procedure and pages requiring change.

6. Additional pages created by the mark-up should be given a letter designation (e.g., 22A, 22B) to ensure fidelity with subsequent pages.

7. Mark-up the changes electronically or manually.

   a. Show deletions and additions such that the user can readily see what the step was originally as well as the new wording.

DEVELOPMENT AND MAINTENANCE OF CONTROLLED PROCEDURE MANUAL PROCEDURES	AD-DC-ALL-0201
	Rev. 14
	Page 34 of 151

5.6 Plan Procedure Development (continued)

- Technical Change (e.g., Temporary Change, Restricted Change, Manual Change) - Used when criteria in Section 5.8 is met and one of the following methods is used to document the change:
  - ◊ Temporary Change - Used if a change to the guidance in a Procedure is needed, but an immediate permanent revision to the Procedure is not required, or when Procedure support is not readily available. Approval is by SM or OSM with full reviews to follow.
  - ◊ Restricted Change - Used if a change to the guidance in a Procedure is needed and the guidance is only applicable to a certain duration or condition. A Restricted Change requires completion of all formal reviews.
  - ◊ Manual Change - Used if a change to the guidance in a Procedure is needed, but an immediate permanent revision to the Procedure is not required. A Manual Change requires completion of all formal reviews.
- Non-Technical Change (Temporary Change, Restricted Change, Manual Change) - Used when criteria in Section 5.9 is met and uses one of the three change methods.
- Editorial Revision - Used when criteria in Section 5.10 is met.

3. Determine the assigned Writer by reviewing the PRR Attributes.

5.7 Developing the Procedure Draft for a New Procedure or a Revision

1. The assigned Writer, in coordination with the Sponsor and applicable Peer Group or Working Group, will perform the Procedure draft development steps.
2. If a PRR cannot be processed electronically, then process manually using Attachment 2, Manual Procedure Revision Form.
3. If revising a Procedure not on a network system (e.g., Safeguards Information, Security-Related Information, Sensitive Security Information), then process the revision without using the working directory or linking the Procedure.

GEN2.3 2.3.12 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 45.9 / 45.10)

Given the following conditions on Unit 2:

- The unit is shutdown in preparation for refueling
- NC system temperature is currently 190°F
- An entry into Containment is planned for an inspection

Based on the conditions above, in accordance with MSD-585 (REACTOR BUILDING PERSONNEL ACCESS AND MATERIAL CONTROL),

1) is permission from the WCC SRO required for the entry?

2) is use of the "buddy system" required for the entry?

A. 1. YES
2. NO

B. 1. NO
2. NO

C. 1. YES
2. YES

D. 1. NO
2. YES

General Discussion

In accordance with MSD-585 (Reactor Building Personnel Access and Material Control), for Containment or Annulus entries in MODES 1-4, permission from the WCC SRO must be obtained. Additionally, use of the buddy system is required in those MODES.

Since the unit is in MODE 5, permission from the WCC SRO and use of buddy system is NOT required.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
In most cases, permission from the WCC SRO is required for a Containment entry (even some cases where the unit is shutdown). Consequently, it would be logical for the applicant to conclude that WCC SRO permission for a Containment entry is always required, making the first part of this question plausible. Additonally, if the applicant does not recognize from the conditions given that the plant is in MODE 5, they would conclude that WCC SRO permission is required.

The second part is correct.

Answer B Discussion

CORRECT: See explanation above.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
In most cases, permission from the WCC SRO is required for a Containment entry (even some cases where the unit is shutdown). Consequently, it would be logical for the applicant to conclude that WCC SRO permission for a Containment entry is always required, making the first part of this question plausible.

Use of the buddy system is required under the same conditions requiring permission from the WCC SRO for containment entry. If the applicant concludes that WCC SRO permission for the entry is required, they should also conclude that use of the buddy system is required.

Additionally, if the applicant does not recognize from the conditions given that the unit is in MODE 5, then YES/YES would be the correct response.

Answer D Discussion

INCORRECT: See explanation above.

PLAUSIBLE:
The first part is correct.

The second part is plausible if the applicant does not recognize from the conditions given that the unit is in MODE 5 and hence use of the buddy system is not required. Additionally, the applicant may conclude that use of the buddy system is only required for Containment entries "at power".

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of Containment entry requirements.

Basis for Hi Cog

This is a higher cognitive level question because it requires more than one mental step.

First, the applicant must analyze the conditions given and determine the plant MODE.

Next, the applicant must recall from memory the requirement for Containment entry from MSD-585.

Finally, the applicant must associated the information determined from the analysis with the recalled information from the procedure to determine the correct response.

Basis for SRO only

This is an SRO only question because approval of Containment entries in MODEs 1-4 is the responsibility of the WCC SRO. Therefore, Containment entry conditions is knowledge only required of the SRO.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	NEW	

Development References
REFERENCES: MSD-585 (Reactor Building Personnel Access and Material Control) LEARNING OBJECTIVES: NONE

Student References Provided

GEN2.3 2.3.12 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 45.9 / 45.10)

401-9 Comments:	Remarks/Status

Q98 References

Attachment 4.3 MSD 585

Procedure for Containment Entry Modes 1 - 4 Page 1 of 2

Prior to Entry:

- ☐ Ensure Pre-Job Brief given per Attachment 4.2 (Containment/Annulus Entry Pre-Job Brief).
- ☐ Obtain WCC SRO permission prior to entry into Containment.
- ☐ Sign into the Containment/Annulus Entry Log in WCC.
- ☐ Obtain VE Door Key (Key # 213 or 223).
- ☐ **IF** VE Door to remain open greater than 2 minutes:
  - ☐ Have WCC SRO declare the Reactor Building inoperable per Tech Spec LCO 3.6.16.
  - ☐ Have WCC SRO issue applicable NSD 316 (Fire Protection Impairment and Surveillance) paperwork.

NOTE:	VE Door must be capable of being secured closed in less than 2 minutes. Ex: VE Door can be tied open with rope or blocked by cables with quick-disconnect fittings. If intended work prevents this, work is **NOT** allowed in Modes 1 - 4.

WHEN stationed at VE Door, perform the following:

- ☐ Establish response measures required to secure VE Door closed upon notification from Control Room Supervisor (CRS). Note that these measures do **NOT** necessarily restore Operability of the Reactor Building but are intended to restore Reactor Building function.
- ☐ Notify CRS at x2157 and ensure working phone by return phone call.
- ☐ Have CRS log VE Door compensatory measures in Narrative Log.

- ☐ Notify RP for further Reactor Building entry guidance.
- ☐ **IF** materials or tools are being taken into Containment, complete Attachment 4.1 (Materials and Tools Control Log).
- ☐ **IF** materials will be left inside Containment, unattended, follow the guidance in Attachment 4.5 (Guidelines and Exclusions for Materials Inside Containment) and document on Attachment 4.6 (Materials Remaining in Containment Log Data Sheet).
- ☐ Ensure appropriate Reactor Building lighting is energized.
- ☐ Ensure FME Monitor stationed at the Containment entrance to log items taken in.

Q98 References

- **IF** VE Door (Unit 1: Doors 702A, 702B, 1200A, 1200B, or 1200C; Unit 2: Doors 713A, 713B, 1250A, 1250B, or 1250C) needs to remain open longer than 2 minutes **OR** repairs are being made, review the following responsibilities: {PIP M-12-05085}

  Maintenance:

  ◊ Ensure materials and tools needed to close and latch door are pre-staged.

  ◊ Ensure dedicated person available to close and latch VE Door within 5 minutes of notification from WCC unless necessary for the door to remain open longer to ensure personnel out of Annulus area and clear of door travel path. Ex., VE Door can be tied open with rope or blocked by cables with quick-disconnect fittings. If intended work prevents this, work is **NOT** allowed in Modes 1 - 4.

  Operations:

  ◊ Ensure designated person available to notify the work group to close and latch the door in the event of a unit transient that may result in VE system operation. These transients include:

    - Safety Injection, unit trip, Primary System Leakage into Containment, Secondary Leakage into Containment, Loss of Electrical Power (Blackout), Loss of Containment Ventilation Cooling, or Loss of VQ capability

  ◊ Ensure Reactor Building is logged inoperable per TS 3.6.16.

- Review the Airlock Door Operation below:

  ◊ **IF** personnel become stuck in the airlock, immediately call x4911 and have Control Room refer to OP/0/A/6700/006 (Personnel Airlock Operations).

  ◊ **IF** doors do **NOT** function as intended, call WCC SRO or designee at x4276.

  ◊ Differential pressure may cause doors to swing open, slam shut, or create a wind tunnel effect.

  ◊ No more than 12 people in airlock at one time.

  ◊ Buddy System shall be in effect when in Modes 1 – 4.

  ◊ **Before** closing the Auxiliary Building airlock door:

    - Ensure the phone in airlock is working.
    - Ensure emergency tool box tamper seal has **NOT** been breached.
    - Stand clear of swing path of doors.

GEN2.3 2.3.14 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)

Given the following Unit 1 conditions:

- The crew is responding to a large LOCA with 10% failed fuel
- 1NI-184B (1B ND PUMP SUCTION FROM CONT SUMP ISOL) would NOT open during FWST swap-over
- 1NI-184B breaker has tripped and will NOT reset
- Manual alignment of 1NI-184B is required to protect the health and safety of the general public
- Expected dose rates in the area of the valve may exceed 150 REM/hr
- It will take 12 minutes to open 1NI-184B

In accordance with the Emergency Response Procedures (RP) requirements for planned Emergency Exposures,

1) who, by title, is allowed to approve the Emergency Exposure?

2) and based on the conditions above, is a volunteer <u>required</u> to be used to open 1NI-184B?

A. 1. Site Vice President
   2. NO

B. 1. Site Vice President
   2. YES

C. 1. Emergency Coordinator
   2. NO

D. 1. Emergency Coordinator
   2. YES

General Discussion

Greater than 25 REM is allowed only on a volunteer basis for protection of the public health and safety. Exposure up to and including 25 REM do NOT require the worker to be a volunteer.

In accordance with Emergency Exposure request attachments in the RPs, The planned Emergency Exposure must be approved by the EC or the EOF Director.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is plausible since, given the magnitude of the exposure, it would be logical for the applicant to conclude that only the Site VP or above could approve the exposure. Additionally, the Site VP must approve a "Planned Special Exposure" during normal operations (in accordance with PD-RP-ALL-1000).

The second part is plausible if the applicant incorrectly calculates the workers planned exposure or does not recall the maximum exposure for which the worker does NOT have to be a volunteer.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is plausible since, given the magnitude of the exposure, it would be logical for the applicant to conclude that only the Site VP or above could approve the exposure. Additionally, the Site VP must approve a "Planned Special Exposure" during normal operations (in accordance with PD-RP-ALL-1000).

The second part is correct.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is correct.

The second part is plausible if the applicant incorrectly calculates the workers planned exposure or does not recall the maximum exposure for which the worker does NOT have to be a volunteer.

Answer D Discussion

CORRECT. See explanation above.

Basis for meeting the K

KA is matched because candidate must have knowledge of the emergency dose limits for lifesaving and equipment saving activities based on whether the individual is a volunteer.

Basis for Hi Cog

Basis for SRO only

This is an SRO Only question linked to 10CFR55.43(b)(4), Radiation hazards that may arise during normal and abnormal situations, including maintenance activities and various contamination conditions. This question requires the candidate to have knowledge of emergency dose for lifesaving and equipment saving activities. This level of knowledge is not expected of a Reactor Operator.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Comprehension	MODIFIED	2012 MNS Audit Q97 (Bank 3102) MODIFIED

Development References

REFERENCES:
Lesson Plan OP-MC-EP-EMP Rev. 12
RP-04 (General Emergency) Rev. 30 Enclosure 4.4 (Request for Emergency

Student References Provided

Exposure)

LEARNING OBJECTIVES:
OP-MC-EP-EMP Objective 5

GEN2.3 2.3.14 - GENERIC - Radiation Control

Radiation Control

Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)

401-9 Comments:	Remarks/Status

Q99 References

Enclosure 4.4

Request for Emergency Exposure (a)

RP/0/A/5700/004
Page 1 of 1

Activity	Total Effective Dose Equivalent (TEDE)	Lens of Eye	Other Organs (b)
All	5 rem	15 rem	50 rem
Protecting Valuable Property	10 rem	30 rem	100 rem
Life saving or Protection of Large Populations	25 rem	75 rem	250 rem
Life saving or Protection of Large Populations (c)	> 25 rem	> 75 rem	> 250 rem

(a) Excludes declared pregnant women.

(b) Includes skin and body extremities.

(c) Only on a volunteer basis to persons fully aware of the risks involved. All factors being equal, select volunteers above the age of 45 and those who normally encounter little exposure.

RP Badge No.	Name	Age	Employer	Signature of Individual

My signature indicates my acknowledgement that I have been informed that I may be exposed to the levels of radiation indicated above. I have been fully briefed on the task to be accomplished and on the risks of this exposure.

I, ________________________________ acknowledge this planned Emergency Exposure __________.
(RPM or designee, signature or note of verbal authorization) Date/Time

I, ________________________________ approve this planned Emergency Exposure at ____________.
(Emergency Coordinator or EOF Director, signature or note of verbal authorization) Date/Time

Subsequent Radiation Protection Action:

- Determine need for medical evaluation
- Initiate reporting requirements per 10CFR20
- Copy to Individual's Exposure History File

RADIATION WORKER RESPONSIBILITIES	PD-RP-ALL-0001
	Rev. 3
	Page 17 of 57

5.2.2 Occupational Annual Dose Limits

1. The table below outlines the NRC and Duke Energy occupational dose limits:

Table Occupational Annual Dose Limits

Body Location	NRC Annual Dose Limit	DE Annual Dose Limit
Total Effective Dose Equivalent (TEDE) to the whole body	5.0 rem/year	2.0 rem/year up to 5.0 rem/year with extension
Shallow Dose Equivalent to Skin and Extremities	50.0 rem/year	50.0 rem/year
Committed Dose Equivalent (CDE) to any tissue or organ except lens of eye	50.0 rem/year	50.0 rem/year
Lens Dose Equivalent to lens of eye	15.0 rem/year	15.0 rem/year
Embryo/fetus (declared pregnant female)	0.5 rem/pregnancy duration, controlled uniformly at .05 rem/month	0.45 rem/pregnancy duration, controlled uniformly at .05 rem/month(Note 1) (Note 2)
Planned Special Dose (PSE)	Up to 5 times annual limits in a lifetime.	Up to 5 times annual limits in a lifetime. Requires Site VP approval
Emergency Dose	See EPA -400-92-001	See Site Emergency Plan
Minors (<18 years of age)	10% of adult limit and may **NOT** enter a High Radiation Area	2% of adult limit and may **NOT** enter a High Radiation Area
(Note 1) Workers exceeding 500 mrem in the period between conception and pregnancy declaration are allowed an additional dose of 50 mrem during the remainder of the pregnancy per 10CFR20.1208.		
(Note 2) Duke Energy uses 450 mrem threshold and additional 50 mrem to ensure worker does not exceed 500 mrem total gestation		

5.2.3 Declaration Of Pregnancy

1. The declaration of pregnancy affects individual dose limits. Upon declaration, additional monitoring and dose limits are applied. Duke Energy follows the guidance provided in Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Dose. This regulatory guide is intended to provide information to pregnant women and other personnel regarding radiation dose during pregnancy.

2. Instructions to declare or undeclare pregnancy are covered in TE-RP-ALL-4001, Declared Pregnant Worker.

3. A worker may declare pregnancy at any time during pregnancy in order to minimize dose of the fetus to radiation. Upon declaration, the worker's dose limit is reduced.

D

2012A MNS SRO Audit Examination QUESTION 97

97

GEN2.3 2.3.4 - GENERIC - Radiation Control
Radiation Control
Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

Given the following conditions on Unit 1:

- Unit 1 is responding to a large LOCA with 10% failed fuel
- 1NI-184B (1B ND Pump Suction From Cont Sump Isol) would not open during FWST swapover
- 1NI-184B breaker has tripped and will not reset
- The OSM has determined that manual alignment of 1NI-184B is required to PROTECT THE HEALTH AND SAFETY OF THE GENERAL PUBLIC
- RP projects that expected dose rates in the area of the valve may exceed 150 REM/hr

Which ONE (1) of the following is the MAXIMUM TEDE exposure limit (if any) for a worker who volunteered to manually open 1NI-184B in accordance with RP-004, General Emergency?

A. Do not exceed 5 REM

B. Do not exceed 10 REM

C. Do not exceed 25 REM

D. The worker may exceed 25 REM

2012A MNS SRO Audit Examination QUESTION 97 | 97 | **D**

General Discussion

Greater than 25 REM is allowed on a volunteer basis for protection of the public health and safety.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible since this is the maximum allowable TEDE for non-emergency conditions..

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible since this is the maximum allowable annual TEDE for equipment protection during accident conditions.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE: This answer is plausible since this is the maximum allowable annual TEDE for life saving or public safety on a non-volunteer basis.

Answer D Discussion

CORRECT. See explanation above.

Basis for meeting the KA

KA is matched because candidate must have knowledge of the emergency dose limits for lifesaving and equipment saving activities based on whether the individual is a volunteer.

Basis for Hi Cog

Basis for SRO only

This is an SRO Only question linked to 10CFR55.43(b)(4). Radiation hazards that may arise during normal and abnormal situations, including maintenance activities and various contamination conditions. This question requires the candidate to have knowledge of emergency dose for lifesaving and equipment saving activities. This level of knowledge is not expected of a Reactor Operator.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	BANK	2010 AUDIT Q98 (Bank 2998)

Development References	Student References Provided
Lesson Plan OP-MC-EP-EMP rev. 12, page 35 Learning Objective OP-MC-EP-EMP, Obj. 5	

GEN2.3 2.3.4 - GENERIC - Radiation Control
Radiation Control
Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)

401-9 Comments:	Remarks/Status

GEN2.4 2.4.44 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11)

Given the following initial plant conditions:

- A large break LOCA has occurred on Unit 1
- At 0220, the OSM, acting as the Emergency Coordinator (EC), declares a General Emergency and makes the following initial Protective Action Recommendations (PARs):
    - Evacuate - Zones B, C, L, M, D, N, O, R
    - Shelter - Zones P, Q, S

At 0230, the following conditions are observed:

- Conditions which resulted in the General Emergency on Unit 1 remain unchanged
- Wind direction has changed and is now from 100°

In accordance with the Response Procedures (RP), the Emergency Coordinator ___(1)___ allowed to delegate making PARs.

Based on the conditions at 0230, the Emergency Coordinator ___(2)___ suspend evacuation of Zone D.

Which ONE (1) of the following completes the statements above?

REFERENCE PROVIDED

A. 1. is
   2. will

B. 1. is
   2. will NOT

C. 1. is NOT
   2. will

D. 1. is NOT
   2. will NOT

General Discussion

In accordance with RP-004 (General Emergency), it is the responsibility of the Emergency Coordinator (EC) to make Protective Action Recommendations. And, there is no provision in the procedure which allows the EC to delegate that responsibility.

In accordance with the EP-EMP lesson plan, once evacuation of a zone has started, it cannot be changed.

Answer A Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is plausible because the EC will normally have someone else fill out the Emergency Notification Form. Consequently, the applicant could conclude that because the EC can delegate filling out the form, that this includes making the PAR determination.

The second part is plausible because with the change in wind direction, Zone D is no longer listed in the zones which require evacuation.

Answer B Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is plausible because the EC will normally have someone else fill out the Emergency Notification Form. Consequently, the applicant could conclude that because the EC can delegate filling out the form, that this includes making the PAR determination.

This second part is corret.

Answer C Discussion

INCORRECT: See explanation above.

PLAUSIBLE:

The first part is correct.

The second part is plausible because with the change in wind direction, Zone D is no longer listed in the zones which require evacuation.

Answer D Discussion

CORRECT: See explanation above.

Basis for meeting the K

The K/A is matched because it requires the applicant to have knowledge of the procedures for making PARs in order to determine the correct recommendation.

Basis for Hi Cog

Basis for SRO only

This is an SRO level question because it requires knowledge of E-plan implementation which is an SRO-specific responsibility.

Job Level	Cognitive Level	QuestionType	Question Source
SRO	Memory	NEW	

Development References

REFERENCES:
RP/0/B/5700/029 Enclosure 4.4 (Offsite Protective Action Recommendations)

LEARNING OBJECTIVES:
OP-MC-EP-EMP Objective 11

Student References Provided

RP/0/B/5700/029 Enclosure 4.4 (Offsite Protective Action Recommendations)

GEN2.4 2.4.44 - GENERIC - Emergency Procedures / Plan
Emergency Procedures / Plan
Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11)

ILT-16-1 MNS SRO NRC Examination **QUESTION 100** 100 **D**

401-9 Comments:	Remarks/Status

Q100 References

Enclosure 4.1
OSM Immediate and Subsequent Actions

RP/0/A/5700/004
Page 2 of 3

_____ 1.2 **IF** valid trip II alarm occurs on any one of the following, immediately contact RP shift at 4282 to perform AD-EP-ALL-0202 (Emergency Response Offsite Dose Assessment):

- 1 **OR** 2 EMF36(L)
- 1 EMF24, 25, 26, 27
- 2 EMF10, 11, 12, 13

_____ 1.3 Ensure Protective Action Recommendations to the Offsite Agencies are made and transmitted within 15 minutes **PER** RP/0/B/5700/029 (Notifications to Offsite Agencies from the Control Room), Enclosure 4.4 (Protective Action Recommendations).

_____ 1.4 **IF** changes to the initial Protective Action Recommendations are recognized and approved by the Emergency Coordinator, these changes shall be transmitted to the offsite agencies within 15 minutes. {PIP M-00-02138}

_____ **IF** B (IS OCCURRING) or C (HAS OCCURRED) on Line 6 (EMERGENCY RELEASE) of the Emergency Notification Form is checked, immediately contact RP shift at 4282 to perform AD-EP-ALL-0202 (Emergency Response Offsite Dose Assessment).

Note that it is the responsibility of the EC to make Protective Action Recommendations. There is no provision in the procedure which allows the EC to delegate the responsibility of making PARs.

Q100 References

- Any other additional information to assist the offsite agencies that you feel is warranted.

Remember to keep these comments at the lay persons level as they are not nuclear workers and do not know our acronyms, jargon, etc.

- Line 14-16: Emergency Release Data. This is not needed on an initial notification, but should be provided on an early follow up message when the data becomes available from RP.

There are 13 lines to be filled out for an initial notification. If you follow the procedure, RP/029, you can get through these 13 lines in a timely manner (if it is not the first time you have reviewed the procedure).

2.12 Protective Action Recommendations (PARs)

Objective # 11

Protective Action Recommendations (PARs) are only required during a General Emergency. PARs are recorded on Line 5 of the ENF. The instructions in RP/0/B/5700/029, Encl 4.1 direct the operator to Enclosure 4.4 to determine the correct PARs. Note that determining the PARs and recording them on the ENF is part of the 15 minute requirement for the initial notification of a General Emergency. Additionally a change in PARs must also be communicated to the off-site agencies within 15 minutes. Therefore, it is prudent for the operator to maintain proficiency by reviewing RP/0/B/5700/029 on a periodic basis.

The following are key points from RP/0/B/5700/029, Enclosure 4.4:

- PARs for the public apply during a General Emergency, and include sheltering, evacuation, and consideration of KI use.
- PARs are based on current plant conditions and/or projected dose.
- After a GE is declared the first set of PARs are made using the Initial PAR Determination flow chart.
- Determining which areas to shelter and which to evacuate will depend on the event in progress (RPSA, HAB) in conjunction with wind direction and wind speed. It is also important to remember that once a zone is selected for evacuation, it cannot be removed, regardless of changes in wind direction or speed.
- After the initial PAR determination, PARs are continuously assessed using the Expanded PAR Determination flow chart. Updated PARs are communicated to off-site agencies as required.
- After the Initial PARs are transmitted to the off-site agencies, off-site dose projections and filed measurements are performed. If the off-site dose projections or the filed measurements exceeds the limits in RP/029, Encl 4.4, then additional areas must be evacuated or sheltered.
- KI use is recommended if the projected Thyroid dose will be $\geq$ 5 Rem.

Q100 References

Table 1			
Protective Action Zones			
Wind Direction	2 Mile Radius	2-5 Miles Downwind	5-10 Miles Downwind
0.1 - 22.5	B,C,L,M	D,O,R	E,F,S
22.6 – 45.0	B,C,L,M	D,O,R	E,Q,S
45.1 – 67.5	B,C,L,M	D,N,O,R	E,P,Q,S
67.6 – 90.0	B,C,L,M	D,N,O,R	P,Q,S
90.1 – 112.5	B,C,L,M	N,O,R	K,P,Q,S
112.6 – 135.0	B,C,L,M	A,N,O,R	I,K,P,Q,S
135.1 – 157.5	B,C,L,M	A,N,O	I,K,P,Q
157.6 – 180.0	B,C,L,M	A,N	H,I,J,K,P
180.1 – 202.5	B,C,L,M	A,N	G,H,I,J,K,P
202.6 – 225.0	B,C,L,M	A,D,N	G,H,I,J,K,P
225.1 – 247.5	B,C,L,M	A,D	F,G,H,I,J
247.6 – 270.0	B,C,L,M	A,D	F,G,H,I,J
270.1 – 292.5	B,C,L,M	A,D	E,F,G,H,J
292.6 – 315.0	B,C,L,M	A,D,R	E,F,G
315.1 – 337.5	B,C,L,M	D,R	E,F,G,S
337.6 – 360.0	B,C,L,M	D,R,O	E,F,S

Table 2	
PROTECTIVE ACTION GUIDES (PAGs) (Projected Dose or Field Measurements)	
Total Effective Dose Equivalent (TEDE)	Committed Dose Equivalent (CDE) Thyroid
$\geq$ 1 Rem	$\geq$ 5 Rem

Table 3	
WIND SPEED/DIRECTION	
ENF Radiation Protection Manager	Line 9
McGuire SDS	Group Display **ERORD5**
DPC Meteorological Lab	704-382-0139 704-373-7896
National Weather Service Greer, S.C	864-879-1085 800-268-7785

Facility: **McGuire**	Scenario No.: **1**	Op Test No.: **N16-1**	
Examiners: ____________		Operators: ____________	(SRO)
____________		____________	(RO)
____________		____________	(BOP)

Initial Conditions:	The plant is at 100% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. Pzr PORV 1NC-32B has been isolated (per AP-11) due PORV leakage. ACTION has been taken in accordance with Technical Specification LCO 3.4.11 ACTION A. MCB Annunciator 1AD-9, B-7, “ICEBED HI TEMP SWITCHES,” spuriously alarmed several times during the shift (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	1	C-BOP C(TS)-SRO	Pzr PORV 1NC34A fails partially OPEN
2	2	C-RO C-BOP C-SRO	MSR Relief Valve fails OPEN/Downpower
3	3	R-RO C-BOP C(TS)-SRO	Steam Generator Tube Leak
4	4	C-RO C-SRO	Continuous inward Rod Motion
5	5	M-RO M-BOP M-SRO	1B Steam Generator Tube Rupture
6	6	C-RO C-SRO	Failure of the C-9 Interlock
7	7	C-BOP C-SRO	Pzr Spray Valves fail to OPEN

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #1

The plant is at 100% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. Pzr PORV 1NC-32B has been isolated (per AP-11) due PORV leakage. ACTION has been taken in accordance with Technical Specification LCO 3.4.11 ACTION A. MCB Annunciator 1AD-9, B-7, “ICEBED HI TEMP SWITCHES,” spuriously alarmed several times during the shift (IAE is investigating).

Shortly after taking the watch, Pzr PORV 1NC34A will fail partially OPEN, and fail in this position. The operator will respond in accordance with AP/1/A/5500/11, “Pressurizer Pressure Anomalies.” The operator will ultimately close the Block Valve for Pressurizer PORV 1NC34A when it is determined that the PORV cannot be closed. The operator will address Technical Specification LCO 3.4.1, “RCS Pressure, Temperature and Flow Departure From Nucleate Boiling (DNB) Limits,” and LCO 3.4.11, “Pressurizer Power Operated Relief Valves (PORVS).”

Following this, MSR Relief Valve 1HS179 will fail open causing a loss of turbine efficiency and an increase in reactor power. The operator will implement AP/1/A/5500/01, “Steam Leak.” The operator will recognize the failure, and perform a rapid downpower in accordance with AP/1/A/5500/04, “Rapid Downpower,” in an attempting to, and eventually shutting the valve.

Subsequently, a 60 gpm Steam Generator Tube Leak will occur (over 10 minutes) on the 1B Steam Generator. The operator will enter AP/1/A/5500/10, “NC System Leakage Within the Capacity of Both NV Pumps.” The operator will address Technical Specification LCO 3.4.13, “RCS Operational Leakage,” and SLC 16.9.7, “Standby Shutdown System.” The crew will be directed by AP/1/A/5500/10 to reduce plant power to Mode 3 within 3 hours. The operator will perform a rapid downpower in accordance with AP/1/A/5500/04, “Rapid Downpower.”

During the downpower, the Control Rods will continuously insert. The operator will enter AP/1/A/5500/14, “Rod Control Malfunction,” and take manual control of the rods.

After this, the leak will develop into a 500 gpm Steam Generator Tube Rupture and the operator will enter EP/1/A/5000/E-0, “Reactor Trip or Safety Injection.” Upon completion of E-0, the operator will transition to EP/1/A/5000/E-3, “Steam Generator Tube Rupture,” to isolate the flow into and out of the 1B Steam Generator and then conduct a cooldown of the NC System.

While performing an NCS cooldown the C-9 Interlock will fail and result in a loss of the steam dumps. The operator will be required to re-initiate the cooldown using the available SG PORVs.

During the NCS depressurization, the Pzr Spray Valves will fail to open. The operator will be required to conduct the depressurization using the last available Pzr PORV.

The scenario will terminate at Step 22.c of E-3, after the crew has closed the Cold Leg Isolation Valves from the NV System.

<u>Critical Tasks:</u>

Manually close the Pzr PORV Block Valve after its PORV (1NC-34A) fails open before the Pressurizer pressure drops to ≤ 1945 psig.

Safety Significance: failure to close the Pzr PORV Block Valve and stop the pressure transient, under the postulated plant conditions, results in an unnecessary transient to the plant and challenge to the Reactor Protection System. Performance of the critical task would stabilize the pressure transient. A failure to stabilize the pressure transient, when able to do so, constitutes a mis-operation or incorrect crew performance which leads to incorrect NCS pressure control.

Isolate feedwater flow into and steam flow from the ruptured SG so that minimum ΔP between ruptured Steam Generator and intact Steam Generators is not less than 250 psid once target temperature is reached (Entry into ECA-3.1). (EOP-Based)

Safety Significance: Failure to isolate the ruptured SG causes a loss of ΔP between the ruptured SG and the intact SGs. Upon a loss of ΔP, the crew must transition to a contingency procedure that constitutes an incorrect performance that "necessitates the crew taking compensating action which complicates the event mitigation strategy." If the crew fails to isolate steam from the SG, or feed flow into the SG the ruptured SG pressure will tend to decrease to the same pressures as the intact SGs, requiring a transition to a contingency procedure, and delaying the stopping of RCS leakage into the SG.

Depressurize the NCS to meet SI termination criteria before the Quality of the steam exiting the SG exceeds 80% (≤0.8 on Void Fraction SGINFO.cts). (EOP-Based)

Safety Significance: Failure to stop the reactor coolant leakage into a ruptured SG by depressurizing the RCS (when it is possible to do so) needlessly complicates the mitigation of the event. It also constitutes a "significant reduction of Safety Margin beyond that irreparably introduced by the scenario. If RCS depressurization does NOT occur, the inventory in the secondary side of the ruptured SG will rise to the level of the Main Steam Lines leading to water release through the SG PORV or Safety Valve, which could cause and unisolable fault in the ruptured SG.

PROGRAM: McGuire Operations Training

MODULE: Initial License Operator Training Class ILC 16-1

TOPIC: NRC Simulator Exam

Scenario N16-1-1

REFERENCES:

1. OP/1/A/6100/010 N, “Annunciator Response for Panel 1AD-13” (Rev 78)
2. Technical Specification LCO 3.4.15, “RCS Leakage Detection Instrumentation” (Amendment 235/217)
3. AP/1/A/5500/11, “Pressurizer Pressure Anomalies” (Rev 11)
4. Technical Specification LCO 3.4.11, “Pressurizer Power Operated Relief Valves (PORVS)” (Amendment 221/203)
5. Technical Specification LCO 3.4.1, “RCS Pressure, Temperature and Flow Departure From Nucleate Boiling (DNB) Limits” (Amendment 219/201)
6. Control Room Expectations Manual (Rev 8/8/12)
7. AP/1/A/5500/01, “Steam Leak” (Rev 18)
8. AP/1/A/5500/04, “Rapid Downpower” (Rev 28)
9. Technical Specification LCO 3.1.6, “Control Bank Insertion Limits” (Amendment 184/166)
10. AP/1/A/5500/10, “NC System Leakage Within the Capacity of Both NV Pumps” (Rev 23)
11. OP/0/A6450/011, “Control Area Ventilation/Chilled Water System” (Rev 101)
12. Technical Specification LCO 3.4.13, “RCS Operational Leakage” (Amendment 237/219)
13. SLC 16.9.7, “Standby Shutdown System” (Rev 145)
14. AP/1/A/5500/14, “Rod Control Malfunction” (Rev 16)
15. EP/1/A/5000/E-0, “Reactor Trip or Safety Injection” (Rev 34)
16. EP/1/A/5000/E-3, “Steam Generator Tube Rupture” (Rev 24)

Validation Time: 127 minutes

Author: David Lazarony, Essential Training & Consulting, LLC

Facility Review: ________________________

Rev. 120415

Facility:	**McGuire**	Scenario No.:	**1**	Op Test No.:	**N16-1**
Examiners:	____________	Operators:		____________	(SRO)
	____________			____________	(RO)
	____________			____________	(BOP)

Initial Conditions:	The plant is at 100% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. Pzr PORV 1NC-32B has been isolated (per AP-11) due PORV leakage. ACTION has been taken in accordance with Technical Specification LCO 3.4.11 ACTION A. MCB Annunciator 1AD-9, B-7, “ICEBED HI TEMP SWITCHES,” spuriously alarmed several times during the shift (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	1	C-BOP C(TS)-SRO	Pzr PORV 1NC34A fails partially OPEN
2	2	C-RO C-BOP C-SRO	MSR Relief Valve fails OPEN/Downpower
3	3	R-RO C-BOP C(TS)-SRO	Steam Generator Tube Leak
4	4	C-RO C-SRO	Continuous inward Rod Motion
5	5	M-RO M-BOP M-SRO	1B Steam Generator Tube Rupture
6	6	C-RO C-SRO	Failure of the C-9 Interlock
7	7	C-BOP C-SRO	Pzr Spray Valves fail to OPEN

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #1

The plant is at 100% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. Pzr PORV 1NC-32B has been isolated (per AP-11) due PORV leakage. ACTION has been taken in accordance with Technical Specification LCO 3.4.11 ACTION A. MCB Annunciator 1AD-9, B-7, “ICEBED HI TEMP SWITCHES,” spuriously alarmed several times during the shift (IAE is investigating).

Shortly after taking the watch, Pzr PORV 1NC34A will fail partially OPEN, and fail in this position. The operator will respond in accordance with AP/1/A/5500/11, “Pressurizer Pressure Anomalies.” The operator will ultimately close the Block Valve for Pressurizer PORV 1NC34A when it is determined that the PORV cannot be closed. The operator will address Technical Specification LCO 3.4.1, “RCS Pressure, Temperature and Flow Departure From Nucleate Boiling (DNB) Limits,” and LCO 3.4.11, “Pressurizer Power Operated Relief Valves (PORVS).”

Following this, MSR Relief Valve 1HS179 will fail open causing a loss of turbine efficiency and an increase in reactor power. The operator will implement AP/1/A/5500/01, “Steam Leak.” The operator will recognize the failure, and perform a rapid downpower in accordance with AP/1/A/5500/04, “Rapid Downpower,” in an attempting to, and eventually shutting the valve.

Subsequently, a 60 gpm Steam Generator Tube Leak will occur (over 10 minutes) on the 1B Steam Generator. The operator will enter AP/1/A/5500/10, “NC System Leakage Within the Capacity of Both NV Pumps.” The operator will address Technical Specification LCO 3.4.13, “RCS Operational Leakage,” and SLC 16.9.7, “Standby Shutdown System.” The crew will be directed by AP/1/A/5500/10 to reduce plant power to Mode 3 within 3 hours. The operator will perform a rapid downpower in accordance with AP/1/A/5500/04, “Rapid Downpower.”

During the downpower, the Control Rods will continuously insert. The operator will enter AP/1/A/5500/14, “Rod Control Malfunction,” and take manual control of the rods.

After this, the leak will develop into a 500 gpm Steam Generator Tube Rupture and the operator will enter EP/1/A/5000/E-0, “Reactor Trip or Safety Injection.” Upon completion of E-0, the operator will transition to EP/1/A/5000/E-3, “Steam Generator Tube Rupture,” to isolate the flow into and out of the 1B Steam Generator and then conduct a cooldown of the NC System.

While performing an NCS cooldown the C-9 Interlock will fail and result in a loss of the steam dumps. The operator will be required to re-initiate the cooldown using the available SG PORVs.

During the NCS depressurization, the Pzr Spray Valves will fail to open. The operator will be required to conduct the depressurization using the last available Pzr PORV.

The scenario will terminate at Step 22.c of E-3, after the crew has closed the Cold Leg Isolation Valves from the NV System.

Critical Tasks:

Manually close the Pzr PORV Block Valve after its PORV (1NC-34A) fails open before the Pressurizer pressure drops to ≤ 1945 psig.

Safety Significance: failure to close the Pzr PORV Block Valve and stop the pressure transient, under the postulated plant conditions, results in an unnecessary transient to the plant and challenge to the Reactor Protection System. Performance of the critical task would stabilize the pressure transient. A failure to stabilize the pressure transient, when able to do so, constitutes a mis-operation or incorrect crew performance which leads to incorrect NCS pressure control.

Isolate feedwater flow into and steam flow from the ruptured SG so that minimum ΔP between ruptured Steam Generator and intact Steam Generators is not less than 250 psid once target temperature is reached (Entry into ECA-3.1). (EOP-Based)

Safety Significance: Failure to isolate the ruptured SG causes a loss of ΔP between the ruptured SG and the intact SGs. Upon a loss of ΔP, the crew must transition to a contingency procedure that constitutes an incorrect performance that "necessitates the crew taking compensating action which complicates the event mitigation strategy." If the crew fails to isolate steam from the SG, or feed flow into the SG the ruptured SG pressure will tend to decrease to the same pressures as the intact SGs, requiring a transition to a contingency procedure, and delaying the stopping of RCS leakage into the SG.

Depressurize the NCS to meet SI termination criteria before the Quality of the steam exiting the SG exceeds 80% (≤0.8 on Void Fraction SGINFO.cts). (EOP-Based)

Safety Significance: Failure to stop the reactor coolant leakage into a ruptured SG by depressurizing the RCS (when it is possible to do so) needlessly complicates the mitigation of the event. It also constitutes a "significant reduction of Safety Margin beyond that irreparably introduced by the scenario. If RCS depressurization does NOT occur, the inventory in the secondary side of the ruptured SG will rise to the level of the Main Steam Lines leading to water release through the SG PORV or Safety Valve, which could cause and unisolable fault in the ruptured SG.

SIMULATOR OPERATOR INSTRUCTIONS

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Sim. Setup	**Rod Step On**	
☐		**Reset to Temp IC 235**	**T = 0 Malfunctions:** **Place 1NC31B to CLOSE; (Pzr PORV 1NC-32B is OOS)** **insert XMT-WL_1WLLT5591 = 100 (1WLL-5591, VUCDT Tank Level is OOS)** **<u>Per Lesson Plan 2016 NRC Exam Scenario 1</u>** **Insert MAL-IPE004H = True (C-9 fails), cd=H_X01_094_2 = 1 (1A RTB Open indicating lamp ON)** **Insert REM-NC0027C = 0 (A Spray Valve fails closed) cd=H_X01_094_2 = 1 (1A RTB Open indicating lamp ON)** **Insert REM-NC0029C = 0 (B Spray Valve fails closed) cd=H_X01_094_2 = 1 (1A RTB Open indicating lamp ON)**
☐		**RUN** **Reset all SLIMs**	**Place Tagout/O-Stick on:** **1NC-32B (O-stick)** **1WLL-5591 (O-stick)** **MCB Annunciator 1AD-13, C-7 (O-stick)** **MCB Annunciator 1AD-9, B-7 (O-stick)**
☐		**Update** Status Board, **Setup OAC**	**NOTE:** RMWST DO = <1000 ppb.
☐		**Freeze.**	
☐		**Update Fresh Tech. Spec. Log.**	
☐		**Fill out the AO's Available section of Shift Turnover Info.**	

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Prior to Crew Briefing	**RUN**	
☐	**Crew Briefing** 1. Assign Crew Positions based on evaluation requirements 2. Review the Shift Turnover Information with the crew. 3. Direct the crew to Review the Control Boards taking note of present conditions, alarms.		
☐	T-0	Begin Familiarization Period	
☐	At direction of examiner	**Execute Lesson Plan for Simulator Scenario N16-1-1.**	
☐	At direction of examiner	**Event 1** **Insert MAL-CNC003B=30** **insert MAL-NC012B = 25**	Pzr PORV 1NC34A fails partially OPEN **NOTE: insert LOA-NC034A = RACKED_OUT when directed.**
☐	At direction of examiner	**Event 2** **insert REM-HS0179 = 0.5**	MSR Relief Valve fails OPEN/Downpower
☐	At direction of examiner	**Event 3** **insert MAL-SG001B = 60 ramp=600**	Steam Generator Tube Leak
☐	At direction of examiner	**Event 4** **Insert MAL-IRE003A = IN**	Continuous inward Rod Motion **NOTE: If needed (i.e. No current Rod Demand) insertMAL-DCS1213 =TRUE**

	Bench Mark	ACTIVITY	DESCRIPTION
☐	At direction of examiner	**Event 5** **insert MAL-SG001B 500 ramp=120**	1B Steam Generator Tube Rupture **NOTE: insertLOA-RN087 =ON and LOA-RN083 = 8000 when directed.** **NOTE: insertREM-SA0002 =0 and REM-00078 = 0 when directed.**
☐	Post-Rx Trip during NCS cooldown	**Event 6** **InsertMAL-IPE004H = True (C-9 fails), cd=H_X01_094_2 = 1 (1A RTB Open indicating lamp ON)**	Failure of the C-9 Interlock **NOTE: This event will occur on Rx Trip**
☐	Post-Rx Trip during depress.	**Event 7** **insertREM-NC0027C = 0 (A Spray Valve fails closed)** **insertREM-NC0029C = 0 (B Spray Valve fails closed)** **cd=H_X01_094_2 = 1 (1A RTB Open indicating lamp ON)**	Pzr Spray Valves fail to OPEN **NOTE: This event will occur on Rx Trip**
☐	**Terminate the scenario upon direction of Lead Examiner**		

Op Test No.:	N16-1	Scenario #	1	Event #	1	Page	8 of 65
Event Description:	**Pzr PORV 1NC34A fails partially OPEN**						

Shortly after taking the watch, Pzr PORV 1NC34A will fail partially OPEN, and fail in this position. The operator will respond in accordance with AP/1/A/5500/11, "Pressurizer Pressure Anomalies." The operator will ultimately close the Block Valve for Pressurizer PORV 1NC34A when it is determined that the PORV cannot be closed. The operator will address Technical Specification LCO 3.4.1, "RCS Pressure, Temperature and Flow Departure From Nucleate Boiling (DNB) Limits," and LCO 3.4.11, "Pressurizer Power Operated Relief Valves (PORVS)."	
Booth Operator Instructions:	**insert MAL-NC003B = 30 (PZR PORV 1NC-34A fails OPEN)** **Insert MAL-NC012B = 25 (PZR PORV 1NC-34A sticks OPEN on CLOSE)**

Indications Available:

- OAC Alarm: U1 PZR PRESS I through IV
- 1NC-34A dual status light indication (Red and Green status lights LIT)
- MCB Annunciator 1AD-6/B-9 PZR PORV DISCH TEMP HI
- MCB Annunciator 1AD-6/C-12 PORV NC-34A ACTUATED
- MCB Annunciator 1AD-6/C-6 PZR LO PRESS CONTROL
- MCB Annunciator 1AD-6/F-5 1NC 1, 2 or 3 FLO DETECTED
- Pzr Pressure is lowering

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: It is likely that the operator will take actions to isolate the Pzr PORV prior to being directed by the CRS.
		AP/1/A/5500/11, PRESSURIZER PRESSURE ANOMALIES	
	BOP	(Step 1) Check Pzr pressure – HAS GONE DOWN.	**Immediate Action**
	BOP	(Step 2) Check Pzr PORVs – CLOSED.	**Immediate Action**
	BOP	(Step 2 RNO) Perform the following:	**Immediate Action**
		• CLOSE PORVs.	**NOTE:** 1NC-34A will display dual indication, even after closing the PORV.

Op Test No.:	N16-1	Scenario #	1	Event #	1	Page	9 of 65
Event Description:	**Pzr PORV 1NC34A fails partially OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF PORV will not close, THEN CLOSE PORV isolation valve.	

Critical Task:

Manually close the Pzr PORV Block Valve after its PORV (1NC-34A) fails open before the Pressurizer pressure drops to ≤ 1945 psig.

Safety Significance: failure to close the Pzr PORV Block Valve and stop the pressure transient, under the postulated plant conditions, results in an unnecessary transient to the plant and challenge to the Reactor Protection System. Performance of the critical task would stabilize the pressure transient. A failure to stabilize the pressure transient, when able to do so, constitutes a mis-operation or incorrect crew performance which leads to incorrect NCS pressure control.

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3) Check Pzr spray valves – CLOSED.	**Immediate Action**
	BOP	(Step 4) Check Pzr PORVs – CLOSED.	**NOTE:** 1NC-34A will display dual indication, even after closing the PORV.
	BOP	(Step 4 RNO) Perform the following:	
		• CLOSE associated PORV inlet drain valve as follows:	
		• IF 1 NC-34A (PZR PORV) failed, THEN CLOSE 1NC-270 (PZR PORV Drn Isol For 1NC-34A).	**NOTE:** 1NC-34A has failed OPEN.
	CRS	• IF Pzr PORV isolation valve is closed for failed Pzr PORV, THEN GO TO Step 5.	
	BOP	(Step 5) Check Pzr spray valves – CLOSED.	**NOTE:** If the Spray valves are OPEN the crew will perform the RNO prior to performing Step 6.

Op Test No.:	N16-1	Scenario #	1	Event #	1	Page	10 of 65
Event Description:	**Pzr PORV 1NC34A fails partially OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 6) Announce occurrence on page.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that AP-11 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	BOP	(Step 7) Check 1NV-21A (NV Spray To PZR Isol) – CLOSED.	
	BOP	(Step 8) Check the following Pzr heaters – ON:	
		• 1A	
		• 1B	
		• 1D	
	BOP	(Step 9) Check 1C Pzr heaters – ON.	**NOTE:** The Pzr heaters may be cycling ON and OFF.
	BOP	(Step 10) Check "PZR PRESS MASTER" – IN AUTO.	
	BOP	(Step 11) Check "1NC-27 PRESSURIZER SPRAY EMERGENCY CLOSE" switch – SELECTED TO "NORMAL".	
	BOP	(Step 12) Check "1NC-29 PRESSURIZER SPRAY EMERGENCY CLOSE" switch – SELECTED TO "NORMAL".	
	BOP	(Step 13) Check Pzr pressure – GOING UP TO DESIRED PRESSURE.	

Op Test No.:	N16-1	Scenario #	1	Event #	1	Page	11 of 65
Event Description:	**Pzr PORV 1NC34A fails partially OPEN**						

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td></td><td>CRS</td><td colspan="3">(Step 14) Exit this procedure.</td><td>NOTE: The CRS may call WCC/IAE to address the valve position.
If so, Booth Instructor acknowledge as WCC.</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td>Booth Instructor: insert LOA-NC034 = Racked Out, delay = 10 minutes.
As AO call and report.</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td>NOTE: The CRS will likely conduct a Focus Brief.</td></tr>
<tr><td colspan="6">TECHNICAL SPECIFICATION 3.4.11, PRESSURIZER POWER OPERATED RELIEF VALVES (PORVs)</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">APPLICABILITY: MODES 1, 2 AND 3.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">ACTIONS</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td rowspan="2">NOTE: The CRS will determine ONLY 1NC-34A is inoperable and NOT capable of being manually cycled. Consequently, the CRS will determine that ACTION B.1, B.2 and B.3 must be entered, however ACTION B.3 is satisfied because 1NC-32B is capable of manually cycled.</td></tr>
<tr><td>B. One or two PORVs inoperable and not capable of being manually cycled.</td><td>B.1 Close associated block valves.
AND
B.2 Remove power from associated block valves.
AND
B.3 Restore one PORV to OPERABLE status if two PORVs are inoperable.</td><td>1 hour

1 hour

72 hours</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
</table>

Op Test No.:	N16-1	Scenario #	1	Event #	1	Page	12 of 65
Event Description:		**Pzr PORV 1NC34A fails partially OPEN**					

Time	Pos.	Expected Actions/Behavior	Comments
TECHNICAL SPECIFICATION 3.4.1, RCS PRESSURE, TEMPERATURE, AND FLOW DEPARTURE FROM NUCLEATE BOILING (DNB) LIMITS			
	CRS	LCO 3.4.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the limits specified in Table 3.4.1-1.	**NOTE:** If NC System Pressure drops to < 2216 psig on the failure, then TS 3.4.1 might be entered and exited during the transient.
	CRS	APPLICABILITY: MODE 1.	
	CRS	ACTIONS	
		<table><tr><th>CONDITION</th><th>REQUIRED ACTION</th><th>COMPLETION TIME</th></tr><tr><td>A. Pressurizer pressure or RCS average temperature DNB parameters not within limits.</td><td>A.1 Restore DNB parameter(s) to within limit.</td><td>2 hours</td></tr></table>	**NOTE:** The CRS will determine that ACTION A.1 must be entered (May be cleared by the time that the determination is made).
At the discretion of the Lead Examiner move to Event #2.			

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	13 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Following this, MSR Relief Valve 1HS179 will fail open causing a loss of turbine efficiency and an increase in reactor power. The operator will implement AP/1/A/5500/01, "Steam Leak." The operator will recognize the failure, and perform a rapid downpower in accordance with AP/1/A/5500/04, "Rapid Downpower," in an attempting to, and eventually shutting the valve.

Booth Operator Instructions: **insert REM-HS0179 0.5 (MSR 1HS179 Relief Failure)**

DURING this event the Booth Instructor may need to adjust the Upper Surge Tank Level to avoid reaching Foldout Page Trip criteria. If so, use PLP-058 (Water Level UST) = 5, Ramp = 300 seconds

Indications Available:

- Turbine MWe lowers rapidly (With MW LOOP IN, in Service EHC will try to raise load)
- Auto Rod Motion will occur
- Rx power rises
- Steam pressure starts to lower
- OAC Alarm: 1C1 L/P TURBINE CROSSOVER STEAM TEMP RATE
- OAC Alarm: 1C2 L/P TURBINE CROSSOVER STEAM TEMP RATE

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The crew may diagnose an overpower condition and adjust turbine load per the Crew Expectations Manual.
		CONTROL ROOM CREW EXPECTATIONS MANUAL	
	RO	Transient load changes: Manual is preferred- immediately reduce 20MWe and then reduce as needed to maintain Rx power less than pre-transient condition. After the initial 20 MWe load reduction, it is preferred that the operators use multiple and diverse indications to determine how much more load should be reduced.	

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	14 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/01, STEAM LEAK	
			NOTE: The CRS may dispatch AOs to look for steam leaks. If so, **Booth Instructor** as AO, respond back in 3-5 minutes per script (See **Page 17**). After 3-5 minutes of Non-investigatory Action, Call as Security and report **Steam Release to atmosphere on U1 TB Roof**.
	RO/ BOP	(Step 1) Monitor Foldout page.	
		Manual Reactor Trip Criteria: (IF any of the following occur: (1) Steam leak is jeopardizing personnel safety or plant equipment, (2) T-Avg is less than 551°F AND going down, or (3) UST level is less than 1 ft – NOT Expected).	
	RO	(Step 2) Reduce turbine load to maintain the following:	**NOTE:** The RO may take the Turbine Control to MANUAL.
		• Excore NI's – LESS THAN OR EQUAL TO 100%	**NOTE:** The power level was originally < 100%. Per the Control Room Expectations Manual, the RO has the authority to remove ≈20 Mwe initially, and then additional load as needed to stabilize temperature.
		• NC Loop D/T's – LESS THAN 60ºF D/T	
		• T-Avg – AT T-REF.	**NOTE:** There may be a Tavg-Tref mismatch due to the transient, however, the control rods are in AUTO.
	CRS	(Step 3) Check containment entry – IN PROGRESS.	**NOTE:** There is no Containment Entry in progress.

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	15 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 3 RNO) GO TO Step 5.	
	BOP	(Step 5) Check Pzr pressure prior to event – GREATER THAN P-11 (1955 PSIG)	
	BOP	(Step 6) Check Pzr level – STABLE OR GOING UP	**NOTE:** If Pzr level is lowering the crew will perform the RNO prior to performing Step 7.
	CRS	(Step 7) IF AT ANY TIME while in this procedure Pzr level cannot be maintained stable, THEN RETURN TO Step 6.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 8) GO TO Step 12.	
	CRS	(Step 12) Announce occurrence on paging system.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 13) Identify and isolate leak on Unit 1 as follows:	
		• Check SM PORVs – CLOSED.	
		• Check condenser dump valves – CLOSED.	
	BOP	• Check containment conditions – NORMAL:	
		• Containment temperature	
		• Containment pressure	
		• Containment humidity	
		• Containment floor and equipment sump level.	
		• Check TD CA pump – OFF.	
		• Check valves on "STEAM LINE DRAIN VALVES" board (1MC-9) - CLOSED.	

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	16 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	• Check opposite Unit (Unit 2) "STEAM HEADER PRESSURE" – GREATER THAN 200 PSIG.	**NOTE:** The CRS will ask U2 RO. If so, **Floor Instructor** acknowledge as U2 RO, and report U2 Steam Header Pressure is ≈1000 psig.
	CRS	• Dispatch operator to check for leaks.	**NOTE:** If not already done, the CRS will dispatch AOs to look for steam leaks. After **2-3 minutes**, **Booth Instructor,** as **AO**, report that **MSR 1C1 Shell Side Relief Valve (1HS179) is lifting.**
	BOP	(Step 14) Check UST level – STABLE OR GOING UP.	**NOTE:** The UST level may be rising or lowering. If rising go to Step 15.
	BOP	(Step 14 RNO) Makeup to UST as required to maintain level.	
	CRS	(Step 15) Evaluate unit shutdown as follows:	
		• Check unit status – IN MODE 1 OR 2.	
		• Determine if unit shutdown or load reduction is warranted based on the following criteria:	
		• Size of leak	
		• Location of leak	
		• Rate of depletion of secondary inventory	
		• IF steam is leaking from a secondary heater relief OR MSR relief valve, THEN reducing turbine load may reduce pressure enough to close relief valve.	**NOTE:** Steam is leaking from an MSR relief valve.

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	17 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF turbine trip will isolate steam leak (such as feedwater heater leak or MSR leak), THEN it may be desirable to perform an orderly shutdown of the turbine and maintain reactor power in Mode 1.	**NOTE:** It is NOT necessary to trip the Turbine.
	CRS	• Check unit shutdown or load reduction – REQUIRED.	**NOTE:** It is necessary to reduce load in an attempt to close the lifting relief valve.
	CRS	• Check reactor trip – REQUIRED.	**NOTE:** A reactor trip is NOT required.
	CRS	(Step 15.d RNO) GO TO Step 15.h.	
	CRS	• (Step 15.h) Determine if turbine trip is desired to isolate steam leak:	
		• Check steam leak location – KNOWN TO BE ISOLABLE BY TURBINE TRIP	
		• Turbine trip – DESIRED.	**NOTE:** A turbine trip is NOT desired.
	CRS	(Step 15.h RNO) Perform the following:	
		• Reduce load as necessary PER one of the following:	
		• OP/1/A/6100/003	
		OR	
		• AP/1/A/5500/04 (Rapid Downpower).	**NOTE:** The CRS will transition to AP-4. **Booth Instructor:** If it appears likely that the crew will use the OP rather than the AP, state as the Operations Manager that it is desired to use AP-4.
AP/1/A/5500/04, RAPID DOWNPOWER			

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	18 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 1) Monitor Foldout page.	
		Uncontrolled Cooldown (If Tavg < 551°F and lowering…..Not Expected)	
		Power Factor (Adjust power factor during load reduction to maintain power factor between 0.9 to 1.0 lagging, using "VOLTAGE ADJUST" pushbutton)	**NOTE:** The RO will adjust MVARS as needed.
		Manual Rod Control Criteria (< C-5, Not Expected)	
		Turbine Shutdown (Turbine Load < 15 MWe Not Expected)	
	CRS	(Step 2) Announce occurrence on page.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 3) Check turbine control – IN AUTO.	**NOTE:** The Turbine may be in MANUAL. If so, the RO will place the Turbine in AUTO.
	RO	(Step 4) Check "MW LOOP" – IN SERVICE.	**NOTE:** If MW LOOP is NOT in service, the RO will place MW LOOP in service per RNO.
	CRS	(Step 5) Check shutdown to Mode 3 – DESIRED.	
	CRS	(Step 5 RNO) Observe Note prior to Step 8 and GO TO Step 8.	
	CRS	(Step 8) Determine the required power reduction rate (MW/min).	**NOTE:** The CRS will reduce load at ≈10-20 MWe/minute.
	RO	(Step 9) Check control rods – IN AUTO.	

Op Test No.: N16-1	Scenario # 1	Event # 2	Page 19 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**		

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 10) Notify SOC of load reduction (red dispatcher phone).	**Booth Instructor:** as **SOC**, acknowledge.
	RO	(Step 11) Initiate turbine load reduction to desired load at desired rate.	
	BOP	(Step 12) Borate NC System as follows:	
		• Energize all backup Pzr heaters.	
		• Check unit to be shutdown – VIA REACTOR TRIP FROM 15% POWER.	**NOTE:** It is normal practice to shut down the reactor by driving rods, rather than tripping from 15%.
	CRS	(Step 12.b RNO) GO TO Step 12.d.	
	BOP	(Step 12.d) Determine boration amount based on the following:	
		• Power Reduction Rate (MW/min)	
		• Present NC System Boron Concentration (ppm)	
		• Total Power change (%).	**NOTE:** The total power change will be determined by the CRS, and will affect the amount of boron inserted by the BOP.
		• Record calculated boration amount:	
	RO	• Check auto or manual rod control – AVAILABLE.	
	BOP	• Perform boration in 4 equal additions during load reduction PER Enclosure 2 (Emergency Boration).	
			NOTE: The CRS may assign the BOP to perform this action. If so, **BOP Examiner** follow actions of Enclosure 2. **Other Examiners** follow **AP-4** Actions, **Step 13**, on **Page 22**.

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	20 of 65
Event Description:	MSR Relief Valve fails OPEN/Downpower						

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/04, RAPID DOWNPOWER ENCLOSURE 2, EMERGENCY BORATION	
	BOP	(Step 1) Check OAC ‑ AVAILABLE.	
	BOP	(Step 2) Use OAC point M1P0785 to monitor boric acid gallons added while 1NV‑265B (U1 NV Pump Boric Acid Sup Isol) is open.	
	BOP	(Step 3) GO TO Step 5.	
	BOP	(Step 5) Check boric acid transfer pump ‑ RUNNING.	**NOTE:** If a Boric Acid Transfer Pump is NOT running, the BOP will start one pump using the RNO, and stop it later, after the boration is complete.
	BOP	(Step 6) OPEN 1NV‑265B (U1 NV Pump Boric Acid Sup Isol).	
	BOP	(Step 7) Do not continue until desired amount of boric acid has been added.	
	BOP	(Step 8) CLOSE 1NV‑265B (U1 NV Pump Boric Acid Sup Isol).	
	BOP	(Step 9) IF boric acid transfer pump was started in Step 5 RNO, THEN perform the following:	**NOTE:** If a Boric Acid Transfer Pump was started earlier, it will be stopped here.
		• Stop boric acid transfer pump.	
		• Ensure one boric acid transfer pump is in auto.	
	BOP	(Step 10) Repeat enclosure as required.	

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	21 of 65
Event Description:		**MSR Relief Valve fails OPEN/Downpower**					

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/04, RAPID DOWNPOWER	
			Examiner NOTE: Examiners following the **CRS/RO** continue **HERE**.
	BOP	(Step 13) Display Rod Insertion Limits on OAC by entering turn on code "RIL."	
	CRS	(Step 14) IF AT ANY TIME "CONTROL ROD BANK LO LO LIMIT" alarm (1AD-2, B-9) is lit, THEN perform one of the following to comply with Tech Spec 3.1.6 (Control Bank Insertion Limits):	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Ensure alarm clears within one hour as Xenon builds in.	
		OR	
		• Initiate boration as necessary within one hour to restore control rods above insertion limits.	
	CRS	(Step 15) IF AT ANY TIME during this procedure C-7A is received, THEN ensure Transient Monitor freeze is triggered.	
	CRS	(Step 16) REFER TO the following:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	CRS	(Step 17) Notify Reactor Engineer on duty of load reduction.	**NOTE:** The CRS may call WCC/RE. If so, **Booth Instructor** acknowledge.

Op Test No.: N16-1	Scenario # 1	Event # 2	Page 22 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**		

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 18) Check target load - LESS THAN 1000 MW.	
Booth Operator Instructions:		**Insert REM-HS0179 = 0 delay=0 " (Remove 1HS179 Relief Valve Failure - after crew has moved turbine approximately 200 MWe)**	
			Booth Instructor: as **AO**, report that 1HS179 Relief Valve has reseated.
	CRS	(Step 19) Check Unit 2 available to supply aux steam as follows:	**NOTE:** The CRS will ask U2 RO. **Floor Instructor:** As U2 RO report "All these conditions are met."
		• Unit 2 Reactor power - GREATER THAN 15%	
		• Unit 2 2AS-12 (U2 SM to AS Hdr Control Inlet Isol) - OPEN	
		• Unit 2 - AVAILABLE TO SUPPLY AS HEADER.	
	RO	(Step 20) Check SM flow on all S/Gs – GREATER THAN 25%.	
	RO	(Step 21) WHEN all SM flows are less than 75%, THEN ensure the following valves ramp CLOSED:	**NOTE:** This is a conditional step. The CRS will make the RO aware of this action, if NOT already done.
		• 1CF-104AB (1A S/G CF Control Bypass)	
		• 1CF-105AB (1B S/G CF Control Bypass)	
		• 1CF-106AB (1C S/G CF Control Bypass)	
		• 1CF-107AB (1D S/G CF Control Bypass)	

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	23 of 65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 22) WHEN P/R instruments indicate less than 48%, THEN check "P-8 HI PWR LO FLO RX TRIP BLOCKED" status light (1SI-18) - LIT.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO	(Step 23) Check the following:	**NOTE:** It is most likely that the crew has stabilized the plant at a power level above 40%.
		• P/R meters indicate reactor power - LESS THAN 40%	
		• All CF flows - LESS THAN 40%	
		• Impulse pressure - LESS THAN 260 PSIG.	
	CRS	(Step 23 RNO) Perform the following:	
		• IF target load is less than 40%......	
		• IF target load is greater than or equal to 40%, THEN perform the following:	
		• Do not continue with this procedure until target load reached.	
			Examiner NOTE: It may be necessary to allow the crew to stabilize the plant prior to moving to Event 4.
TECHNICAL SPECIFICATION 3.1.6, CONTROL BANK INSERTION LIMITS			
	CRS	LCO 3.1.6: The control banks shall be within the insertion, sequence, and overlap limits specified in the COLR.	**NOTE:** If rod insertion drops below the Rod Insert Limit, LCO 3.1.6 will be addressed.
	CRS	APPLICABILITY: MODE 1 and Mode 2 with Keff > 1.	
	CRS	ACTIONS	

Op Test No.:	N16-1	Scenario #	1	Event #	2	Page	24 of	65
Event Description:	**MSR Relief Valve fails OPEN/Downpower**							

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td rowspan="2">NOTE: The CRS will determine that ACTION A.1.1 must be completed within 1 hour.</td></tr>
<tr><td>A. Control Bank Insertion Limits not met</td><td>A.1.1 Verify SDM is within the limit specified in the COLR
OR
A.1.2 Initiate boration to restore SDM to within limit
AND
A.2 Restore control bank(s) to within limit</td><td>1 hour

1 hour

2 hours</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="6">At the discretion of the Lead Examiner move to Event #3.</td></tr>
</table>

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	25 of 65
Event Description:		**Steam Generator Tube Leak**					

Subsequently, a 60 gpm Steam Generator Tube Leak will occur (over 10 minutes) on the 1B Steam Generator. The operator will enter AP/1/A/5500/10, "NC System Leakage Within the Capacity of Both NV Pumps." The operator will address Technical Specification LCO 3.4.13, "RCS Operational Leakage," and SLC 16.9.7, "Standby Shutdown System." The crew will be directed by AP/1/A/5500/10 to reduce plant power to Mode 3 within 3 hours. The operator will perform a rapid downpower in accordance with AP/1/A/5500/04, "Rapid Downpower."

Booth Operator Instructions: **insert MAL-SG001B 60 delay=0 ramp=600 (S/G 1B Tube Leak)**

Indications Available:

- Pzr level is lowering
- Charging flow starts to rise
- MCB Annunciator 1AD-6/E-7, PZR LO LEVEL DEVIATION
- Trip 2 on EMF 71, 72, 73, and 74

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/10, NC SYSTEM LEAKAGE WITHIN THE CAPACITY OF BOTH NV PUMPS **CASE I, STEAM GENERATOR TUBE LEAKAGE**	
	BOP	(Step 1) Check Pzr level – STABLE OR GOING UP.	**NOTE:** Pzr Level will be slowly lowering.
	BOP	(Step 1 RNO) Perform the following as required to maintain level:	
		• Maintain charging flow less than 200 GPM at all times in subsequent steps.	
		• Ensure 1NV-238 (U1 Charging Hdr Control) – OPENING.	**NOTE:** The BOP may take manual control of 1NV-238.
		• OPEN 1NV-241 (U1 Seal Water Inj Flow Control) while maintaining NC pump seal flow greater than 6 GPM.	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	26 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Reduce or isolate letdown.	**NOTE:** The BOP may reduce letdown flow to 45 gpm, or isolate it altogether (Now or Later).
		• Start additional NV pump.	**NOTE:** The BOP will NOT need to start an additional NV Pump.
		• IF CLAs are isolated, ….	**NOTE:** The CLAs are NOT isolated.
		• IF Pzr level cannot be maintained greater than 4% ….	**NOTE:** The Pzr level is NOT < 4%, or decreasing with maximum Charging flow.
	RO/ BOP	(Step 2) IF AT ANY TIME Pzr level goes down in an uncontrolled manner OR cannot be maintained greater than 4%, THEN perform Step 1.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO/ BOP	(Step 3) Identify affected S/G as follows:	
		• Any S/G N/R level – GOING UP IN AN UNCONTROLLED MANNER.	
		OR	
		• Check any of the following EMFs – ABOVE NORMAL:	
		• 1EMF-24 (S/G A Steamline Hi Rad)	
		• 1EMF-25 (S/G B Steamline Hi Rad)	**NOTE:** 1EMF-25 is in TRIP 2.
		• 1EMF-26 (S/G C Steamline Hi Rad)	
		• 1EMF-27 (S/G D Steamline Hi Rad)	
		• 1EMF-71 (S/G A Leakage Hi Rad)	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	27 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1EMF-72 (S/G B Leakage Hi Rad)	**NOTE:** This rad monitor will be rising, and could be in either Trip 1 or TRIP 2.
		• 1EMF-73 (S/G C Leakage Hi Rad)	
		• 1EMF-74 (S/G D Leakage Hi Rad)	
		OR	
		• Check CF Flow – LOWER IN ANY S/G COMPARED TO ALL.	
	CRS	(Step 4) Announce occurrence on page.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that AP-10 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	CRS	(Step 5) REFER TO the following:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	CRS	(Step 6) IF AT ANY TIME NC leakage exceeds Tech Spec limits, THEN perform the following:	**NOTE:** The CRS will determine that Leakage has exceeded the TS Limits.
		• Ensure Outside Air Pressure Filter train in service PER OP/0/A/6450/011 (Control Area Ventilation/Chilled Water System), Enclosure 4.4 (Control Room Atmosphere Pressurization During Abnormal Conditions).	**NOTE:** The CRS may ask U2 BOP to take this action. If so, **Floor Instructor** acknowledge as U2 BOP, and perform actions.

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	28 of 65
Event Description:		Steam Generator Tube Leak					

Time	Pos.	Expected Actions/Behavior	Comments
		• Have another SRO evaluate if leakage exceeds SLC 16.9.7 condition C limits and immediately notify security if SSF is inoperable.	**NOTE:** The CRS may ask OSM, STA, or Plant SRO to perform this action. If so, **Floor Instructor** acknowledge accordingly.
			NOTE: The CRS may assign the BOP to perform this action. If so, **BOP Examiner** follow actions of Enclosure 4.4. **Other Examiners** follow **AP-10** Actions, **Step 7**, on **Page 31**.
OP/0/A/6450/011, CONTROL AREA VENTILATION/CHILLED WATER SYSTEM **ENCLOSURE 4.4, CONTROL ROOM ATMOSPHERE PRESSURIZATION DURING ABNORMAL CONDITIONS**			
			Examiner NOTE: Follow the actions associated with Enclosure 4.4 if BOP is assigned by CRS to perform.
	BOP	(Step 3.1) Evaluate all outstanding R&Rs that may impact performance of this procedure.	
	BOP	(Step 3.2) Perform the following sections as applicable:	
		• Section 3.3, Pressurize Control Room Using Outside Air Pressure Fans	
		• Section 3.4, Securing Pressurization of Control Room	
	BOP	(Step 3.3) Pressurize Control Room using Outside Air Pressure Fans as follows:	
	BOP	(Step 3.3.1) Ensure at least one of the following groups of intake valves open:	
		• 1VC-1A (VC Otsd Air Intake Isol from Unit 1)	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	29 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1VC-2A (VC Otsd Air Intake Isol from Unit 1)	
		• 1VC-3B (VC Otsd Air Intake Isol from Unit 1)	
		• 1VC-4B (VC Otsd Air Intake Isol from Unit 1)	
		OR	
	BOP	• 1VC-9A (VC Otsd Air Intake Isol from Unit 2)	
		• 1VC-10A (VC Otsd Air Intake Isol from Unit 2)	
		• 1VC-11B (VC Otsd Air Intake Isol from Unit 2)	
		• 1VC-12B (VC Otsd Air Intake Isol from Unit 2)	
	BOP	(Step 3.3.2) IF A Train VC/YC operating, place “A Train CR Outside Air Press Fan” to “ON”.	
	BOP	(Step 3.3.3) IF B Train VC/YC operating, place “B Train CR Outside Air Press Fan” to “ON”.	
	BOP	(Step 3.3.4) Depress “MAN” for the following (to ensure fans off):	
		• #1 CRA Otsd Air Fan	
		• #2 CRA Otsd Air Fan	
	BOP	(Step 3.3.5) Depress “OFF” for the following:	
		• CRA-OAD-4 (CR Area Otsd Air Fans Damper)	
		• CRA-OAD-3 (CR Area Otsd Air Fans Damper)	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	30 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 3.3.6) Check the following dark:	
		• CRA-OAD-4 (CR Area Otsd Air Fans Damper) "OPEN" light.	
		• CRA-OAD-3 (CR Area Otsd Air Fans Damper) "OPEN" light.	
AP/1/A/5500/10, NC SYSTEM LEAKAGE WITHIN THE CAPACITY OF BOTH NV PUMPS CASE I, STEAM GENERATOR TUBE LEAKAGE			
			Examiner NOTE: Examiners following the **CRS/RO** continue **HERE**.
	BOP	(Step 7) Check if unit shutdown or reactor trip required as follows:	
		• Check VCT makeup – IN PROGRESS.	**NOTE:** A VCT makeup may be in progress.
		• Check VCT level – GOING UP.	
	BOP	• Check S/G tube leak size – LESS THAN 90 GPM.	**NOTE:** The CRS will determine the SGTL to be about 20-80 gpm.
		• Leakage in one S/G – GREATER THAN 125 GPD (GALLON PER DAY).	
	CRS	• Observe the following limits while reducing load in Step 8:	
		• Ensure reactor power is less than 50% within 1 hour of exceeding 125 GPD.	
		• Be in Mode 3 within 3 hours of exceeding 125 GPD.	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	31 of 65
Event Description:		**Steam Generator Tube Leak**					

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Note prior to Step 8) If load reduction less than 10 MW/min is planned once below 50% power, the OP below is the optimal procedure to use. If load reduction greater than or equal to 10 MW/min all the way to mode 3 is planned, AP04 is the optimal procedure to use. A more rapid shutdown is prudent for larger leaks.	
	CRS	(Step 8) Reduce load PER one of the following, while continuing with this AP as time allows beginning at Step 9.	
	CRS	• AP/1/A/5500/04 (Rapid Downpower)	**NOTE:** The CRS will implement AP-4, and may continue with these actions after the downpower is started. **(Examiner Move forward to Page 44)**
		OR	
		• OP/1/A/6100/003 (Controlling Procedure For Unit Operation). Enclosure 4.2 (Power Reduction).	
	RO	(Step 9) Minimize secondary side contamination as follows:	**NOTE:** The following actions are scripted because as the plant power is reduced, the CRS may continue to perform actions within AP-10.
		• Check affected S/G – IDENTIFIED.	
		• CLOSE the blowdown throttle control valve for affected S/G.	
		• 1A: 1BB-123 (1A S/G Blowdown Throttle Control)	
		• 1B: 1BB-124 (1B S/G Blowdown Throttle Control)	
		• 1C: 1BB-125 (1C S/G Blowdown Throttle Control)	
		• 1D: 1BB-126 (1D S/G Blowdown Throttle Control)	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	32 of 65
Event Description:		**Steam Generator Tube Leak**					

Time	Pos.	Expected Actions/Behavior	Comments
		• Perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 15 (Minimizing Secondary Side Contamination).	**NOTE:** The CRS may ask the U2 BOP to perform this action. If so, **Floor Instructor:** acknowledge as **U2 BOP**.
	RO	(Step 10) Check reactor trip breakers – OPEN.	
		(Step 10 RNO) Do not continue in the procedure until the reactor is tripped PER Step 8.	
			Examiner NOTE: Based on the transient nature of evaluating this TS, the Examiner may need to question the CRS after the scenario.
TECHNICAL SPECIFICATION 3.4.13, RCS OPERATIONAL LEAKAGE			
	CRS	LCO 3.4.13 RCS operational LEAKAGE shall be limited to:	
		• 389 gallons per day total primary to secondary LEAKAGE through all steam generators (SGs): and	
		• 135 gallons per day primary to secondary LEAKAGE through any one steam generator (SG)	
	CRS	APPLICABILITY: MODES 1, 2, 3 and 4	
	CRS	ACTIONS	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	33 of 65
Event Description:	Steam Generator Tube Leak						

Time	Pos.	Expected Actions/Behavior			Comments
	CRS	CONDITION	REQUIRED ACTION	COMPLETION TIME	**NOTE:** The CRS will determine that ACTION B.1 and B.2 must be entered.
		B. Required Action and associated Completion Time of Condition A not met. OR Pressure boundary LEAKAGE exists. OR Primary to secondary LEAKAGE not within limits.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours	
SELECTED LICENSEE COMMITMENT 16.9.7, STANDBY SHUTDOWN SYSTEM					
	CRS	COMMITMENT The Standby Shutdown System (SSS) shall be operable.			
	CRS	APPLICABILITY: MODES 1, 2, and 3.			
	CRS	REMEDIAL ACTIONS			
		The SRO should ensure that security is notified 10 minutes prior to declaring the SSS inoperable. Immediately upon discovery of the SSS inoperability, Security must be notified to implement compensatory measures within 10 minutes of discovery.			

Op Test No.: N16-1	Scenario # 1	Event # 3	Page 34 of 65		
Event Description:	**Steam Generator Tube Leak**				

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	CONDITION: C. Total Unidentified LEAKAGE, Identified LEAKAGE, and reactor coolant pump seal leakoff > 20 gpm. OR Total reactor coolant pump seal leakoff > 16.3 gpm. OR Any reactor coolant pump No. 1 seal leakoff > 4.0 gpm. REQUIRED ACTION: C.1 Declare the Standby Makeup Pump inoperable. AND C.2 Enter Condition A. COMPLETION TIME: Immediately	**NOTE:** The CRS will determine that ACTION C.1 and C.2 must be entered (Enter Condition A).
AP/1/A/5500/04, RAPID DOWNPOWER			
	RO/ BOP	(Step 1) Monitor Foldout page.	
		Uncontrolled Cooldown (If Tavg < 551F and lowering…..Not Expected)	
		Power Factor (Adjust power factor during load reduction to maintain power factor between 0.9 to 1.0 lagging, using "VOLTAGE ADJUST" pushbutton)	**NOTE:** The RO will adjust MVARS as needed.
		Manual Rod Control Criteria (< C-5, Not Expected)	
		Turbine Shutdown (Turbine Load < 15 MWe Not Expected)	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	35 of 65
Event Description:		**Steam Generator Tube Leak**					

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 2) Announce occurrence on page.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that AP-4 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 3) Check turbine control – IN AUTO.	
	RO	(Step 4) Check “MW LOOP” – IN SERVICE.	
	CRS	(Step 5) Check shutdown to Mode 3 – DESIRED.	
	CRS	(Step 6) Check if “Shutdown Via Reactor Trip from 15% Power” appropriate:	
		• Shutdown Via Reactor Trip from 15% Power – DESIRED.	**NOTE:** It is normal practice to shut down the reactor by driving rods, rather than tripping from 15%.
		• At least two CA pumps - FUNCTIONAL	
	CRS	(Step 7 Enter target load of 180 MWE in turbine control panel	
	CRS	(Step 8) Determine the required power reduction rate (MW/min).	**NOTE:** The CRS will reduce load at ≈10-15 MWe/minute.
	RO	(Step 9) Check control rods – IN AUTO.	
	BOP	(Step 10) Notify SOC of load reduction (red dispatcher phone).	**Booth Instructor:** as **SOC**, acknowledge.

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	36 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 11) Initiate turbine load reduction to desired load at desired rate.	
	BOP	(Step 12) Borate NC System as follows:	
		• Energize all backup Pzr heaters.	
		• Check unit to be shutdown – VIA REACTOR TRIP FROM 15% POWER.	NOTE: It is normal practice to shut down the reactor by driving rods, rather than tripping from 15%.
	CRS	(Step 12.b RNO) GO TO Step 12.d.	
	BOP	(Step 12.d) Determine boration amount based on the following:	
		• Power Reduction Rate (MW/min)	
		• Present NC System Boron Concentration (ppm)	
		• Total Power change (%).	**NOTE:** The total power change will be determined by the CRS, and will affect the amount of boron inserted by the BOP.
		• Record calculated boration amount:	
	RO	• Check auto or manual rod control – AVAILABLE.	
	BOP	• Perform boration in 4 equal additions during load reduction PER Enclosure 2 (Emergency Boration).	
			NOTE: The CRS may assign the BOP to perform this action. If so, **BOP Examiner** follow actions of Enclosure 2. **Other Examiners** follow **AP-4** Actions, **Step 13**, on **Page 38**.
AP/1/A/5500/04, RAPID DOWNPOWER ENCLOSURE 2, EMERGENCY BORATION			

Op Test No.: N16-1	Scenario # 1	Event # 3	Page 37 of 65
Event Description:	Steam Generator Tube Leak		

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 1) Check OAC - AVAILABLE.	
	BOP	(Step 2) Use OAC point M1P0785 to monitor boric acid gallons added while 1NV-265B (U1 NV Pump Boric Acid Sup Isol) is open.	
	BOP	(Step 3) GO TO Step 5.	
	BOP	(Step 5) Check boric acid transfer pump - RUNNING.	**NOTE:** If a Boric Acid Transfer Pump is NOT running, the BOP will start one pump using the RNO, and stop it later, after the boration is complete.
	BOP	(Step 6) OPEN 1NV-265B (U1 NV Pump Boric Acid Sup Isol).	
	BOP	(Step 7) Do not continue until desired amount of boric acid has been added.	
	BOP	(Step 8) CLOSE 1NV-265B (U1 NV Pump Boric Acid Sup Isol).	
	BOP	(Step 9) IF boric acid transfer pump was started in Step 5 RNO, THEN perform the following:	**NOTE:** If a Boric Acid Transfer Pump was started earlier, it will be stopped here.
		• Stop boric acid transfer pump.	
		• Ensure one boric acid transfer pump is in auto.	
	BOP	(Step 10) Repeat enclosure as required.	
AP/1/A/5500/04, RAPID DOWNPOWER			
			Examiner NOTE: Examiners following the **CRS/RO** continue **HERE**.

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	38 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 13) Display Rod Insertion Limits on OAC by entering turn on code "RIL".	
	RO	(Step 14) IF AT ANY TIME "CONTROL ROD BANK LO LO LIMIT" alarm (1AD-2, B-9) is lit THEN comply with Tech Spec 3.1.6 (Control Bank Insertion Limits):	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO	(Step 15) IF AT ANY TIME during procedure C-7A is received, THEN insure Transient Monitor freeze is triggered.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 16) REFER TO the following:	
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
	CRS	(Step 17) Notify Reactor Engineer on duty of load reduction.	**NOTE:** The CRS may call WCC/RE to address the switch position. If so, **Booth Instructor** acknowledge as WCC/RE as appropriate.
	RO	(Step 18) Check target load - LESS THAN 1000 MW.	
	CRS	(Step 19) Check Unit 2 available to supply aux steam as follows:	**NOTE:** The CRS will ask U2 RO. **Floor Instructor:** As U2 RO report "All these conditions are met."

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	39 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Unit 2 Reactor power - GREATER THAN 15%	
		• Unit 2 2AS-12 (U2 SM to AS Hdr Control Inlet Isol) - OPEN	
		• Unit 2 - AVAILABLE TO SUPPLY AS HEADER.	
	RO	(Step 20) Check SM flow on all S/Gs – GREATER THAN 25%.	
	RO	(Step 21) WHEN all SM flows are less than 75%, THEN ensure the following valves ramp CLOSED:	**NOTE:** This is a conditional step. The CRS will make the RO aware of this action, if NOT already done.
		• 1CF-104AB (1A S/G CF Control Bypass)	
		• 1CF-105AB (1B S/G CF Control Bypass)	
		• 1CF-106AB (1C S/G CF Control Bypass)	
		• 1CF-107AB (1D S/G CF Control Bypass)	
	CRS	(Step 22) WHEN P/R instruments indicate less than 60%, THEN check "P-8 HI PWR LO FLO RX TRIP BLOCKED" status light (1SI-18) - LIT.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO	(Step 23) Check the following:	**NOTE:** It is most likely that the power level is above 55%.
		• P/R meters indicate reactor power - LESS THAN 55%	
		• All CF flows - LESS THAN 55%	
		• Turbine inlet pressure - LESS THAN 500 PSIG.	
	CRS	(Step 23 RNO) Perform the following:	
		• IF target load is less than 40%......	
		• IF target load is greater than or equal to 55%, THEN perform the following:	

Op Test No.:	N16-1	Scenario #	1	Event #	3	Page	40 of 65
Event Description:	**Steam Generator Tube Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Do not continue with this procedure until target load reached.	
At the discretion of the Lead Examiner, move to Event #4.			

Op Test No.:	N16-1	Scenario #	1	Event #	4	Page	41 of 65
Event Description:		**Continuous inward Rod Motion**					

During the downpower, the Control Rods will continuously insert. The operator will enter AP/1/A/5500/14, "Rod Control Malfunction," and take manual control of the rods.

Booth Operator Instructions: **insertMAL-IRE003A (IN)**

NOTE: If needed (i.e. No current Rod Demand) insertMAL-DCS1213 =TRUE

Indications Available:

- Control Rods are moving inward in AUTO without a proper signal.

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/14, ROD CONTROL MALFUNCTION	
	RO	(Step 1) IF two or more rods are either dropped OR misaligned by greater than 24 steps…	**Immediate Action** **NOTE:** No Rods have dropped in this event.
	RO	(Step 2) Place control rods in manual.	**Immediate Action** **NOTE:** The RO will place the rods in MANUAL.
	RO	(Step 3) Check rod movement – STOPPED.	**Immediate Action** **NOTE:** When the RO places the Rods to MANUAL, continual inward Rod Motion will stop.
	RO	(Step 4) Check all rods – ALIGNED WITH ASSOCIATED BANK.	
	RO	(Step 5) Check "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10) – DARK.	

Op Test No.:	N16-1	Scenario #	1	Event #	4	Page	42 of 65
Event Description:	**Continuous inward Rod Motion**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 6) Check "T-AVG/T-REF FAILURE ROD STOP" alarm (1AD-2, B-7) – DARK.	
	CRS	(Step 7) IF this AP entered due to unwarranted rod insertion or withdrawal, THEN GO TO Enclosure 3 (Response To Continuous Rod Movement).	**NOTE:** The CRS will transition to Enclosure 3 of AP-14.
ROD CONTROL MALFUNCTION ENCLOSURE 3 – RESPONSE TO CONTINUOUS ROD MOVEMENT			
	CRS	(Step 1) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that AP-14 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	CRS	(Step 2) Notify IAE to investigate problem.	**NOTE:** The CRS may call WCC/IAE to address the switch position. If so, **Booth Instructor** acknowledge as WCC.
	CRS	(Step 3) Evaluate the following prior to any control rod withdrawal:	
		• Ensure no inadvertent mode change will occur.	
		• Ensure control rods are withdrawn in a deliberate manner, while closely monitoring the reactor's response.	
	RO	(Step 4) Check T-Ref indication - NORMAL	

Op Test No.: N16-1	Scenario # 1	Event # 4	Page 43 of 65
Event Description:	**Continuous inward Rod Motion**		

Time	Pos.	Expected Actions/Behavior	Comments
	CRS/ RO	(Step 5) Do not move rods until IAE determines rod motion in permissible.	**Booth Instructor:** after **2 minutes,** as **IAE**, report that MANUAL rod control only is permissible.
	RO	(Step 6) Maintain T-Avg within 1°F of T-Ref as follows:	
		• Adjust Turbine load	
		OR	
		• Borate/dilute NC System.	
	RO	(Step 7) IF AT ANY TIME a runback occurs while in this procedure,…	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO/ BOP	(Step 8) IF AT ANY TIME while in this procedure a unit shutdown is required AND rods cannot be moved, THEN perform the following:	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Borate as required during shutdown to maintain T-Avg at T-Ref.	
		• Monitor AFD during load reduction.	
		• IF AT ANY TIME AFD reaches Tech Spec limit AND reactor power is greater than 50%, …	
		• IF entry into Mode 3 is desired, THEN perform the following:	
		• WHEN the turbine is tripped OR at desired power level, THEN perform the following:	
		• Trip Reactor.	
		• GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
	CRS	(Step 9) WHEN problem is repaired…	

Op Test No.:	N16-1	Scenario #	1	Event #	4	Page	44	of	65	
Event Description:		**Continuous inward Rod Motion**								

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The CRS will likely conduct a Focus Brief.
At the discretion of the Lead Examiner, move to Events #5-7.			

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	45 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

After this, the leak will develop into a 500 gpm Steam Generator Tube Rupture and the operator will enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection." Upon completion of E-0, the operator will transition to EP/1/A/5000/E-3, "Steam Generator Tube Rupture," to isolate the flow into and out of the 1B Steam Generator and then conduct a cooldown of the NC System. While performing an NCS cooldown the C-9 Interlock will fail and result in a loss of the steam dumps. The operator will be required to re-initiate the cooldown using the available SG PORVs. During the NCS depressurization, the Pzr Spray Valves will fail to open. The operator will be required to conduct the depressurization using the last available Pzr PORV. The scenario will terminate at Step 22.c of E-3, after the crew has closed the Cold Leg Isolation Valves from the NV System.

Booth Operator Instructions: **insert MAL-SG001B 500 delay=0 ramp=120 (S/G 1B Tube Rupture)**

Indications Available:
- Pzr level lowers uncontrollably
- Pzr pressure lowers consistently with Pzr level

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: Upon changing plant conditions the crew will implement Continuous Action Step 2 of AP-10, and return to Step 1 of AP-10.
AP/1/A/5500/10, NC SYSTEM LEAKAGE WITHIN THE CAPACITY OF BOTH NV PUMPS CASE I, STEAM GENERATOR TUBE LEAKAGE			
	BOP	(Step 1) Check Pzr level – STABLE OR GOING UP.	**NOTE:** Pzr Level will be slowly lowering.
	BOP	(Step 1 RNO) Perform the following as required to maintain level:	
		• Maintain charging flow less than 200 GPM at all times in subsequent steps.	
		• Ensure 1NV-238 (Charging Line Flow Control) – OPENING.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	46 of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• OPEN 1NV-241 (U1 Seal Water Inj Flow Control) while maintaining NC pump seal flow greater than 6 GPM.	
	BOP	• Reduce or isolate letdown.	**NOTE:** If not isolated already the BOP isolate letdown.
	BOP	• Start additional NV pump.	**NOTE:** The BOP will need to start an additional NV Pump.
		• IF CLAs are isolated, ….	**NOTE:** The CLAs are NOT isolated.
		• IF Pzr level cannot be maintained greater than 4% OR Pzr level going down with maximum charging flow, THEN perform the following:	**NOTE:** The Pzr level is decreasing with maximum Charging flow.
		• IF 1B OR 1C S/G identified as ruptured, THEN immediately dispatch two operators to isolate TD CA pump steam supply from ruptured S/G PER Enclosure 3 (TD CA Pump Steam Supply Isolation)	**NOTE:** The CRS will dispatch two AOs. **Floor Instructor:** Acknowledge as AOs. **Booth Instructor:** **insertREMSA0002 = 0** **insertREMSA0078 = 0** Within **3 minutes,** as **AO** report that **steam has been isolated to the TD CA Pump from the 1B SG.**
	RO	• Trip reactor.	
	RO/ BOP	• WHEN reactor tripped OR auto S/I setpoint reached, THEN ensure S/I initiated.	
	CRS	• GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	

EP/1/A/5000/E-0, REACTOR TRIP OR SAFETY INJECTION

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	47 of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 1) Monitor Foldout page.	**NOTE:** Crew will carry out Immediate Actions of E-0, prior to the CRS addressing the EP.
		NC Pump Trip Criteria (Not expected)	
		CA Suction Sources (CA storage tank (water tower) goes below 1.5 ft – Not expected)	
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recird Isol)	**NOTE:** The BOP will monitor these conditions.
		• IF NV S/I flowpath aligned AND NC pressure is less than 1500 PSIG, THEN CLOSE 1NV-150B and 1NV-151A.	
		• IF NC pressure is greater than 2000 PSIG, THEN OPEN 1NV-150B and 1NV-151A.	
		Ruptured S/G Aux Feedwater Isolation Criteria (Expected)	**NOTE:** The BOP will monitor these conditions, and isolate CA flow to the 1B SG when met.
		• IF both of the following conditions met, THEN stop CA flow to affected S/G:	
		• Level going up in an uncontrolled manner or radiation level in that S/G is abnormal	
		• N/R level - GREATER THAN 11% (32% ACC).	
		Faulted S/G Aux Feedwater Isolation Criteria (Not expected)	
	RO	(Step 2) Check Reactor Trip:	**Immediate Action**
		• All rod bottom lights – LIT	
		• Reactor trip and bypass breakers – OPEN	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	48 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• I/R amps – GOING DOWN.	
	RO	(Step 3) Check Turbine Trip:	**Immediate Action**
		• All throttle valves – CLOSED.	
	BOP	(Step 4) Check 1ETA and 1ETB – ENERGIZED.	**Immediate Action**
	RO/ BOP	(Step 5) Check if S/I is actuated:	**Immediate Action**
		• “SAFETY INJECTION ACTUATED” status light (1SI-18) – LIT.	
		• Both LOCA Sequencer Actuated status lights (1SI-14) – LIT.	
	CRS	(Step 6) Announce “Unit 1 Safety Injection”.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that a U1 Safety Injection has occurred. If so, **Floor Instructor** acknowledge as U2 RO.
	BOP	(Step 7) Check all Feed water Isolation status lights (1SI-4) – LIT.	
	BOP	(Step 8) Check Phase A “RESET” lights – DARK.	
	BOP	(Step 9) Check ESF Monitor Light Panel on Energized train(s):	
		• Groups 1, 2, 5 – DARK.	
		• Group 3 – LIT.	
		• Group 4 – LIT AS REQUIRED.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	49 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Group 6 – LIT.	
	CRS	• GO TO Step 10.	
	RO	(Step 10) Check proper CA pump status:	
		• MD CA pumps – ON.	
		• N/R level in at least 3 S/Gs – GREATER THAN 17%.	
	BOP	(Step 11) Check all KC pumps – ON.	
	BOP	(Step 12) Check both RN pumps – ON.	
	CRS	(Step 13) Notify Unit 2 to perform the following:	**Floor Instructor:** As U2 RO report "2A RN Pump is running."
		• Start 2A RN pump.	
		• THROTTLE Unit 2 RN flow to minimum for existing plant condition.	**Booth Instructor:** **insert LOA-RN087 (Start 2A RN Pump)** **insert LOA-RN083 8050.000000 delay=0 ramp=10 (Unit 2 Train A Demand Flow)**
	RO	(Step 14) Check all S/G pressures – GREATER THAN 775 PSIG.	
	BOP	(Step 15) Check Containment Pressure – HAS REMAINED LESS THAN 3 PSIG.	**NOTE:** Containment Pressure is normal.
	BOP	(Step 16) Check S/I flow:	
		• Check "NV PMPS TO COLD LEG FLOW" gauge – INDICATING FLOW.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	50	of	65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**								

Time	Pos.	Expected Actions/Behavior	Comments
		• Check NC pressure – LESS THAN 1600 PSIG.	
	BOP	(Step 16b RNO) Perform the following:	
		• Ensure ND pump miniflow valve on running pump(s) OPEN:	
		• 1ND-68A (1A ND Pump & Hx Mini Flow Isol)	
		• 1ND-67B (1B ND Pump & Hx Mini Flow Isol).	
	CRS	• IF valve(s) open on all running ND pumps, THEN GO TO Step 17.	
	CRS	(Step 17) Notify OSM or other SRO to perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 22 (OSM Actions Following an S/I) within 10 minutes.	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
	RO/ BOP	(Step 18) Check CA flow:	
		• Total CA flow – GREATER THAN 450 GPM.	**NOTE:** The crew may have throttled CA flow to < 450 gpm because NR S/G levels are > 11%. If so, the RNO will be performed.
	BOP	• Check VI header pressure – GREATER THAN 60 PSIG.	
	RO/ BOP	• WHEN each S/G N/R level is greater than 11% (32% ACC), THEN control CA flow to maintain that S/G N/R level between 11% (32% ACC) and 50%.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO	(Step 19) Check NC temperatures:	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	51 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF any NC pumps on, THEN check NC T-Avg – STABLE OR TRENDING TO 557°F.	
			NOTE: It is most likely that the cooldown will be under control. If NOT, the CRS will assign the RO (BOP) to perform Enclosure 3 (Not Scripted), and continue the performance of E-0 with the BOP (RO).
	BOP (RO)	(Step 20) Check Pzr PORV and spray valves:	
		• All Pzr PORVs – CLOSED.	**NOTE:** 1NC-34A has previously failed OPEN.
	BOP	(Step 20a RNO) IF Pzr pressure less than 2315 PSIG, THEN perform the following:	
		• CLOSE Pzr PORV(s).	
		• IF any Pzr PORV cannot be closed, THEN perform the following:	
		• CLOSE its isolation valve.	**NOTE:** The 1NC-34A Isolation Valve has been previously CLOSED.
		• CLOSE the following valve(s):	
		• IF 1NC-34A (U1 Pzr PORV) failed, THEN CLOSE 1NC-270 (PZR PORV Drn Isol For 1NC-34).	
		• IF PORV isolation valve cannot be closed…	
		• Normal Pzr spray valves – CLOSED.	**NOTE:** The Pzr Spray Valves may be OPEN. If so, the RNO will be performed.
		• At least one Pzr PORV isolation valve-OPEN.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	52 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP (RO)	(Step 21) Check NC subcooling based on core exit T/Cs – GREATER THAN 0°F.	
	BOP (RO)	(Step 22) Check if main steamlines intact:	
		• All S/G pressures – STABLE OR GOING UP	
		• All S/Gs – PRESSURIZED.	
	BOP (RO)	(Step 23) Check if S/G tubes intact:	
		• The following secondary EMFs – NORMAL:	
		• 1EMF-33 (Condenser Air Ejector Exhaust)	
		• 1EMF-34(L) (S/G Sample (Lo Range))	**NOTE:** 1EMF-34 is in TRIP 2.
		• 1EMF-24 (S/G A)	
		• 1EMF-25 (S/G B)	**NOTE:** 1EMF-25 is in TRIP 2.
		• 1EMF-26 (S/G C)	
		• 1EMF-27 (S/G D).	
		• S/G levels – STABLE OR GOING UP IN A CONTROLLED MANNER.	**NOTE:** The 1B SG Level is increasing in an uncontrolled manner.
	CRS	(Step 23 RNO) IF S/G levels going up in an uncontrolled manner OR any EMF abnormal, THEN perform the following:	
		• Implement EP/1/A/5000/F-0 (Critical Safety Function Status Trees).	
		• GO TO EP/1/A/5000/E-3 (Steam Generator Tube Rupture).	
			NOTE: The CRS will transition to E-3.
EP/1/A/5000/E-3, STEAM GENERATOR TUBE RUPTURE			

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	53 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 1) Monitor Foldout page.	
		NC Pump Trip Criteria (Not expected)	
		S/I Reinitiation Criteria (SI On – Not expected)	
		Secondary Integrity Criteria (Not expected)	
		Cold Leg Switchover Criteria (< 95 INCHES in FWST – Not expected)	
		CA Suction Sources (<1.5 feet – Not expected)	
		Multiple Tube Rupture Criteria (Not expected)	
		Position Criteria for 1NV-150B and 1NV-151A (NV Pumps Recirculation)	
		• IF NV S/I flowpath aligned AND NC pressure is less than 1500 PSIG, THEN CLOSE 1NV-150B and 1NV-151A.	**NOTE:** The BOP will monitor these conditions.
		• IF NC pressure is greater than 2000 PSIG, THEN OPEN 1NV-150B and 1NV-151A.	
	BOP	(Step 2) Identify ruptured S/G(s):	
		• Any S/G N/R level – GOING UP IN AN UNCONTROLLED MANNER	**NOTE:** The 1B SG Level is increasing in an uncontrolled manner and 1EMF-25 is in TRIP 2.
		OR	
		• Chemistry or RP has determined ruptured S/G.	**NOTE:** The CRS may contact Chemistry for sampling. **Booth Instructor:** Acknowledge as appropriate.
		OR	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	54	of	65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
		• Any of the following EMFs – ABOVE NORMAL:	
		• 1EMF-24 (S/G A)	
		• 1EMF-25 (S/G B)	
		• 1EMF-26 (S/G C)	
		• 1EMF-27 (S/G D)	
	RO	(Step 3) Check at least one S/G – AVAILABLE FOR NC SYSTEM COOLDOWN.	
	RO	(Step 4) Isolate flow from ruptured S/G(s) as follows:	
		• Check ruptured S/G(s) PORV – CLOSED.	
		• Check S/Gs 1B and 1C – INTACT.	**NOTE:** The 1B SG is NOT Intact.
	CRS	(Step 4b RNO) Isolate TD CA pump steam supply from ruptured S/G as follows:	
		• IF TD CA pump is the only source of feedwater….	**NOTE:** The TD CA Pump is NOT the ONLY CA Source.
		• Ensure operators dispatched in next step immediately notify Control Room Supervisor when valves are closed.	**NOTE:** It is likely that these actions have already been performed.
		• Immediately dispatch 2 operators to concurrently verify (CV), unlock and CLOSE valves on ruptured S/G(s):	**NOTE:** This step was most likely accomplished in AP-10 If NOT, the CRS will dispatch two AOs. **Floor Instructor:** Acknowledge as AOs.
		• For 1B S/G:	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	55 of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
		• 1SA-78 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Loop Seal Isol) (Unit 1 interior doghouse, 767+10, FF-53).	**Booth Instructor**: **insertREMSA0002 = 0** **insertREMSA0078 = 0** Within **3 minutes,** as **AO** report that **steam has been isolated to the TD CA Pump from the 1B SG.**
		• 1SA-2 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Maint Isol) (Unit 1 interior doghouse, 767+10, FF-53, above ladder).	
	CRS	• IF AT ANY TIME local closure of SA valves takes over 8 minutes, THEN isolate TD CA pump steam supply PER Enclosure 2 (Tripping TD CA Pump Stop Valve or Alternate Steam Isolation).	**NOTE:** Eight minutes will NOT elapse before the valves are closed.
	RO	• Check blowdown isolation valves on ruptured S/G/(s) – CLOSED.	
		• For 1B S/G:	
		• 1BB-2B (1B S/G Blowdown Cont Outside Isol Control)	
		• 1BB-6A (B S/G BB Cont Inside Isol).	
	BOP	• CLOSE steam drain on ruptured S/G(s)	
		• 1SM-89 (B SM Line Drain Isol)	
	RO	• CLOSE the following valves on ruptured S/G(s):	
		• MSIV	
		• MSIV bypass valve.	
	RO	(Step 5) Control ruptured S/G(s) level as follows:	
		• Check ruptured S/G(s) N/R level – GREATER THAN 11% (32% ACC).	
	BOP	• Isolate feed flow to ruptured S/G(s):	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	56	of	65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**								

Time	Pos.	Expected Actions/Behavior	Comments
		• For 1B S/G:	
		• CLOSE 1CA-54AC (U1 TD CA Pump Disch TO 1B S/G Isol).	
		• CLOSE 1CA-58A (1A CA Pump Disch To 1B S/G Isol).	
	RO	(Step 6) Check ruptured S/G(s) pressure – GREATER THAN 280 PSIG.	
	BOP	(Step 7) Check any NC pump – RUNNING.	
	BOP	(Step 8) Check Pzr pressure – GREATER THAN 1955 PSIG.	
	RO	(Step 9) Initiate NC System cooldown as follows:	
	CRS	• Determine required core exit temperature based on lowest ruptured S/G pressure:	
		>1099 psig - 520°F 1000-1099 psig - 508°F	**NOTE:** The CRS will determine the target temperature to be between 508-520°F.
	RO	• Check the following valves on ruptured S/G(s) – CLOSED:	
		• MSIV	
		• MSIV bypass valve.	
	RO	• Check ruptured S/G(s) SM PORV – CLOSED.	
	RO	• Check S/G(s) 1B and 1C – INTACT.	**NOTE:** The 1B SG is ruptured.
	RO	(Step 9.d RNO) IF 1B OR 1C S/G is ruptured, THEN perform the following:	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	57	of	65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**								

Time	Pos.	Expected Actions/Behavior	Comments
		• Ensure steam to TDCA pump is isolated from ruptured S/G per one of the following:	**NOTE:** It is likely that these actions have already been performed.
		• Local isolation of SA line (per Step 4.b)	
			NOTE: If NOT already done, the CRS will direct two AOs to CLOSE 1SA-2 and 78. **Booth Instructor**: **insertREMSA0002 = 0** **insertREMSA0078 = 0** Within **3 minutes,** as **AO** report that **steam has been isolated to the TD CA Pump from the 1B SG.**
	RO	• (Step 9e) Check condenser available as follows:	**NOTE:** Because of a C-9 failure the Condenser is NOT available.
	RO	• "C-9 COND AVAILABLE FOR STEAM DUMP" status light (1SI-18) – LIT	
	CRS	(Step 9e RNO) GO TO RNO for Step 9.h.	
	BOP	(Step 9h RNO) Perform the following:	
		• Ensure at least one Pzr PORV isolation valve is OPEN.	
		• IF VI is lost…	**NOTE:** Neither condition has occurred.
		• IF Pzr pressure is greater than 1955 PSIG, THEN depressurize to 1900 PSIG using Pzr PORV.	**NOTE:** Pzr Pressure may be < 1955 psig. If pressure > 1955 psig, the crew will have to depressurize.

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	58 of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	• Depress "BLOCK" on Low Pressure Steamline Isolation block switches.	
	BOP	• Maintain NC pressure less than 1955 PSIG.	
	RO	• Ensure Main Steam Isolation reset.	
	RO	• Ensure SM PORVs reset.	
	RO	• IF any intact S/G SM PORV isolation valves is closed AND associated SM PORV is operable THEN ……	
	RO	• Dump steam using all intact S/G(s) SM PORVs at maximum rate as follows:	**NOTE:** This condition is NOT met.
		• CLOSE SM PORV manual loader on ruptured S/G(s).	**NOTE:** The RO will close the 1B SM PORV Manual Loader.
		• Place intact S/G SM PORV manual loaders at 50%.	**NOTE:** The RO will open the 1A, 1C and 1D SM PORV Manual Loaders to 50%.
		• Select "MANUAL" on "SM PORV MODE SELECT".	
		• Adjust manual loaders on intact S/G SM PORVs as required to control intact S/G depressurization rate at approximately 2 PSIG per second.	**NOTE:** The RO will adjust the 1A, 1C and 1D SM PORV Manual Loaders as needed.
	CRS	• IF any intact S/G SM PORV closed,…	
	CRS	• IF no intact S/G available…	**NOTE:** The 1A, 1C and 1D SG are available.
	RO	(Step 9i) Check Low Pressure Steamline Isolation – BLOCKED.	
	RO	• (Step 9.j) Check Core exit T/Cs- LESS THAN REQUIRED TEMPERATURE.	**NOTE:** It is likely that when the CRS arrives at this step, that the target temperature will NOT be reached.

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	59 of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 9.j RNO) Perform the following:	**NOTE:** This action will be taken after the target temperature has been achieved.
	CRS	• WHEN Core exit T/Cs are less than required temperature, THEN perform the following:	**NOTE:** The CRS will proceed and return to this step when the target temperature has been achieved.
		• Stop NC System cooldown.	
		• Maintain core exit T/Cs less than required temperature.	
	RO	(Step 10) Control intact S/G levels:	
		• Check N/R level in any intact S/G – GREATER THAN 11% (32% ACC).	
		• Throttle feed flow to maintain all intact S/G N/R levels between 22% (32% ACC) and 50%.	
	BOP	(Step 11) Check Pzr PORVs and isolation valves:	
		• Power to all Pzr PORV isolation valves – AVAILABLE.	
	BOP	(Step 11a RNO) Evaluate cause of power loss and initiate actions to restore power to affected isolation valve(s).	
		• All Pzr PORVs – CLOSED.	**NOTE:** 1NC-34A has previously failed OPEN.
	BOP	(Step 11b RNO) IF Pzr pressure less than 2315 PSIG, THEN perform the following:	
		• CLOSE Pzr PORV(s).	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	60 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF any Pzr PORV cannot be closed, THEN CLOSE it isolation valve.	**NOTE:** The 1NC-34A Isolation Valve has been previously CLOSED.
		• IF PORV isolation valve cannot be closed…	
		• IF any Pzr PORV cannot be closed or isolated…	
		• IF any Pzr PORV cannot be closed, THEN CLOSE the following valve(s):	
		IF 1NC-34A (U1 Pzr PORV) failed, THEN CLOSE 1NC-270 (PZR PORV Drn Isol For 1NC-34A).	
	BOP	(Step 11c) At least one Pzr PORV isolation valve – OPEN.	
	BOP	(Step 12) Reset the following:	
		• S/I	
		• Sequencers	
		• Phase A Isolation	
		• Phase B Isolation	
	BOP	(Step 13) Establish VI to containment as follows:	
		• Open the following valves:	
		• 1VI-129B (VI Supply to A Cont Ess VI Hdr Outside Isol))	
		• 1VI-160B (VI Supply to B Cont Ess VI Hdr Outside Isol))	
		• 1VI-150B (Lwr Cont Non Ess Cont Outside Isol).	
		• Check VI header pressure – GREATER THAN 85 PSIG.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	61	of 65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 14) Check if NC System cooldown should be stopped as follows:	
		Check cooldown – INITIATED PER STEP 9.	
		• Check Core exit T/Cs – LESS THAN REQUIRED TEMPERATURE.	**NOTE:** It is likely that when the CRS arrives at this step, that the target temperature will NOT be reached.
	CRS	(Step 14b RNO) Perform the following:	
		• IF AT ANY TIME while in this step ruptured S/G pressure changes by over 100 PSIG, AND ruptured S/G pressure is greater than 400 PSIG, THEN select a new target temperature from table in Step 9.a.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware, and HOLD.
		• Do not continue until core exit T/Cs are less than target temperature.	
	RO	• (Step 14c) Stop NC System cooldown.	
		• Maintain Core exit T/Cs – LESS THAN REQURIED TEMPERATURE.	
	RO	(Step 15) Check ruptured S/G(s) pressure – STABLE OR GOING UP.	

Critical Task:

(E-3A) Isolate feedwater flow into and steam flow from the ruptured SG so that minimum ΔP between ruptured Steam Generator and intact Steam Generators is not less than 250 psid once target temperature is reached (Entry into ECA-3.1).

Safety Significance: Failure to isolate the ruptured SG causes a loss of ΔP between the ruptured SG and the intact SGs. Upon a loss of ΔP, the crew must transition to a contingency procedure that constitutes an incorrect performance that “necessitates the crew taking compensating action which complicates the event mitigation strategy.” If the crew fails to isolate steam from the SG, or feed flow into the SG the ruptured SG pressure will tend to decrease to the same pressures as the intact SGs, requiring a transition to a contingency procedure, and delaying the stopping of RCS leakage into the SG.

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	62	of	65

Event Description: **1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 16) Check NC subcooling based on core exit T/Cs – GREATER THAN 20°F.	
	BOP	(Step 17) Depressurize NC System using Pzr spray as follows:	
		• Check normal Pzr spray flow – AVAILABLE.	
		• Initiate NC depressurization using maximum available spray.	**NOTE:** The Pzr Spray valves will not open when operated.
		• IF AT ANY TIME during this step, spray valves are not effective in reducing NC pressure, OR ruptured S/G(s) NR level goes above 83% (73% ACC), THEN GO TO Step 18.	
	CRS	(Step 17a RNO) GO TO Step 18.	
	BOP	(Step 18) Depressurize NC System using Pzr PORV as follows:	
		• Check at least one Pzr PORV - AVAILABLE.	
		• Open one Pzr PORV.	
		• Do not continue until any of the following conditions satisfied:	
		• NC subcooling based on core exit T/Cs - LESS THAN 0°F	
		OR	
		• Pzr level - GREATER THAN 76% (58% ACC)	
		OR	
		• Both of the following:	
		• NC pressure - LESS THAN RUPTURED S/G(s) PRESSURE.	

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	63 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Pzr level - GREATER THAN 11% (29% ACC).	
		• Close Pzr PORV.	
		• Close Pzr spray valves.	
	BOP	(Step 19) Check NC pressure - GOING UP.	
	RO/ BOP	(Step 20) Check S/I termination criteria:	
		• NC subcooling based on core exit T/Cs – GREATER THAN 0°F.	
		• Secondary heat sink:	
		• N/R level in at least one intact S/G – GREATER THAN 11% (32% ACC)	
		• NC pressure – STABLE OR GOING UP.	
		• Pzr level – GREATER THAN 11%	
	BOP	(Step 21) Stop S/I pumps as follows:	
		• NI pumps.	
		• All but one NV pump.	
	BOP	(Step 22) Isolate NV S/I flowpath as follows:	
		• Check the following valves - OPEN	
		• 1NV-221A (U1 NV Pumps Suct From FWST Isol)	
		• 1NV-222B (U1 NV Pumps Suct From FWST Isol).	
		• Check the following valves - OPEN	
		• 1NV-150B (U1 NV Pump Recirc Isol).	**NOTE:** Both valves are CLOSED (Due to Item #3 of the E-3 Foldout Page). These valves will be OPENED.

Op Test No.:	N16-1	Scenario #	1	Event #	5, 6 & 7	Page	64 of 65
Event Description:	**1B Steam Generator Tube Rupture/ Failure of the C-9 Interlock/ Pzr Spray Valves fail to OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1NV-151A (U1 NV Pump Recirc Isol).	
	BOP	• Close the following valves:	
		• 1NI-9A (NC Cold Leg Inj From NV)	
		• 1NI-10B (NC Cold Leg Inj From NV).	

<u>Critical Task:</u>

Depressurize the NCS to meet SI termination criteria before the Quality of the steam exiting the SG exceeds 80% (≤0.8 on Void Fraction SGINFO.cts).

Safety Significance: Failure to stop the reactor coolant leakage into a ruptured SG by depressurizing the RCS (when it is possible to do so) needlessly complicates the mitigation of the event. It also constitutes a “significant reduction of Safety Margin beyond that irreparably introduced by the scenario. If RCS depressurization does NOT occur, the inventory in the secondary side of the ruptured SG will rise to the level of the Main Steam Lines leading to water release through the SG PORV or Safety Valve, which could cause and unisolable fault in the ruptured SG.

At the discretion of the Lead Examiner terminate the exam.

UNIT 1 STATUS:

Power Level: 100% NCS [B] 935 ppm Pzr [B]: 935 ppm Xe: Per OAC

Power History: At this power level for 78 days Core Burnup: 251 EFPDs

CONTROLLING PROCEDURE: OP/1/A/6100/003 Controlling Procedure for Unit Operation

OTHER INFORMATION NEEDED TO ASSUME THE SHIFT:

- The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.

The following equipment is Out-Of-Service:

- The VUCDT Level indication is OOS. MCB Annunciator 1AD-13, C-7, "VENT UNIT HI-HI LEVEL," is LIT. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C.
- Pzr PORV 1NC-32B has been isolated (per AP-11) due PORV leakage. ACTION has been taken in accordance with Technical Specification LCO 3.4.11 ACTION A.
- MCB Annunciator 1AD-9, B-7, "ICEBED HI TEMP SWITCHES," spuriously alarmed several times during the shift (IAE is investigating).

Crew Directions:

- The crew will maintain current plant conditions

Work Control SRO/Offsite Communicator **Jim**

Plant SRO **Joe (FB)**

AO's AVAILABLE

<u>Unit 1</u>	**<u>Unit 2</u>**
Aux Bldg. John	**Aux Bldg. Chris**
Turb Bldg. Bob (FB)	**Turb Bldg. Mike (FB)**
5th Rounds. Carol	

Extra(s) Bill (FB) Ed (FB) Wayne (FB) Tanya Gus (RW)

Facility: **McGuire**	Scenario No.: **2**	Op Test No.: **N16-1**	
Examiners: ____________	Operators:	____________	(SRO)
____________		____________	(RO)
____________		____________	(BOP)

Initial Conditions:	The plant is at 90% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1B MDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION B. MCB Annunciator 1AD-8, A-4, "CF PUMP DISCHARGE HI PRESS," has alarmed spuriously several times over the last hour, and has currently failed ON (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	1	C-BOP C-SRO	VCT Level Channel 1 fails HIGH
2	2	I-BOP I(TS)-SRO	1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE
3	3	C-RO C(TS)-SRO	1SA48 fails OPEN/TDCA Pump starts inadvertently
4	NA	R-RO N-BOP N-SRO	Rapid Downpower
5	4	C-RO C-SRO	Turbine Control Unit fails to MANUAL
6	5	C-BOP C-SRO	High Vibration on 1B NCP
7	6	M-RO M-BOP M-SRO	Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation
8	6	NA	Overspeed Trip of TDCA Pump
9	6	NA	1A MDCA Pump trips upon Auto Start

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #2

The plant is at 90% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1B MDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION B. MCB Annunciator 1AD-8, A-4, "CF PUMP DISCHARGE HI PRESS," has alarmed spuriously several times over the last hour, and has currently failed ON (IAE is investigating).

Shortly after taking the watch, the VCT Level Channel 1 will fail HIGH. The operator will respond in accordance with MCB Annunciator 1AD-2, F8, DCS ALTERNATE ACTION, and go to OP/1/A/6102/003, "DCS System Operation," Enclosure 4.4, "Removing/Returning a VCT Level Channel From/To Service."

Next, 1EMF-38, Containment Particulate Radiation Monitor, will fail HIGH, although the VQ valves will fail to automatically CLOSE. The operator will respond in accordance with OP/1/A/6100/010 Q, "Annunciator Response for 1RAD-1," A-1, 1EMF 38 CONTAINMENT PART HI RAD, and manually terminate the Containment Release. The operator may enter Case I of AP/1/A/5500/10, "NC System Leakage Within the Capacity of Both NV Pumps." The crew will determine that the alarm is due to a failure, and NOT an actual high radioactivity condition. The operator will address Technical Specification LCO 3.4.15, "RCS Leakage Detection Instrumentation."

Following this, 1SA48 will fail OPEN causing the TDCA Pump to start. The crew will recognize that reactor power is rising, and that the pump should not be running, and take action to reduce Turbine load and isolate CA flow to the Steam Generators per the Crew Expectation Manual. The operator will address Technical Specification LCO 3.7.5, "Auxiliary Feedwater (AFW) System," which will require a plant shutdown, and SLC 16.9.7, "Standby Shutdown System." The operator may use AP/1/A/5500/1, "Steam Leak," to diagnose the failure, and if so, use OP/1/A/6250/002, "Auxiliary Feedwater System," in an attempt to stop the pump. Ultimately, the crew will enter AP/1/A/5500/4, "Rapid Downpower."

During the downpower, a failure will occur in the Turbine Control Unit causing the unit to shift from Operator Auto to Manual control. The operator will address 1AD-1/F-4, TURBINE IN MANUAL, and control the Turbine manually during the downpower in accordance with OP/1/A/6300/001A, Enclosure 4.1, "Turbine Generator Load Change."

After this, a high vibration condition will develop on the 1B NCP. The operator will respond in accordance with OAC Alarm M1D3041, 1B NC PUMP VIBRATION (HALM), and enter AP/1/A/5500/08, "Malfunction of NC Pump." Ultimately, the vibration condition will rise above the Hi-Hi threshold requiring tripping of the reactor and stopping the NCP. The operator will manually trip the reactor and enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection."

Following the plant trip, a Feedwater Isolation Signal (FWIS) will occur prematurely, the Main Turbine will fail to trip automatically or manually, and the Main Steam Line Isolation signal will fail to automatically actuate. The operator will be required to either manually close the Turbine Governor Valves or the MSIVs. It is likely that SI will actuate due to the delayed Turbine isolation. At the same time, the TDCA Pump, if not already running, will start on low Steam Generator levels. If the

TDCA Pump was not running at the start of the event, it will trip on overspeed upon startup. If the TDCA Pump was running at the start of the event, it will trip when the operator initiates flow to the Steam Generators. Furthermore, the 1A MDCA Pump will trip on overcurrent during pump startup, and any attempts to restart the pump will be unsuccessful. Consequently, a Red Path on Heat Sink will occur shortly after SI actuation, or upon the transition to EP/1/A/5000/ES-0.1, "Reactor Trip Response." The operator will transition from EP/1/A/5000/E-0 to EP/1/A/5000/FR-H.1, "Response to Loss of Secondary Heat Sink."

The operator will eventually restore feed flow using a CF Pump in accordance with Enclosure 8 (Re-establishing CF Flow) of FR-H.1, and the scenario will terminate.

<u>Critical Tasks:</u>

Trip the Reactor prior to stopping the NCP during a high vibration condition, and trip the NCP only after Reactor power level has dropped to less than 5%.

Safety Significance: The P-8 interlock allows one NCP to be stopped less than 48% power. If a NCP is stopped in Mode 1 or 2, Tech Spec 3.4.4 requires the unit to be in Mode 3 within 6 hours. In addition, T-ave for the idle loop may violate Tech Spec 3.4.2, minimum temperature for criticality. In this case, the unit must be sub-critical within 30 minutes. The transient placed on the unit when a NCP is secured at power can challenge both reactor protection and control systems. Furthermore, an added burden is placed on the operator to stabilize the unit and shut down within 6 hours (possibly 30 minutes) to comply with Tech Specs. Even though the plant is designed and analyzed to operate in this configuration for a short time, station management has decided that the conservative approach to dealing with this transient is to trip the reactor anytime a NCP malfunction warrants stopping a pump in Mode 1 or 2. Guidance is given to wait until reactor power is less than 5% before stopping the NC pump. This will ensure the NC pump will provide adequate flow/core cooling until reactor power is sufficiently low enough to preclude a challenge to fuel integrity. If the action can be taken, and is not taken, this demonstrates "mis-operation" or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).

Manually close the Main Turbine Governor Valves and establish feedwater flow into at least one Steam Generator before Wide Range Level in 3 Steam Generators reaches 24% (36%).

Safety Significance: Failure to trip the Main Turbine when conditions exist that allow the operator to do so, and failure to establish feedwater flow into at least one Steam Generator results in the crew having to rely upon the lower-priority action of having to initiate RCS Bleed and Feed to minimize the possibility of core uncovery. Failure to perform this task, when able to do so, constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

PROGRAM: McGuire Operations Training

MODULE: Initial License Operator Training Class 16-1

TOPIC: NRC Simulator Exam

Scenario N16-1-2

REFERENCES:

1. OP/1/A/6100/010 N, “Annunciator Response for Panel 1AD-13” (Rev 78)
2. Technical Specification LCO 3.4.15, “RCS Leakage Detection Instrumentation” (Amendment 235/217)
3. Technical Specification LCO 3.7.5, “Auxiliary Feedwater (AFW) System” (Amendment 221/203)
4. OP/1/A/6100/010 C, “Annunciator Response for Panel 1AD-2” (Rev 5
5. OP/1/A/6102/003, “DCS System Operation” (Rev 10)
6. OP/1/A/6100/010 Q, “Annunciator Response for Panel 1RAD-1” (Rev 66)
7. AP/1/A/5500/10, “NC System Leakage Within the Capacity of Both NV Pumps” (Rev 23)
8. Control Room Crew Expectations Manual (Rev 8/8/12)
9. AP/1/A/5500/1, “Steam Leak” (Rev 18)
10. OP/1/A/6250/002, “Auxiliary Feedwater System” (Rev 129)
11. SLC 16.9.7, “Standby Shutdown System” (Rev 145)
12. Technical Specification LCO 3.4.1 “RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits” (Amendment 219/201)
13. AP/1/A/5500/04, “Rapid Downpower” (Rev 28)
14. OP/1/A/6100/010 B, “Annunciator Response for Panel 1AD-1” (Rev 48)
15. OP/1/A/6300/001A, “Turbine Generator Load Change” (Rev 12)
16. AP/1/A/5500/08, “Malfunction of NC Pump” (Rev 14)
17. EP/1/A/5000/E-0, “Reactor Trip or Safety Injection” (Rev 34)
18. EP/1/A/5000/ES-0.1, “Reactor Trip Response” (Rev 42)
19. EP/1/A/5000/F-0, “Critical Safety Function Status Trees” (Rev 6)
20. EP/1/A/5000/FR-H.1, “Response to Loss of Secondary Heat Sink” (Rev 19`)

Validation Time: 103 minutes

Author: David Lazarony, Essential Training & Consulting, LLC

Facility Review: _________________________

Rev. 120515

Facility:	McGuire	Scenario No.:	2	Op Test No.:	N16-1
Examiners:	____________	Operators:		____________	(SRO)
	____________			____________	(RO)
	____________			____________	(BOP)

Initial Conditions:	The plant is at 90% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1B MDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION B. MCB Annunciator 1AD-8, A-4, "CF PUMP DISCHARGE HI PRESS," has alarmed spuriously several times over the last hour, and has currently failed ON (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	1	C-BOP C-SRO	VCT Level Channel 1 fails HIGH
2	2	I-BOP I(TS)-SRO	1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE
3	3	C-RO C(TS)-SRO	1SA48 fails OPEN/TDCA Pump starts inadvertently
4	NA	R-RO N-BOP N-SRO	Rapid Downpower
5	4	C-RO C-SRO	Turbine Control Unit fails to MANUAL
6	5	C-BOP C-SRO	High Vibration on 1B NCP
7	6	M-RO M-BOP M-SRO	Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation
8	6	NA	Overspeed Trip of TDCA Pump
9	6	NA	1A MDCA Pump trips upon Auto Start

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #2

The plant is at 90% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1B MDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION B. MCB Annunciator 1AD-8, A-4, "CF PUMP DISCHARGE HI PRESS," has alarmed spuriously several times over the last hour, and has currently failed ON (IAE is investigating).

Shortly after taking the watch, the VCT Level Channel 1 will fail HIGH. The operator will respond in accordance with MCB Annunciator 1AD-2, F8, DCS ALTERNATE ACTION, and go to OP/1/A/6102/003, "DCS System Operation," Enclosure 4.4, "Removing/Returning a VCT Level Channel From/To Service."

Next, 1EMF-38, Containment Particulate Radiation Monitor, will fail HIGH, although the VQ valves will fail to automatically CLOSE. The operator will respond in accordance with OP/1/A/6100/010 Q, "Annunciator Response for 1RAD-1," A-1, 1EMF 38 CONTAINMENT PART HI RAD, and manually terminate the Containment Release. The operator may enter Case I of AP/1/A/5500/10, "NC System Leakage Within the Capacity of Both NV Pumps." The crew will determine that the alarm is due to a failure, and NOT an actual high radioactivity condition. The operator will address Technical Specification LCO 3.4.15, "RCS Leakage Detection Instrumentation."

Following this, 1SA48 will fail OPEN causing the TDCA Pump to start. The crew will recognize that reactor power is rising, and that the pump should not be running, and take action to reduce Turbine load and isolate CA flow to the Steam Generators per the Crew Expectation Manual. The operator will address Technical Specification LCO 3.7.5, "Auxiliary Feedwater (AFW) System," which will require a plant shutdown, and SLC 16.9.7, "Standby Shutdown System." The operator may use AP/1/A/5500/1, "Steam Leak," to diagnose the failure, and if so, use OP/1/A/6250/002, "Auxiliary Feedwater System," in an attempt to stop the pump. Ultimately, the crew will enter AP/1/A/5500/4, "Rapid Downpower."

During the downpower, a failure will occur in the Turbine Control Unit causing the unit to shift from Operator Auto to Manual control. The operator will address 1AD-1/F-4, TURBINE IN MANUAL, and control the Turbine manually during the downpower in accordance with OP/1/A/6300/001A, Enclosure 4.1, "Turbine Generator Load Change."

After this, a high vibration condition will develop on the 1B NCP. The operator will respond in accordance with OAC Alarm M1D3041, 1B NC PUMP VIBRATION (HALM), and enter AP/1/A/5500/08, "Malfunction of NC Pump." Ultimately, the vibration condition will rise above the Hi-Hi threshold requiring tripping of the reactor and stopping the NCP. The operator will manually trip the reactor and enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection."

Following the plant trip, a Feedwater Isolation Signal (FWIS) will occur prematurely, the Main Turbine will fail to trip automatically or manually, and the Main Steam Line Isolation signal will fail to automatically actuate. The operator will be required to either manually close the Turbine Governor Valves or the MSIVs. It is likely that SI will actuate due to the delayed Turbine isolation. At the same time, the TDCA Pump, if not already running, will start on low Steam Generator levels. If the TDCA Pump was not running at the start of the event, it will trip on overspeed upon startup. If the TDCA Pump was running at the start of the event, it will trip when the operator initiates flow to the Steam Generators. Furthermore, the 1A MDCA Pump will trip on overcurrent during pump startup, and any attempts to restart the pump will be unsuccessful. Consequently, a Red Path on Heat Sink will occur shortly after SI actuation, or upon the transition to EP/1/A/5000/ES-0.1, "Reactor Trip Response." The operator will transition from EP/1/A/5000/E-0 to EP/1/A/5000/FR-H.1, "Response to Loss of Secondary Heat Sink."

The operator will eventually restore feed flow using a CF Pump in accordance with Enclosure 8 (Re-establishing CF Flow) of FR-H.1, and the scenario will terminate.

Critical Tasks:

Trip the Reactor prior to stopping the NCP during a high vibration condition, and trip the NCP only after Reactor power level has dropped to less than 5%.

Safety Significance: The P-8 interlock allows one NCP to be stopped less than 48% power. If a NCP is stopped in Mode 1 or 2, Tech Spec 3.4.4 requires the unit to be in Mode 3 within 6 hours. In addition, T-ave for the idle loop may violate Tech Spec 3.4.2, minimum temperature for criticality. In this case, the unit must be sub-critical within 30 minutes. The transient placed on the unit when a NCP is secured at power can challenge both reactor protection and control systems. Furthermore, an added burden is placed on the operator to stabilize the unit and shut down within 6 hours (possibly 30 minutes) to comply with Tech Specs. Even though the plant is designed and analyzed to operate in this configuration for a short time, station management has decided that the conservative approach to dealing with this transient is to trip the reactor anytime a NCP malfunction warrants stopping a pump in Mode 1 or 2. Guidance is given to wait until reactor power is less than 5% before stopping the NC pump. This will ensure the NC pump will provide adequate flow/core cooling until reactor power is sufficiently low enough to preclude a challenge to fuel integrity. If the action can be taken, and is not taken, this demonstrates "mis-operation" or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).

Manually close the Main Turbine Governor Valves and establish feedwater flow into at least one Steam Generator before Wide Range Level in 3 Steam Generators reaches 24% (36%).

Safety Significance: Failure to trip the Main Turbine when conditions exist that allow the operator to do so, and failure to establish feedwater flow into at least one Steam Generator results in the crew having to rely upon the lower-priority action of having to initiate RCS Bleed and Feed to minimize the possibility of core uncovery. Failure to perform this task, when able to do so, constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

SIMULATOR OPERATOR INSTRUCTIONS

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Sim. Setup	**Rod Step On**	
☐		**Reset to Temp IC 236**	**T = 0 Malfunctions:** **Initiate a Containment Release per Enclosure 4.2 of OP/1/A/6450/17.** **insert XMT-WL_1WLLT5591 = 100 (1WLL-5591, VUCDT Tank Level is OOS)** **insert LOA-CA010 = RACKED OUT; insert LOA-CA010A = RACKED OUT; (1B MDCA Pump is OOS)** **insert OVR-1AD8_A04 = ON (MCB Annunciator 1AD8/A4)** **<u>Per Lesson Plan 2016 NRC Exam Scenario 2</u>** **insert MAL-DEH008A TRUE cd='h_x10_280_4 eq 1' (DEH Switch to Manual - triggered from 1NV-265B open light ON)** **insert MAL-ISE007A ACT_AUTO cd='H_X01_094_2 EQ 1' (Automatic FWI Train A occurs on Reactor Trip Breaker Open Indicating Light)** **insert MAL-ISE007B ACT_AUTO cd='H_X01_094_2 EQ 1' (Automatic FWI Train B occurs on Reactor Trip Breaker Open Indicating Light)** **insert MAL-ISE007A INACTIVE cd='H_X02_102_2 EQ 1' (Remove signal after insertion)** **insert MAL-ISE007B INACTIVE cd='H_X02_110_2 EQ 1' (Remove signal after insertion)** **insert MAL-CA009A TRUE cd='H_X10_077_4 EQ 1' delay=0 (MD CA Pump 1A trips on overcurrent after pump ON light actuates)** **insert MAL-CA005 TRIP cd='H_X01_094_2 EQ 1' delay=0** **insert MAL-SM029 = 0, cd=H_X01_094_2 EQ1 (TDCA Overspeed Trip occurs and Breaker Open Indicating Light, 1SA-3 fails CLOSED on Reactor Trip)** **insertMAL-DEH003A = TRUE (Main Turbine fails to Auto Trip)** **insertMAL-DEH003B = TRUE (Main Turbine fails to Manually Trip)** **insertMAL-ISE006A = BLK_AUTO (MSI Fails in AUTO)**

	Bench Mark	ACTIVITY	DESCRIPTION
			insertMAL-ISE006B = BLK_AUTO (MSI Fails in AUTO)
☐		**RUN** **Reset all SLIMs**	**Place Tagout/O-Stick on:** **1B MDCA Pump (Tagout)** **1WLL-5591 (O-stick)** **MCB Annunciator 1AD-13, C-7 (O-stick)** **MCB Annunciator 1AD-8, A-4 (O-stick)**
☐		**Update** Status Board, **Setup OAC**	**NOTE:** RMWST DO = <1000 ppb.
☐		**Freeze.**	
☐		**Update Fresh Tech. Spec. Log.**	
☐		**Fill out the AO's Available section of Shift Turnover Info.**	
☐	Prior to Crew Briefing	**RUN**	
☐	**Crew Briefing** 1. Assign Crew Positions based on evaluation requirements 2. Review the Shift Turnover Information with the crew. 3. Direct the crew to Review the Control Boards taking note of present conditions, alarms. 4. Provide the crew with an “In-progress” copy of Enclosure 4.2 of OP/1/A/6450/17, and the Release Permit.		
☐	T-0	Begin Familiarization Period	
☐	At direction of examiner	**Execute Lesson Plan for Simulator Scenario N16-1-2.**	

	Bench Mark	ACTIVITY	DESCRIPTION
☐	At direction of examiner	**Event 1** **insertXMT-NV_1NVLT5760 = 100**	VCT Level Channel 1 fails HIGH
☐	At direction of examiner	**Event 2** **insert EMF-38L = 10^4 (5 seconds delayed)** **insert MAL-ISE008A/B = BLK** **Insert 1AD9_F08=ON (6 seconds delayed)**	1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE
☐	At direction of examiner	**Event 3** **insert REM-SA0048ABC = 1.0**	1SA48 fails OPEN/TDCA Pump starts inadvertently **NOTE: Locally Close 1SA-1 if directed: insert REM-SA0001 = 0**
☐	Upon Crew Entry into AP4	**Event 4**	Rapid Downpower
☐	At direction of examiner	**Event 5** **insert DEH008A (Turbine Control Fails to MANUAL) Set in initial conditions. Triggered from 1NV-265B open light ON.**	Turbine Control Unit fails to MANUAL
☐	At direction of examiner	**Event 6** **insertMAL-NCP003B=4.6 (HI Vibration Alarm)** **insertMAL-NCP003B=5.1 cd = X05_001e11_1 = 1 (Hi Vibration Alarm Ramp = 360 seconds) (HI-HI Vibration Alarm)**	High Vibration on 1B NCP

	Bench Mark	ACTIVITY	DESCRIPTION
☐	At direction of examiner	**Event 7** **insert ISE007A/B (FWIS actuates) Set in initial conditions. Triggered from Rx trip.** **insert DEH003A/B (Main Turbine fails to trip) Set in initial conditions.**	Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation **These malfunctions will occur on Reactor Trip.** **NOTE: Start 2A RN Pump and throttle flow:** **insertLOA-RN088 = ON** **insert LOA-RN084 = 8000.0024**
☐	Post-Rx Trip	**Event 8** **insert CA005 and SM-029** **Set in initial conditions.**	Overspeed Trip of TDCA Pump **This malfunction will occur on Reactor Trip.**
☐	Post-Rx Trip	**Event 9** **insert CA009** **Set in initial conditions.**	1A MDCA Pump trips upon Auto Start **This malfunction will occur on Reactor Trip.**
☐	**Terminate the scenario upon direction of Lead Examiner**		

Op Test No.:	N16-1	Scenario #	2	Event #	1	Page	9 of 70
Event Description:	**VCT Level Channel 1 fails HIGH**						

Shortly after taking the watch, the VCT Level Channel 1 will fail HIGH. The operator will respond in accordance with MCB Annunciator 1AD-2, F8, DCS ALTERNATE ACTION, and go to OP/1/A/6102/003, "DCS System Operation," Enclosure 4.4, "Removing/Returning a VCT Level Channel From/To Service."

Booth Operator Instructions: **insert XMT-NV_1NVLT5760 = 100**

Indications Available:

- MCB Annunciator 1AD-7 D3, VCT ABNORMAL (Momentary)
- MCB Annunciator 1AD-2 E8, DCS TROUBLE
- MCB Annunciator 1AD-2 F8, DCS Alternate Action
- VCT Level (1NVP-5760) indicates 100%
- VCT Level (1NVP-5763) indicates that the level is lowering.
- VCT Level SLIMs shifts into MANUAL

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The BOP may address ARP for 1AD-7, D3.
			NOTE: The CRS may direct the BOP to place 1NV-137 to VCT position.
		MCB ANNUNCIATOR 1AD-2, F8 DCS ALTERNATE ACTION	
	CRS	(Step 1) Halt any power change in progress.	
	BOP	(Step 2) Check DCS Workstation alarms.	
		DCS WORKSTATION ALARMS M1D1168, VCT LEVEL ALTERNATE ACTION	
	BOP	(Step 1) Manually control VCT level at desired value.	
	CRS	(Step 2) Write work request and investigate repair.	

Op Test No.:	N16-1	Scenario #	2	Event #	1	Page	10 of 70
Event Description:	**VCT Level Channel 1 fails HIGH**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 3) GO TO OP/1/A/6102/003 (DCS System Operation).	
			NOTE: The CRS will transition to OP/1/A/6102/003.
OP/1/A/6102/003, DCS SYSTEM OPERATION ENCLOSURE 4.4, REMOVING/RETURNING A VCT LEVEL CHANNEL FROM/TO SERVICE			
	BOP	(Step 3.1) Performing the following section, as applicable:	
		• Section 3.2, Respond To An Alternate Action.	
	BOP	(Step 3.2) Respond To An Alternate Action	
		• On DCS Boric Acid Blender graphic, perform the following:	
		• Select 2XS for VCT Level 1.	
		• Determine which level transmitter is NOT faulted.	
		▪ NVAA 5760 (Transmitter A)	
		▪ NVAA 5761 (Transmitter B)	**NOTE:** NVAA 5761 (Transmitter B) is NOT faulted.
		• Select the non-faulted level transmitter for VCT level input (Transmitter A or Transmitter B).	**NOTE:** The BOP will select Transmitter B.
		• Select “DEV MRE INHIBIT” to block the deviation input.	
		• Check “MRE BLOCKED” lit (blinking red).	
	BOP	• On DCS Boric Acid Blender Graphic, perform the following:	
		• Select 2XS for VCT Level 2.	
		• Determine which level transmitter is NOT faulted.	

Op Test No.:	N16-1	Scenario #	2	Event #	1	Page	11 of 70
Event Description:	**VCT Level Channel 1 fails HIGH**						

Time	Pos.	Expected Actions/Behavior	Comments
		▪ NVAA 5761 (Transmitter A)	**NOTE:** NVAA 5761 (Transmitter A) is NOT faulted.
		▪ NVAA 5760 (Transmitter B)	
		• Select the non-faulted level transmitter for VCT level input (Transmitter A or Transmitter B).	**NOTE:** The BOP will recognize that Transmitter A is selected.
		• Select "DEV MRE INHIBIT" to block the deviation input.	
		• Check "MRE BLOCKED" lit (blinking red).	
			NOTE: An Auto Makeup may occur once the crew removes the faulty instrument from service.
	BOP	• On DCS Boric Acid Blender graphic, perform the following:	
		• Select NV-137A (VCT Level)	
		• Ensure NV-137A is in auto	
	CRS	• WHEN VCT Level Channel has been repaired, go to Section 3.4.	**NOTE:** The CRS may call WCC/IAE to address the malfunction. If so, **Booth Instructor** acknowledge as WCC.
			NOTE: The CRS will likely conduct a Focus Brief.
At the discretion of the Lead Examiner move to Event #2.			

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	12 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Next, 1EMF-38, Containment Particulate Radiation Monitor, will fail HIGH, although the VQ valves will fail to automatically CLOSE. The operator will respond in accordance with OP/1/A/6100/010 Q, "Annunciator Response for 1RAD-1," A-1, 1EMF 38 CONTAINMENT PART HI RAD, and manually terminate the Containment Release. The operator may enter Case I of AP/1/A/5500/10, "NC System Leakage Within the Capacity of Both NV Pumps." The crew will determine that the alarm is due to a failure, and NOT an actual high radioactivity condition. The operator will address Technical Specification LCO 3.4.15, "RCS Leakage Detection Instrumentation."

Booth Operator Instructions:

Insert EMF-38L = 10^4 (5 seconds delayed)

Insert MAL-ISE008A/B = BLK

Insert 1AD9_F08=ON (6 seconds delayed)

Indications Available:

- 1EMF-38 in TRIP 2
- MCB Annunciator 1RAD1-A1, 1EMF 38 CONTAINMENT PART HI RAD, is LIT
- MCB Annunciator 1RAD1-E2, 1EMF CONTAINMENT PARTS
- MCB Annunciator 1AD9-F8, CONT VENT ISOL
- 1VQ-1A Red light is LIT, Green light is OFF
- 1VQ-2B Red light is LIT, Green light is OFF

Time	Pos.	Expected Actions/Behavior	Comments
		OP/1/A/6100/010 Q, ANNUNCIATOR RESPONSE FOR 1RAD-1 A-1, 1EMF 38 CONTAINMENT PART HI RAD	
	RO	(IA Step 1) IF VP in operation,……	**NOTE:** VP is NOT in operation.
	BOP	(IA Step 2) Ensure VQ valves are closed to prevent possible release.	**NOTE:** The VQ Valves should have closed, but a failure has prevented this. The BOP will need to manually close the VQ Valves.

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	13 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(SA Step 1) Notify RP to perform trending for source term identification and leak location.	**NOTE:** The CRS may call RP to address the Rad Monitor failure. If so, **Booth Instructor** acknowledge as RP. After **five minutes** report back that **there is no abnormal radiation and that it is believed that 1EMF-38 has failed high.**
	CRS	(SA Step 2) IF VP in operation,……	**NOTE:** VP is NOT in operation.
	CRS	(SA Step 3) WHEN informed by RP that Containment purge OR air release is permissible, perform the following:	**NOTE:** EMF-38L will remain failed throughout the remainder of the scenario.
		• Ensure "1EMF 38 CONTAINMENT PART HI RAD" alarm is clear.	
		• Reset Containment Ventilation isolation.	
		• Startup VP per OP/1/A/6450/015 (Containment Purge System) OR VQ per OP/1/A/6450/017 (Containment Air Release and Addition System), if desired.	
	CRS	(SA Step 4) IF Trip 2 alarm is valid,……	**NOTE:** It will ultimately be determined that the Trip 2 alarm is invalid.
	CRS	(SA Step 5) IF 1EMF-38 is declared inoperable, perform PT/1/A/4200/040 (Reactor Coolant Leakage Detection) as required.	**NOTE:** Ultimately, 1EMF-38L will be declared inoperable, and this action will be required.
			NOTE: The CRS may enter AP-10 believing that an NCS leak exists.
AP/1/A/5500/10, NC SYSTEM LEAKAGE WITHIN THE CAPACITY OF BOTH NV PUMPS, CASE I			

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	14 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: After the RP has reported that it is suspected that 1EMF-38(L) has failed high, the operator may suspend use of AP-10. **Examiner NOTE:** May seek to discuss with CRS after the scenario.
	BOP	(Step 1) Check leak - KNOWN TO BE IN THE AUX BUILDING.	**NOTE:** There is no NCS leak.
	BOP	(Step 2) Check Pzr level - STABLE OR GOING UP.	**NOTE:** Pzr level will be stable.
	CRS/ BOP	(Step 3) IF AT ANY TIME while in this procedure Pzr level cannot be maintained stable, THEN perform Step 2.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO/ BOP	(Step 4) Check Pzr pressure - STABLE OR IF TRENDING TO 2235 PSIG.	
	RO/ BOP	(Step 5) Check main steam line intact as follows:	
		• Reactor power - AT TURBINE POWER	
		• NC Loop T-Avg - STABLE.	
	CRS	(Step 6) Announce occurrence on page.	**NOTE:** CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO/ BOP	(Step 7) Estimate leak rate using any of the following methods:	**NOTE:** There is no NCS leak.
		Monitor OAC NV graphic	
		OR	
		Compare charging flow to letdown flow plus seal return flow	

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	15 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
		OR	
		Monitor VCT level trend (OAC point M1P1271).	
	CRS	(Step 8) REFER TO the following:	
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	CRS	(Step 9) IF AT ANY TIME NC leakage exceeds Tech Spec limits, THEN perform the following:	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Ensure Outside Air Pressure Filter Train in service PER OP/0/A/6450/011 (Control Area Ventilation/Chilled Water System), Enclosure 4.4 (Control Room Atmosphere Pressurization During Abnormal Conditions).	
		• Have another SRO evaluate if leakage exceeds SLC 16.9.7 condition C limits and immediately notify Security if SSF is inoperable.	
	CRS	(Step 10) IF AT ANY TIME VCT level goes below 16% ("VCT ABNORMAL LEVEL" alarm (1AD-7, D-3) low setpoint), THEN align NV pump suction to FWST	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	BOP	(Step 11) IF AT ANY TIME Containment pressure exceeds Tech Spec limit (0.3 PSIG), THEN evaluate placing all 4 VL AHU mode select switches in "HIGH" to prevent them from cycling around 0.5 PSIG.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	BOP	(Step 12) Check seal leakoff on all NC pumps – LESS THAN 6 GPM.	

Op Test No.: N16-1 Scenario # 2 Event # 2	Page 16 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 13) Check NC pump thermal barriers intact as follows:	
		• NC pump thermal barrier KC outlet flows and temperatures on OAC KC graphic NORMAL (flow and temperature should be similar for all 4 NC pumps).	
		• KC surge tank level rates on OAC KC graphic – NORMAL.	
		• KC Surge Tank level – NORMAL.	
		• 1EMF-46A (Train A Component Cooling) – NORMAL.	
		• 1EMF-46B (Train B Component Cooling) – NORMAL.	
	CRS	(Step 14) GO TO Step 16.	
	BOP	(Step 16) Check leak – SUSPECTED ON LETDOWN LINE NEAR DEMINERALIZERS.	**NOTE:** The NCS leak is NOT suspected to be on the Letdown Line near the Demineralizers.
	CRS	(Step 16 RNO) GO TO Step 18.	
	BOP	(Step 18) Check leak – KNOWN TO BE ON NORMAL LETDOWN LINE.	**NOTE:** The NCS leak is NOT known to be on the Normal Letdown Line.
	CRS	(Step 18 RNO) GO TO Step 20.	
	BOP	(Step 20) Check leak – KNOWN TO BE ON VCT.	**NOTE:** The NCS leak is NOT known to be on the VCT.
	CRS	(Step 20 RNO) GO TO Step 22.	

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	17 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 22) Check leak – KNOWN TO BE ON NORMAL CHARGING LINE DOWNSTREAM OF 1NV-244A (Charging Line Cont Outside Isol).	**NOTE:** There is no NCS leak.
	CRS	(Step 22 RNO) GO TO Step 24.	
	BOP	(Step 24) Check the following indications – NORMAL:	
		• Pzr safeties:	
		• "PZR RELIEF VALVE TEMP"	
		• "PZR RELIEF LINE NO FLOW" acoustic indication light.	
		• Pzr PORVs:	
		• "PZR RELIEF VALVE TEMP".	
		• PRT conditions:	
		• Pressure	
		• Level	
		• Temperature	
	BOP	(Step 25) check all CLA levels – NORMAL.	
	BOP	(Step 26) Check the following NCDT parameters:	
		• Level – NORMAL	
		• Temperature – NORMAL	
		• "PUMP FLOW" – AT "RECIRC FLOW".	
	BOP	(Step 27) Check Containment floor and equipment sumps – NORMAL.	
	CRS	(Step 28) Check leak location – HAS BEEN IDENTIFIED.	**NOTE:** There is no NCS leak.

Op Test No.: N16-1	Scenario # 2	Event # 2	Page 18 of 70
Event Description:	1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE		

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 28 RNO) Perform the following steps as necessary to identify location of leak:	
		• IF leak is inside containment, THEN evaluate isolating letdown and charging PER Steps 19 and 23 to see if leak exists on these headers.	
		• Notify WCC SRO to review recent changes in plant status:	**NOTE:** CRS may call WCC to address the suspected leak. If so, **Booth Instructor** acknowledge as WCC, and respond as appropriate.
		• Any equipment removed from service	
		• Any equipment returned to service	
		• Any venting or draining in progress.	
	BOP	• Notify Radwaste Chemistry to check the following tanks and sumps for excessive input:	**NOTE:** CRS may call RW to address the suspected leak. If so, **Booth Instructor** acknowledge as RW, and respond as appropriate.
		• ND/NS sump	
		• RHT	
		• Waste Drain Tank	
		• WEFT	
		• FDT	
		• Spent Resin Storage Tank.	
		• IF affected tank or sump readily identified,……	
	BOP	• IF affected tank or sump not identified, THEN check all tanks and sumps in next steps.	
		• Check inputs to desired tanks and sumps PER PT/1/A/4150/001D (Identifying NC System Leakage).	**NOTE:** CRS may ask U2 BOP to perform. If so, **Floor Instructor** acknowledge as U2 BOP.

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	19 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• IF necessary to check inputs to FDT or WEFT, THEN ……..	**NOTE:** The suspected NCS leak location is known to be in the Containment.
		• IF leakage suspected through 1NV-137A (NC Filters Otlt 3-Way Cntrl) to RHT, THEN ………	**NOTE:** The suspected NCS leak location is known to be in the Containment.
	CRS	(Step 29) Ensure RP is notified of location and size of leak.	**NOTE:** CRS may call WCC/RP to address the NCS leak. If so, **Booth Instructor** acknowledge as WCC/RP.
	BOP	(Step 30) Check normal letdown - IN SERVICE.	
	CRS	(Step 31) Contact station management to evaluate need to shutdown.	**NOTE:** CRS may call WCC to contact management. If so, **Booth Instructor** acknowledge as WCC.
	CRS	(Step 32) Check unit shutdown – REQUIRED.	
	CRS	(Step 32 RNO) GO TO Step 35	
			NOTE: After the RP has reported that it is suspected that 1EMF-38(L) has failed high, the operator may suspend use of AP-10. **Examiner NOTE:** May seek to discuss with CRS after the scenario.
TECHNICAL SPECIFICATION 3.4.15, RCS LEAKAGE DETECTION INSTRUMENTATION			
	CRS	LCO 3.4.15, The following RCS leakage detection instrumentation shall be OPERABLE:	

Op Test No.:	N16-1	Scenario #	2	Event #	2	Page	20 of 70
Event Description:	**1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**						

Time	Pos.	Expected Actions/Behavior	Comments
		The containment floor and equipment sump level monitors and the incore instrument sump level alarm;	
		The containment atmosphere particulate radioactivity monitor; and	
		The containment ventilation unit condensate drain tank level monitor.	
	CRS	APPLICABILITY: MODE 1 for all instrumentation.	
	CRS	ACTIONS	

Op Test No.: N16-1 Scenario # 2 Event # 2 Page 21 of 70

Event Description: **1EMF-38 (LO) fails HIGH/VQ valves fail to Auto CLOSE**

Time	Pos.	Expected Actions/Behavior			Comments
		CONDITION	REQUIRED ACTION	COMPLETION TIME	**NOTE:** The CRS will determine that ACTION B and D must be entered (C is already entered).
		B. Containment atmosphere particulate radioactivity monitor inoperable.	B.1 Perform SR 3.4.13.1. OR B.2 Analyze grab samples of the containment atmosphere.	Once per 24 hours Once per 24 hours	
		D. Containment atmosphere particulate radioactivity monitor inoperable in MODE 1. AND Containment ventilation unit condensate drain tank level monitor inoperable in MODE 1.	D.1 Restore containment atmosphere particulate radioactivity monitor to OPERABLE status. OR D.2 Restore containment ventilation unit condensate drain tank level monitor to OPERABLE status.	30 Days 30 Days	

At the discretion of the Lead Examiner move to Event #3.

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	22 of 70
Event Description:	1SA48 fails OPEN/TDCA Pump starts inadvertently						

Following this, 1SA48 will fail OPEN causing the TDCA Pump to start. The crew will recognize that reactor power is rising, and that the pump should not be running, and take action to reduce Turbine load and isolate CA flow to the Steam Generators per the Crew Expectation Manual. The operator will address Technical Specification LCO 3.7.5, “Auxiliary Feedwater (AFW) System,” which will require a plant shutdown, and SLC 16.9.7, “Standby Shutdown System.” The operator may use AP/1/A/5500/1, “Steam Leak,” to diagnose the failure, and if so, use OP/1/A/6250/002, “Auxiliary Feedwater System,” in an attempt to stop the pump.

Booth Operator Instructions: **insert REM-SA0048ABC = 1.0**

Indications Available:

- Reactor power starts to rise
- 1SA48ABC Red status light is LIT
- TDCA Pump Turbine Speed rising

Time	Pos.	Expected Actions/Behavior	Comments
		CONTROL ROOM EXPECTATIONS MANUAL	
	RO/ BOP	T/G load reduction during normal ops and transients (no procedure guidance and immediate need to reduce load = transient) for over power events.	
		Normal load changes: Auto is preferred Transient load changes: Manual is preferred- immediately reduce 20MWe and then reduce as needed to maintain Rx power less than pre-transient condition. After the initial 20 MWe load reduction, it is preferred that the operators use multiple and diverse indications to determine how much more load should be reduced. TPBE on the OAC updates once per minute. Other indications (PR meters and Delta T meters) will indicate reactor response more quickly and will enable the operators to control the plant even more precisely. (This combines the Operator Fundamentals of Conservatism and Controlling Plant Evolutions Precisely).	**NOTE:** The RO will reduce Turbine load sufficiently to maintain Rx power < 90%.
	RO/ BOP	CA Operation above 10% power.	

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	23 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior	Comments
		IF CA Auto start at greater than 3% power and Main Feedwater is providing flow to the steam generators, then CA flow should be throttled/isolated as soon as practical. This will make the affected CA pumps inoperable due to the control valve not being fully open above 10% as required by the CA Surveillance Requirements.	**NOTE:** The BOP will throttle CA flow from the TDCA Pump, rendering the CA Pumps inoperable.
			NOTE: The CRS may or may not address AP1. If so, the crew may ultimately go to OP/1/A/6250/002 and attempt to shutdown the TDCA Pump. On the other hand, the operator may elect to leave the pump running, close the CA Control Valves, and investigate the failure.
AP/1/A/5500/01, STEAM LEAK			
	CRS	(Step 1) Monitor Foldout page.	**NOTE:** Manual Reactor Trip Criteria is NOT expected to be utilized.
	RO	(Step 2) Reduce turbine load to maintain the following:	**NOTE:** The RO will need to reduce load to limit reactor power.
		• Excore NI's – LESS THAN OR EQUAL TO 100%.	
		• NC Loop D/T's – LESS THAN 60°F D/T	
		• T-Avg – AT T-REF.	
	CRS	(Step 3) Check containment entry – IN PROGRESS.	**NOTE:** A Containment Entry is NOT in progress.
	CRS	(Step 3 RNO) GO TO Step 5.	

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	24 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 5) Check Pzr pressure prior to event – GREATER THAN P-11 (1955 PSIG).	
	BOP	(Step 6) Check Pzr level – STABLE OR GOING UP.	**NOTE:** Pzr level is expected to be stable, however, it may be lowering. If so, perform Step 6 RNO. Otherwise continue with Step 7.
	BOP	(Step 6 RNO) Perform the following as required to maintain level:	
		• Maintain charging flow less than 200 GPM at all times in subsequent steps.	
		• Ensure 1NV-238 (U1 Charging Hdr Control) OPENING.	
		• OPEN 1NV-241 (U1 Seal Water Inj Flow Control) while maintaining NC pump seal flow greater than 6 GPM.	
		• Reduce or isolate letdown.	
		• Start additional NV pump.	
		IF Pzr level going down with maximum charging flow…	**NOTE:** It is expected that the BOP will be able to control Pzr level.
	BOP	(Step 7) IF AT ANY TIME while in this procedure Pzr level cannot be maintained stable, THEN RETURN TO Step 6.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 8) GO TO Step 12.	

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	25 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 12) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that AP-1 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	RO/ BOP	(Step 13) Identify and isolate leak on Unit 1 as follows:	
		• (Step 13a) Check SM PORVs – CLOSED.	
		• (Step 13.b) Check condenser dump valves – CLOSED.	
		• (Step 13.b RNO) IF steam dumps required to be closed…	**NOTE:** The Steam Dumps are likely to be closed.
		• (Step 13.c) Check containment conditions – NORMAL:	
		• Containment temperature	
		• Containment pressure	
		• Containment humidity	
		• Containment floor and equipment sump level.	
	RO / BOP	• (Step 13.d) Check TD CA pump – OFF.	**NOTE:** The TDCA Pump is running.
		• (Step 13.d RNO) IF operation of TD CA pump is causing uncontrolled cooldown AND flow from TD CA pump not required, THEN stop TD CA pump PER OP/1/A/6250/002 (Auxiliary Feedwater System) Enclosure 4.4 (Manual Operation of #1 TD CA Pump)	**Examiner NOTE:** CRS may direct that the TDCA Pump be stopped per the OP. If so, continue as scripted. If NOT, continue with the remaining steps of **AP-1 on Page 27**.
			NOTE: The CRS may address Tech Specs based on plant response.
OP/1/A/6250/002, AUXILIARY FEEDWATER SYSTEM ENCLOSURE 4.4, MANUAL OPERATION OF #1 TD CA PUMP			

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	26 of 70
Event Description:	1SA48 fails OPEN/TDCA Pump starts inadvertently						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3.1) Evaluate all outstanding R&Rs that may impact performance of this procedure.	**NOTE:** The CRS/BOP may call WCC/IAE to address the R&Rs on the TDCA Pump. If so, **Booth Instructor** acknowledge as WCC, and report none exist.
	BOP	(Step 3.2) Ensure that a pre-job briefing has been performed that includes discussion of reactivity management concerns with this procedure.	
	BOP	(Step 3.3) IF #1 TD CA Pump to be operated locally…	**NOTE:** The pump is NOT to be operated locally.
	BOP	(Step 3.4) Perform the following sections, as applicable:	
		• Section 3.6, Stopping #1 TD CA Pump	
	BOP	(Step 3.6) Stopping #1 TD CA Pump	
		• IF stopping pump following EP/AP, check "TURB" depressed on the following:	**NOTE:** The CRS may decide to take this action if the OP was entered from AP1.
		• CA Modulating Valves Reset Train A	
		• CA Modulating Valves Reset Train B	
		• IF operating #1 TD CA Pump locally…	**NOTE:** The pump is NOT to be operated locally.
	BOP	• Ensure the following closed:	
		• 1CA-64AB (U1 TD CA Pump Disch to 1A S/G Control)	
		• 1CA-52AB (U1 TD CA Pump Disch to 1B S/G Control)	
		• 1CA-48AB (U1 TD CA Pump Disch to 1C S/G Control)	
		• 1CA-36AB (U1 TD CA Pump Disch to 1D S/G Control)	

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	27 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• Ensure "RESET" lit on "TD CA Pump Auto Start Reset.	
	BOP	• Place "#1 TD CA Pump" in "STOP".	
		• Ensure the following closed:	
		• 1SA-48ABC (1C S/G SM Supply To U1 TD CA Pump Turb Isol)	**NOTE:** The CRS may dispatch an AO or contact WCCS/IAE to investigate the failure of 1SA-48ABC. If so, **Floor Instructor** acknowledge as **AO**. **Booth Instructor:** Wait 2 minutes and indicate that the valve is OPEN, not sure why, and that it will require further investigation.
			NOTE: The CRS will recognize that 1SA-48ABC has failed OPEN. Because of this the CRS may dispatch an AO to locally close the upstream isolation valve 1SA-1. The only other choice is to leave the TDCA Pump running. If so, **Floor Instructor** acknowledge as **AO**. **Booth Instructor:** Wait 3 minutes and Insert **REM-SA0001 = 0.0**; then call as AO and report that 1SA-1 is CLOSED.
		• 1SA-49AB (1B S/G SM Supply To U1 TD CA Pump Turb Isol)	
			NOTE: The CRS will likely conduct a Focus Brief.
AP/1/A/5500/01, STEAM LEAK			
			Examiner NOTE: Continue here if the OP is NOT used to stop TDCA Pump.

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	28 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• (Step 13.e) Check valves on "STEAM LINE DRAIN VALVES" board (1MC-9) – CLOSED.	**NOTE:** One or more of these valves may be cycling. The RNO will direct closing the valves.
	CRS	• (Step 13.f) Check opposite Unit (Unit 2) "STEAM HEADER PRESSURE" – GREATER THAN 200 PSIG.	**NOTE:** CRS may ask U2 RO for AS Header pressure. If so, **Floor Instructor** report as **U2 RO** that **U2 Steam Header pressure is ≈1000 psig.**
		• (Step 13.g) Dispatch operator to check for leaks.	**NOTE:** The CRS may dispatch an AO to look for leaks. If so, **Floor Instructor:** acknowledge**.** **Booth Instructor:** Report back in 3-5 minutes that there are no leaks.
			NOTE: The CRS may NOT dispatch AOs to look for leaks because it is understood that 1SA48 opening was the reason that AP-1 was entered.
	BOP	(Step 14) Check UST level – STABLE OR GOING UP.	
	CRS	(Step 15) Evaluate unit shutdown as follows:	
		• Check unit status – IN MODE 1 OR 2.	
		• Determine if unit shutdown or load reduction is warranted based on the following criteria:	
		• Size of leak	
		• Location of leak	
		• Rate of depletion of secondary inventory	
		• IF steam is leaking from a secondary heater relief OR MSR relief valve, THEN reducing turbine load….	**NOTE:** No Relief Valve is leaking.

Op Test No.: N16-1	Scenario # 2	Event # 3	Page 29 of 70
Event Description:	1SA48 fails OPEN/TDCA Pump starts inadvertently		

Time	Pos.	Expected Actions/Behavior	Comments
		• IF turbine trip will isolate steam leak (such as feedwater heater leak or MSR leak)…	**NOTE:** A Turbine Trip is NOT needed to isolate the steam leak.
		• Check unit shutdown or load reduction – REQUIRED.	**NOTE:** Shutdown/Load Reduction will NOT be required to mitigate the Steam leak.
	CRS	(Step 15.c RNO) Perform the following:	
		• Maintain present plant conditions until leak can be isolated or repaired.	
		• Exit this procedure.	
			NOTE: The CRS will likely conduct a Focus Brief.
			NOTE: The CRS may address Tech Specs based on plant response.
TECHNICAL SPECIFICATION 3.7.5, AUXILIARY FEEDWATER (AFW) SYSTEM			
	CRS	LCO 3.7.5 Three AFW trains shall be OPERABLE.	
	CRS	APPLICABILITY: MODE 1, 2, And 3, MODE 4 when steam generator is relied upon for heat removal.	
	CRS	ACTIONS	

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	30 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior			Comments
		CONDITION	REQUIRED ACTION	COMPLETION TIME	
		A. One steam supply to turbine driven AFW pump inoperable	A.1 Restore steam supply to OPERABLE status.	7 days AND 10 days form discovery of failure to meet the LCO	**NOTE:** The CRS will determine that ACTION A.1 must be entered.
		B. One AFW train inoperable in MODE 1, 2, or 3 for reasons other than Condition A.	B.1 Restore AFW train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO	**NOTE:** The CRS will recognize that ACTION B.1 was entered upon shift turnover.
		C. Required Action and associated Completion Time for Condition A or B not met. OR Two AFW trains inoperable in MODE 1, 2, or 3.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	6 hours 12 hours	**NOTE:** If the CA Valves remain closed the CRS will determine that ACTION C.1 and C.2 must be entered. The CRS will note that this condition requires a plant shutdown.
SELECTED LICENSEE COMMITMENT 16.9.7, STANDBY SHUTDOWN SYSTEM					
	CRS	COMMITMENT The Standby Shutdown System (SSS) shall be FUNCTIONAL.			
	CRS	APPLICABILITY: MODES 1, 2, and 3.			
	CRS	REMEDIAL ACTIONS			
		The SRO should ensure that security is notified 10 minutes prior to declaring the SSS inoperable. Immediately upon discovery of the SSS inoperability, Security must be notified to implement compensatory measures within 10 minutes of discovery.			

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	31	of	70
Event Description:	1SA48 fails OPEN/TDCA Pump starts inadvertently								

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">CRS</td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td rowspan="2">NOTE: <u>If the CA Valves remain closed</u> the CRS will determine that SLC 16.9.7 ACTION A.1 and A.2 must be entered.</td></tr>
<tr><td>A. One or more required SSS components identified in Table 16.9.7-1 non-functional.</td><td>A.1 Verify the FUNCTIONALITY of fire detection and suppression systems in the associated areas identified in Table16.9.7-1.
AND
A.2 Restore the component to FUNCTIONAL status.</td><td>1 hour

7 days</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td colspan="6">TECHNICAL SPECIFICATION 3.4.1, RCS PRESSURE, TEMPERATURE, AND FLOW DEPARTURE FROM NUCLEATE BOILING (DNB) LIMITS</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">LCO 3.4.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the limits specified in Table 3.4.1-1.</td><td>NOTE: <u>If NC System Pressure drops to < 2216 psig</u> on the failure, then TS 3.4.1 might be entered and exited during the transient.</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">APPLICABILITY: MODE 1.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">ACTIONS</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
</table>

Op Test No.:	N16-1	Scenario #	2	Event #	3	Page	32 of 70
Event Description:	**1SA48 fails OPEN/TDCA Pump starts inadvertently**						

Time	Pos.	Expected Actions/Behavior			Comments
		CONDITION	REQUIRED ACTION	COMPLETION TIME	**NOTE:** The CRS will determine that ACTION A.1 must be entered (May be cleared by the time that the determination is made).
		A. Pressurizer pressure or RCS average temperature DNB parameters not within limits.	A.1 Restore DNB parameter(s) to within limit.	2 hours	
					NOTE: CRS will call WCC/Management to address the CA inoperability. When this occurs, **Booth Instructor** acknowledge as **WCC,** and **as Station Management** direct the crew to **be in Mode 3** within **2 hours due to the inoperability.**

At the discretion of the Lead Examiner move to Event #4.

Op Test No.:	N16-1	Scenario #	2	Event #	4	Page	33 of 70
Event Description:	**Rapid Downpower**						

Ultimately, the crew will enter AP/1/A/5500/4, "Rapid Downpower."
Booth Operator Instructions: **NA**
Indications Available: **NA**

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/04, RAPID DOWNPOWER	
	RO/ BOP	(Step 1) Monitor Foldout page.	
		Uncontrolled Cooldown (If Tavg < 551F and lowering…..Not Expected)	
		Power Factor (Adjust power factor during load reduction to maintain power factor between 0.9 to 1.0 lagging, using "VOLTAGE ADJUST" pushbutton)	**NOTE:** The RO will adjust MVARS as needed.
		Manual Rod Control Criteria (< C-5, Not Expected)	
		Turbine Shutdown (Turbine Load < 15 MWe Not Expected)	
	CRS	(Step 2) Announce occurrence on page.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that AP-4 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 3) Check turbine control – IN AUTO.	
	RO	(Step 4) Check "MW LOOP" – IN SERVICE.	**NOTE:** IF MW LOOP is in service, proceed to Step 5.
	RO	(Step 4 RNO) Depress "MW IN/MW OUT" pushbutton.	

Op Test No.:	N16-1	Scenario #	2	Event #	4	Page	34	of 70
Event Description:	**Rapid Downpower**							

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 5) Check shutdown to Mode 3 – DESIRED.	
	CRS	(Step 6) Check if "Shutdown Via Reactor Trip from 15% Power" appropriate:	
		• Shutdown Via Reactor Trip from 15% Power – DESIRED	**NOTE:** It is normal practice to shut down the reactor by driving rods, rather than tripping from 15%. If the crew elects to trip the reactor from 15% power, the CRS will perform Step 7, rather than the Step 6 RNO.
		• At least two CA pumps - FUNCTIONAL.	
	CRS	(Step 6 RNO) Perform the following:	
		• IF Mode 3 is timed critical AND the reactor will be shutdown by manually inserting control rods, THEN allow an additional 45 minutes to reach Mode 3 once turbine load reduction is complete.	
		• IF turbine will be shutdown during downpower, THEN enter target load of 15 MWE in turbine control panel.	
		• Observe Note prior to Step 8 and GO TO Step 8.	
	CRS	(Step 8) Determine the required power reduction rate (MW/min).	**NOTE:** The CRS will reduce load at ≈10-15 MWe/minute.
	RO	(Step 9) Check control rods – IN AUTO.	
	RO	(Step 9RNO) Perform the following:	
		• IF auto control available, THEN perform the following:	

Op Test No.:	N16-1	Scenario #	2	Event #	4	Page	35 of 70
Event Description:		Rapid Downpower					

Time	Pos.	Expected Actions/Behavior	Comments
		• Place control rods in auto.	
		• GO TO Step 10.	
	BOP	(Step 10) Notify SOC of load reduction (red dispatcher phone).	**Booth Instructor:** as **SOC**, acknowledge.
	RO	(Step 11) Initiate turbine load reduction to desired load at desired rate.	
	BOP	(Step 12) Borate NC System as follows:	
		• Energize all backup Pzr heaters.	
	CRS	• Check unit to be shutdown – VIA REACTOR TRIP FROM 15% POWER.	**NOTE:** It is normal practice to shut down the reactor by driving rods, rather than tripping from 15%.
	CRS	(Step 12.b RNO) GO TO Step 12.d.	
	BOP	(Step 12.d) Determine boration amount based on the following:	
		• Power Reduction Rate (MW/min)	
		• Present NC System Boron Concentration (ppm)	
		• Total Power change (%).	**NOTE:** The total power change will be determined by the CRS, and will affect the amount of boron inserted by the BOP.
		• Record calculated boration amount:	
	RO	• Check auto or manual rod control – AVAILABLE.	
	BOP	• Perform boration in 4 equal additions during load reduction PER Enclosure 2 (Emergency Boration).	

Op Test No.:	N16-1	Scenario #	2	Event #	4	Page	36 of 70
Event Description:	**Rapid Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The CRS may assign the BOP to perform this action. If so, **BOP Examiner** follow actions of Enclosure 2. **Other Examiners** follow **AP-4** Actions, **Step 13**, on **Page 37**.
AP/1/A/5500/04, RAPID DOWNPOWER ENCLOSURE 2, EMERGENCY BORATION			
	BOP	(Step 1) Check OAC - AVAILABLE.	
	BOP	(Step 2) Use OAC point M1P0785 to monitor boric acid gallons added while 1NV-265B (U1 NV Pump Boric Acid Sup Isol) is open.	
	BOP	(Step 3) GO TO Step 5.	
	BOP	(Step 5) Check boric acid transfer pump - RUNNING.	**NOTE:** If a Boric Acid Transfer Pump is NOT running, the BOP will start one pump using the RNO, and stop it later, after the boration is complete.
	BOP	(Step 6) OPEN 1NV-265B (U1 NV Pump Boric Acid Sup Isol).	
	BOP	(Step 7) Do not continue until desired amount of boric acid has been added.	
	BOP	(Step 8) CLOSE 1NV-265B (U1 NV Pump Boric Acid Sup Isol).	**Examiner NOTE:** When the Turbine Shifts to Manual, move to Event #5.
	BOP	(Step 9) IF boric acid transfer pump was started in Step 5 RNO, THEN perform the following:	**NOTE:** If a Boric Acid Transfer Pump was started earlier, it will be stopped here.
		• Stop boric acid transfer pump.	

Op Test No.:	N16-1	Scenario #	2	Event #	4	Page	37 of 70
Event Description:	**Rapid Downpower**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Ensure one boric acid transfer pump is in auto.	
	BOP	(Step 10) Repeat enclosure as required.	
AP/1/A/5500/04, RAPID DOWNPOWER			
			Examiner NOTE: Examiners following the **CRS/RO** continue **HERE**. **Examiner NOTE:** When the Turbine Shifts to Manual, move to Event #5.
	BOP	(Step 13) Display Rod Insertion Limits on OAC by entering turn on code "RIL."	
	CRS	(Step 14) IF AT ANY TIME "CONTROL ROD BANK LO LO LIMIT" alarm (1AD-2, B-9) is lit, THEN perform one of the following to comply with Tech Spec 3.1.6 (Control Bank Insertion Limits):	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Ensure alarm clears within one hour as Xenon builds in.	
		OR	
		• Initiate boration as necessary within one hour to restore control rods above insertion limits.	
	CRS	(Step 15) IF AT ANY TIME during this procedure C-7A is received, THEN ensure Transient Monitor freeze is triggered.	
	CRS	(Step 16) REFER TO the following:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
		• RP/0/A/5700/000 (Classification of Emergency)	

Op Test No.: N16-1	Scenario # 2	Event # 4	Page 38 of 70
Event Description:	**Rapid Downpower**		

Time	Pos.	Expected Actions/Behavior	Comments
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	CRS	(Step 17) Notify Reactor Engineer on duty of load reduction.	**NOTE:** The CRS may call WCC/RE. If so, **Booth Instructor** acknowledge.
	RO	(Step 18) Check target load - LESS THAN 1000 MW.	
	CRS	(Step 19) Check Unit 2 available to supply aux steam as follows:	**NOTE:** The CRS will ask U2 RO. **Floor Instructor:** As U2 RO report "All these conditions are met."
		• Unit 2 Reactor power - GREATER THAN 15%	
		• Unit 2 2AS-12 (U2 SM to AS Hdr Control Inlet Isol) - OPEN	
		• Unit 2 - AVAILABLE TO SUPPLY AS HEADER.	
	RO	(Step 20) Check SM flow on all S/Gs – GREATER THAN 25%.	

When the Turbine Shifts to Manual, move to Event #5.

Op Test No.: N16-1	Scenario # 2	Event # 5	Page 39 of 70
Event Description:	**Turbine Control Unit fails to MANUAL**		

During the downpower, a failure will occur in the Turbine Control Unit causing the unit to shift from Operator Auto to Manual control. The operator will address 1AD-1/F-4, TURBINE IN MANUAL, and control the Turbine manually during the downpower in accordance with OP/1/A/6300/001A, Enclosure 4.1, “Turbine Generator Load Change.”

Booth Operator Instructions: **(Turbine Control Fails to MANUAL) Set in initial conditions. Triggered from 1NV-265B open light ON.**

Indications Available:

- Turbine MWe indication stabilizes
- MCB Annunciator 1AD-1/F-4, TURBINE IN MANUAL

Time	Pos.	Expected Actions/Behavior	Comments
			Examiner NOTE: The CRS will continue in AP-4 while the ARP/OP are addressed **(Page 40)**.
			NOTE: The BOP will likely stop the boration.
		MCB ANNUNCIATOR 1AD-1/F4, TURBINE IN MANUAL	
	RO	Immediate Action: Ensure Turbine/Generator operation stabilizes in either Load or Speed Modes of operation.	**NOTE:** The Turbine will stabilize in LOAD Mode.
	CRS	(Step 1) Determine cause and effect, then notify IAE of any malfunction.	**NOTE:** The CRS may call WCC/IAE to address the Turbine Control failure. If so, **Booth Instructor** acknowledge as WCC.
	RO	(Step 2) Refer to OP/1/A/6300/001 A (Turbine-Generator Load Change) for manual operation of Turbine Generator.	**NOTE:** The RO will continue the load reduction in MANUAL.
	CRS	(Step 3) WHEN available and desired, return DEH to “OPER AUTO”.	

Op Test No.:	N16-1	Scenario #	2	Event #	5	Page	40 of 70
Event Description:	**Turbine Control Unit fails to MANUAL**						

Time	Pos.	Expected Actions/Behavior	Comments
		OP/1/A/6300/001 A, TURBINE-GENERATOR LOAD CHANGE ENCLOSURE 4.1, TURBINE-GENERATOR LOAD CHANGE	
	RO	(Step 3.5) Changing Turbine Load	
	RO	(Step 3.5.1) IF Turbine in “OPERATOR AUTO”…	
	RO	(Step 3.5.3) IF Turbine in “MANUAL” perform the following:	
		• Ensure desired change within “Calculated Capability Curve”.	
		• If turbine load will increase or decrease more than 10 MWs, notify Dispatcher of expected load change.	
		• IF raising load, …	
		• IF decreasing load, depress “GV LOWER”.	
		AP/1/A/5500/04, RAPID DOWNPOWER	
	RO	(Step 13) Display Rod Insertion Limits on OAC by entering turn on code “RIL”.	
	CRS	(Step 14) IF AT ANY TIME "CONTROL ROD BANK LO LO LIMIT" alarm (1AD-2, B-9) is lit, THEN perform one of the following to comply with Tech Spec 3.1.6 (Control Bank Insertion Limits)	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Ensure alarm clears within one hour as Xenon builds in.	
		OR	
		• Initiate boration as necessary within one hour to restore control rods above insertion limits.	

Op Test No.:	N16-1	Scenario #	2	Event #	5	Page	41 of 70
Event Description:	**Turbine Control Unit fails to MANUAL**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 15) IF AT ANY TIME during this procedure C-7A is received, THEN ensure Transient Monitor freeze is triggered.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 16) REFER TO the following:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	CRS	(Step 17) Notify Reactor Engineer on duty of load reduction.	**NOTE:** The CRS may call WCC/RE to address the load reduction. If so, **Booth Instructor** acknowledge as WCC/RE.
			Examiner NOTE: The CRS may proceed past Step 18 of AP4 while waiting for the BOP to complete the first boration. If so, wait until the BOP is complete with the first boration and then proceed to the next event.
		(Step 18) Check target load – LESS THAN 1000 MW.	
		(Step 19) Check Unit 2 available to supply aux steam as follows:	
		• Unit 2 Reactor power – GREATER THAN 15%	**NOTE:** CRS will ask U2 RO for status. **Floor Instructor:** Report **as U2 RO** that **Unit 2** is at **100% power.**

Op Test No.:	N16-1	Scenario #	2	Event #	5	Page	42 of 70
Event Description:	**Turbine Control Unit fails to MANUAL**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Unit 2 AS-12 (U2 SM to AS Hdr Control Inlet Isol) – OPEN	**NOTE:** CRS will ask U2 RO for valve position. **Floor Instructor:** Report **as U2 RO** that **Unit 2 AS-12** is **OPEN.**
		• Unit 2 – AVAILABLE TO SUPPLY AS HEADER.	**NOTE:** CRS will ask U2 RO for AS availability. **Floor Instructor:** Report **as U2 RO** that **Unit 2** is **available to supply AS Header.**
		(Step 20) Check SM flow on all S/Gs – GREATER THAN 25%.	
		(Step 21) WHEN all SM flows are less than 75%, THEN ensure the following valves ramp CLOSED:	
		• 1CF-104AB (1A S/G CF Control Bypass)	
		• 1CF-105AB (1B S/G CF Control Bypass)	
		• 1CF-106AB (1C S/G CF Control Bypass)	
		• 1CF-107AB (1D S/G CF Control Bypass)	
			EXAMINER NOTE: The crew will continue in AP4 as Event 6 is ramping in.
At the discretion of the Lead Examiner, move to Event #6.			

Op Test No.:	N16-1	Scenario #	2	Event #	6	Page	43 of 70
Event Description:	**High Vibration on 1B NCP**						

After this, a high vibration condition will develop on the 1B NCP. The operator will respond in accordance with OAC Alarm M1D3041, 1B NC PUMP VIBRATION (HALM), and enter AP/1/A/5500/08, "Malfunction of NC Pump." Ultimately, the vibration condition will rise above the Hi-Hi threshold requiring tripping of the reactor and stopping the NCP. The operator will manually trip the reactor and enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection."	
Booth Operator Instructions:	**insertMAL-NCP003B=4.6 (HI Vibration Alarm)** **insertMAL-NCP003B=5.1 cd = X05_001E11_1 = 1 (Hi Vibration Alarm Ramp = 300 seconds) (HI-HI Vibration Alarm)**
Indications Available: • OAC Alarm: 1B NC Pump Vibration • MCB Annunciator 1AD-6/E-11 NC Pump Hi Vibration • 1B NC Pump hi vibration on NC Pump Vibration Monitor	

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The performance of Step 5 of AP8 will be dependent upon the timing addressing the procedure (i.e. Step 5 may be performed when Hi-Hi Vibration exceeds setpoint).
		AP/1/A/5500/08, MALFUNCTION OF NC PUMP CASE III, EXCESSIVE VIBRATION	
	BOP	(Step 1) Check NC Pump vibration problem – KNOWN TO BE VALID.	
	BOP	(Step 2) Check affected NC pump vibration indication within operating limits:	
		• Motor frame vibration – LESS THAN 5 MILS • All of the following - LESS THAN 20 MILS • Motor shaft vibration • Pump shaft vibration • Motor axial vibration • Motor flywheel vibration	**NOTE:** The Motor Frame Vibration will be rising.

Op Test No.:	N16-1	Scenario #	2	Event #	6	Page	44 of 70
Event Description:	High Vibration on 1B NCP						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 3) IF AT ANY TIME vibration exceeds operating limits, THEN GO TO Step 5	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 4) GO TO Step 6	
	CRS	(Step 6) Announce occurrence on the paging system.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that AP-8 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	CRS	(Step 7) Check NC pumps - ANY RUNNING	**NOTE:** All 4 NCPs are currently running. The CRS will direct the crew to continue monitoring NCP vibrations until the Hi-Hi Vibration alarm actuates. When alarm occurs, the crew will go to Step 5.
	BOP	(Step 5) Stop affected NC pump as follows:	
		• IF A or B NC pump is the affected pump, Then CLOSE associated spray valve:	
	BOP	• 1NC-27C (1A NC Loop PZR Spray Control).	
		• 1NC-29C (1B NC Loop PZR Spray Control).	**NOTE:** The 1B RCP is affected.
		• Check unit status – IN MODE 1 OR 2.	
	RO	• Trip reactor	
	BOP	• WHEN reactor power less than 5%, THEN stop affected NC pump.	

Op Test No.:	N16-1	Scenario #	2	Event #	6	Page	45 of 70
Event Description:	**High Vibration on 1B NCP**						

Time	Pos.	Expected Actions/Behavior	Comments
<u>Critical Task:</u> **Trip the Reactor prior to stopping the NCP during a high vibration condition, and trip the NCP only after Reactor power level has dropped to less than 5%.** Safety Significance: The P-8 interlock allows one NCP to be stopped less than 48% power. If a NCP is stopped in Mode 1 or 2, Tech Spec 3.4.4 requires the unit to be in Mode 3 within 6 hours. In addition, T-ave for the idle loop may violate Tech Spec 3.4.2, minimum temperature for criticality. In this case, the unit must be sub-critical within 30 minutes. The transient placed on the unit when a NCP is secured at power can challenge both reactor protection and control systems. Furthermore, an added burden is placed on the operator to stabilize the unit and shut down within 6 hours (possibly 30 minutes) to comply with Tech Specs. Even though the plant is designed and analyzed to operate in this configuration for a short time, station management has decided that the conservative approach to dealing with this transient is to trip the reactor anytime a NCP malfunction warrants stopping a pump in Mode 1 or 2. Guidance is given to wait until reactor power is less than 5% before stopping the NC pump. This will ensure the NC pump will provide adequate flow/core cooling until reactor power is sufficiently low enough to preclude a challenge to fuel integrity. If the action can be taken, and is not taken, this demonstrates "mis-operation" or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).			
	CRS	• GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
When the crew trips the reactor move to Events #7-9.			

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	46 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Following the plant trip, a Feedwater Isolation Signal (FWIS) will occur prematurely, the Main Turbine will fail to trip automatically or manually, and the Main Steam Line Isolation signal will fail to automatically actuate. The operator will be required to either manually close the Turbine Governor Valves or the MSIVs. It is likely that SI will actuate due to the delayed Turbine isolation. At the same time, the TDCA Pump, if not already running, will start on low Steam Generator levels. If the TDCA Pump was not running at the start of the event, it will trip on overspeed upon startup. If the TDCA Pump was running at the start of the event, it will trip when the operator initiates flow to the Steam Generators. Furthermore, the 1A MDCA Pump will trip on overcurrent during pump startup, and any attempts to restart the pump will be unsuccessful. Consequently, a Red Path on Heat Sink will occur shortly after SI actuation, or upon the transition to EP/1/A/5000/ES-0.1, “Reactor Trip Response.” The operator will transition from EP/1/A/5000/E-0 to EP/1/A/5000/FR-H.1, “Response to Loss of Secondary Heat Sink.” The operator will eventually restore feed flow using a CF Pump in accordance with Enclosure 8 (Re-establishing CF Flow) of FR-H.1. Upon restoration of feed flow to the Steam Generators, the crew will transition back to E-0. The scenario will terminate upon the operator returning to E-0, or ES-0.1, after the secondary heat sink has been restored.

Booth Operator Instructions:

The following will occur on the Rx trip:

- **insert MAL-ISE007A ACT_AUTO cd='H_X01_094_2 EQ 1' (FWIS Train A)**
- **insert MAL-ISE007B ACT_AUTO cd='H_X01_094_2 EQ 1' (FWIS Train B)**
- **insertMAL-DEH003A = TRUE (Main Turbine fails to Auto Trip)**
- **insertMAL-DEH003B = TRUE (Main Turbine fails to Manually Trip)**
- **insert MAL-CA009A TRUE cd='H_X10_102_4 EQ 1' (MD CA Pump 1A trips on startup)**
- **insert MAL-CA005 TRIP cd='H_X01_094_2 EQ 1' delay=0, insert MAL-SM029 = 0, cd=H_X01_094_2 EQ1 (TDCA Overspeed Trip occurs and Breaker Open Indicating Light, 1SA-3 fails CLOSED on Reactor Trip)**

NOTE: **When an AO is dispatched to check the 1A MDCA Pump Breaker. Acknowledge as AO. Wait five minutes and report back that the breaker has an overcurrent lockout relay showing, and the motor smells of burnt insulation.**

NOTE: **When an AO is dispatched to check the 1TDCA Pump. Wait five minutes and report back that the TDCA Turbine has tripped on overspeed and will NOT reset.**

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	47 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Indications Available:

- MCB Annunciator 1AD-4/B-1 through 4, S/G A-D LEVEL DEVIATION
- MCB Annunciator 1AD-4/C-1 through 4, S/G A-D FLOW MISMATCH LO CF FLOW
- MCB Annunciator 1AD-4/E-1 through 4, S/G A-D LO LEVEL ALERT
- RED Path on Heat Sink.

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: If the TDCA Pumps is still running from a previous malfunction, the BOP may attempt to open the CA Control Valves to prevent the Red Path on Heat Sink. However, the TDCA will overspeed shortly after event initiation.
EP/1/A/5000/E-0, REACTOR TRIP OR SAFETY INJECTION			
	RO/ BOP	(Step 1) Monitor Foldout page.	
		NC Pump Trip Criteria (Not expected)	
		CA Suction Sources (CA storage tank (water tower) goes below 1.5 ft – Not expected)	
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recird Isol)	**NOTE:** The BOP will monitor these conditions.
		• IF NV S/I flowpath aligned AND NC pressure is less than 1500 PSIG, THEN CLOSE 1NV-150B and 1NV-151A.	
		• IF NC pressure is greater than 2000 PSIG, THEN OPEN 1NV-150B and 1NV-151A.	
		Ruptured S/G Aux Feedwater Isolation Criteria (Not expected)	
		Faulted S/G Aux Feedwater Isolation Criteria (Not expected)	
	RO	(Step 2) Check Reactor trip:	**Immediate Action**
		• All rod bottom lights – LIT	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	48 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• Reactor trip and bypass breakers – OPEN	
		• I/R amps – GOING DOWN.	
	RO	(Step 3) Check Turbine Trip:	**Immediate Action**
		• All throttle valves – CLOSED.	
	RO	(Step 3 RNO) Perform the following:	**Immediate Action**
		• Trip turbine.	
		• IF turbine will not trip, THEN perform the following:	**NOTE:** Turbine will NOT trip manually.
		• Place turbine in manual.	
		• CLOSE governor valves in fast action.	
		• IF governor valves will not close…	

Critical Tasks:

Manually close the Main Turbine Governor Valves or establish feedwater flow into at least one Steam Generator before Wide Range Level in 3 Steam Generators reaches 24% (36%).

Safety Significance: Failure to trip the Main Turbine when conditions exist that allow the operator to do so, or failure to establish feedwater flow into at least one Steam Generator results in the crew having to rely upon the lower-priority action of having to initiate RCS Bleed and Feed to minimize the possibility of core uncovery. Failure to perform this task, when able to do so, constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 4) Check 1ETA and 1ETB – ENERGIZED.	**Immediate Action**

Op Test No.: N16-1	Scenario # 2	Event # 7, 8 & 9	Page 49 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
			Examiner NOTE: Depending on the timing of diagnosis of the failure of the Main Turbine to trip, the crew may or may not actuate SI. The script assumes that SI has occurred, and that FR-H.1 will be entered later. **If SI is NOT actuated** the crew will transition to EP/1/A/5000/ES-0.1, and with the RED Path on Heat Sink active, transition to FR-H.1 instead. If so, **Examiners move forward to Page 52.**
	RO/ BOP	(Step 5) Check if S/I is actuated:	**Immediate Action**
		• “A SAFETY INJECTION ACTUATED” status light (1SI-18) – LIT.	
		• Both LOCA Sequencer Actuated status lights (1SI-14) – LIT.	
	CRS	(Step 6) Announce “Unit 1 Safety Injection”.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that Unit 1 Safety Injection has actuated. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 7) Check all Feedwater Isolation status lights (1SI-4) – LIT.	
	BOP	(Step 8) Check Phase A “RESET” lights – DARK.	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	50 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 9) Check ESF Monitor Light Panel on energized train(s):	
		• Groups 1, 2, 5 – DARK.	
		• Group 3 – LIT.	
		• Group 4 – LIT AS REQUIRED.	
		• Group 6 – LIT.	
	CRS	• GO TO Step 10.	
	RO/ BOP	(Step 10) Check proper CA pump status:	**NOTE:** Both MDCA Pumps are OFF.
		• MD CA pumps – ON	
		(Step 10a RNO) Start pumps	
		• N/R level in at least 3 S/Gs – GREATER THAN 17%.	
		(Step 10b RNO) Ensure TD CA pump on.	
	BOP	(Step 11) Check all KC pumps - ON	
	BOP	(Step 12) Check both RN pumps – ON.	
	CRS	(Step 13) Notify Unit 2 to perform the following:	**Floor Instructor:** As U2 RO report “2A RN Pump is running.”
		• Start 2A RN pump.	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	51	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• THROTTTLE Unit 2 RN flow to minimum for existing plant conditions.	**Booth Instructor:** **insert LOA-RN087 (Start 2A RN Pump)** **insert LOA-RN083 8050.000000 delay=0 ramp=10 (Unit 2 Train A Demand Flow)**
	RO	(Step 14) Check all S/G pressures – GREATER THAN 775 PSIG.	
	BOP	(Step 15) Check Containment Pressure – HAS REMAINED LESS THAN 3 PSIG.	**NOTE:** Containment pressure is normal.
	BOP	(Step 16) Check S/I flow:	
	BOP	• Check “NV PMPS TO COLD LEG FLOW” gauge – INDICATING FLOW.	
		• Check NC pressure – LESS THAN 1600 PSIG.	
	BOP	(Step 16.b RNO) Perform the following:	
	BOP	• Ensure ND pump miniflow valve on running pump(s) OPEN:	
		• 1ND-68A (1A ND Pump & Hx Mini Flow Isol)	
		• 1ND-67B (1B ND Pump & Hx Mini Flow Isol).	
	CRS	• IF valve(s) open on all running ND pumps, THEN GO TO Step 17.	
	CRS	(Step 17) Notify OSM or other SRO to perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 22 (OSM Actions Following an S/I) within 10 minutes.	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	52 of 70
Event Description:	**Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**						

Time	Pos.	Expected Actions/Behavior	Comments
		(Step 18) Check CA flow:	
		• Total CA flow – GREATER THAN 450 GPM.	
		(Step 18 RNO) Perform the following:	
		• IF N/R level in all S/Gs is less than 11% (32% ACC), THEN perform the following:	
		• Ensure correct valve alignment.	
		• Start CA pumps.	
		• IF N/R level in all S/Gs is less than 11% (32% ACC) AND feed flow greater than 450 GPM cannot be established, THEN perform the following:	
		• Implement EP/1/A/5000/F-0 (Critical Safety Function Status Trees).	
		• GO TO EP/1/A/5000/FR-H.1 (Response To Loss of Secondary Heat Sink).	
			NOTE: It is expected that the Red Path on Heat Sink will exist by this time. The CRS will transition to FR-H.1.
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK			
	CRS	(Step 1) IF total feed flow is less than 450 GPM due to operator action…	**NOTE:** This condition is NOT met, and the crew will remain in FR-H.1.
	RO/ BOP	(Step 2) Check if secondary heat sink is required:	

Op Test No.: N16-1	Scenario # 2	Event # 7, 8 & 9	Page 53 of 70				

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• NC pressure – GREATER THAN ANY NON-FAULTED S/G PRESSURE.	
		• Any NC T-Hot – GREATER THAN 350°F (347°F ACC).	**NOTE:** A Secondary Heat Sink is required.
	RO/ BOP	(Step 3) Monitor Foldout Page.	
		NC System Feed and Bleed Criteria (Applies after Step 2 in the body of the procedure) (3 S/Gs goes below 24% (36% ACC) – Not expected)	
		Cold Leg Recirc Switchover Criteria (FWST level reaches 95 inches – Not expected)	
		CA Suction Sources (CA storage tank (water tower) goes below 1.5 ft – Not expected)	
	BOP	(Step 4) Check at least one of the following NV pumps – AVAILABLE:	
		• 1A NV pump	
		OR	
		• 1B NV pump.	
	RO	(Step 5) Check if NC System feed and bleed should be initiated:	
		• Check W/R level in at least 3 S/Gs – LESS THAN 24% (36% ACC).	
	RO/ BOP	(Step 5.a RNO) Perform the following:	
		• Monitor feed and bleed initiation criteria.	
		• WHEN criteria satisfied, THEN GO TO Step 22.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	• GO TO Step 6.	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	54	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 6) Ensure S/G BB and NM valves CLOSED PER Enclosure 3 (S/G BB and Sampling Valve Checklist).	**NOTE:** The CRS may assign the BOP (RO) to perform this action. If so, **BOP (RO) Examiner** follow actions of **Enclosure 3.** **Others** should move ahead to Step 7 on **Page 55** to continue in FR-H.1.
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK ENCLOSURE 3, S/G BB AND SAMPLING VALVE CHECKLIST			
	BOP (RO)	(Step 1) Check the following valves – CLOSED.	**Examiner NOTE:** Follow the actions associated with Enclosure 3 if BOP is assigned by CRS to perform.
		• 1BB-1B (1A S/G Blowdown Cont Outside Isol Control) - CLOSED	
		• 1BB-2B (1B S/G Blowdown Cont Outside Isol Control) - CLOSED	
		• 1BB-3B (1C S/G Blowdown Cont Outside Isol Control) - CLOSED	
		• 1BB-4B (1D S/G Blowdown Cont Outside Isol Control) - CLOSED	
		• 1BB-5A (A S/G BB Cont Inside Isol) - CLOSED	
		• 1BB-6A (B S/G BB Cont Inside Isol) - CLOSED	
		• 1BB-7A (C S/G BB Cont Inside Isol) - CLOSED	
		• 1BB-8A (D S/G BB Cont Inside Isol) - CLOSED	

Op Test No.: N16-1	Scenario # 2	Event # 7, 8 & 9	Page 55 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• 1NM-187A (1A S/G Upper Shell Sample Cont Inside Isol) - CLOSED	
	BOP (RO)	• 1NM-190A (1A S/G Blowdown Sample Cont Inside Isol) - CLOSED	
		• 1NM-201A (1B S/G Blowdown Sample Hdr Cont Outside Isol) - CLOSED	
		• 1NM-207A (1C S/G Upper Shell Sample Cont Inside Isol) - CLOSED	
		• 1NM-210A (1C S/G Blowdown Sample Cont Inside Isol) - CLOSED	
		• 1NM-221A (1D S/G Blowdown Sample Hdr Cont Outside Isol) - CLOSED	
		• 1NM-191B (1A S/G Blowdown Sample Hdr Cont Outside Isol) - CLOSED	
		• 1NM-197B (1B S/G Upper Shell Sample Cont Inside Isol) - CLOSED	
	BOP (RO)	• 1NM-200B (1B S/G Blowdown Sample Cont Inside Isol) - CLOSED	
		• 1NM-211B (1C S/G Blowdown Sample Hdr Cont Outside Isol) - CLOSED	
		• 1NM-217B (1D S/G Upper Shell Sample Cont Inside Isol) - CLOSED	
		• 1NM-220B (1D S/G Blowdown Sample Cont Inside Isol) - CLOSED	
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK			
	RO (BOP)	(Step 7) Attempt to establish CA flow to at least one S/G as follows:	**Examiner NOTE:** Examiners NOT following BOP (RO) actions in Enclosure 3, continue **HERE**.
		• Check power to both MD CA pumps – AVAILABLE.	**NOTE:** The 1A MDCA Pump is OOS, and the 1B MDCA Pump has failed upon Auto Start.

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	56 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 7.a RNO) Perform the following:	
		• IF 1ETA OR 1ETB deenergized, THEN…..	**NOTE:** 1ETA and 1ETB are both energized.
		• IF the essential bus is energized, THEN dispatch operator to determine cause of breaker failure.	**NOTE:** The CRS will dispatch an AO. **Booth Instructor:** Acknowledge as AO. Wait **five minutes** and **report back** that the breaker has an **overcurrent lockout relay showing**, and the motor smells of burnt insulation.
	RO (BOP)	(Step 7.b) Ensure control room CA valves aligned PER Enclosure 4 (CA Valve Alignment).	**NOTE:** The CRS may assign the RO (BOP) to perform this action. If so, RO (**BOP) Examiner** follow actions of **Enclosure 4.** **Others** should move ahead to Step 7.c on **Page 59** to continue in FR-H.1.
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK ENCLOSURE 4, CA VALVE ALIGNMENT			
			Examiner NOTE: Follow the actions associated with Enclosure 4 if RO (BOP) is assigned by CRS to perform.
	RO (BOP)	(Step 1) Check the following valves - OPEN	
		• 1CA-66AC (U1 TD CA Pump Disch To 1A S/G Isol) - OPEN	
		• 1CA-62A (1A CA Pump Disch To 1A S/G Isol) - OPEN	
		• 1CA-54AC (U1 TD CA Pump Disch To 1B S/G Isol) - OPEN	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	57	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• 1CA-58A (1A CA Pump Disch To 1B S/G Isol) - OPEN	
		• 1CA-50B (U1 TD CA Pump Disch To 1C S/G Isol) - OPEN	
		• 1CA-46B (1B CA Pump Disch To 1C S/G Isol) - OPEN	
		• 1CA-38B (U1 TD CA Pump Disch To 1D S/G Isol) - OPEN	
		• 1CA-42B (1B CA Pump Disch To 1D S/G Isol) - OPEN	
	RO (BOP)	(Step 2) Check the following valves - OPEN	
		• 1CA-64B (U1 TD CA Pump Disch To 1A S/G Control) – OPEN	
		• 1CA-60A (1A CA Pump Disch To 1A S/G Control) - OPEN	
		• 1CA-52AB (U1 TD CA Pump Disch To 1B S/G Control) - OPEN	
		• 1CA-56A (1A CA Pump Disch To 1B S/G Control) - OPEN	
		• 1CA-48AB (U1 TD CA Pump Disch To 1C S/G Control) - OPEN	
		• 1CA-44B (1B CA Pump Disch To 1C S/G Control) - OPEN	
		• 1CA-36AB (U1 TD CA Pump Disch To 1D S/G Control) - OPEN	
		• 1CA-40B (1B CA Pump Disch To 1D S/G Control) - OPEN	
	RO (BOP)	(Step 3) Check CA Storage Tank (water tower) level – GREATER THAN 1.5 FT.	
	RO (BOP)	(Step 4) Check the following valves - CLOSED	

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• 1RN-69A (1A RN Assured Supply TO U1 CA Isol) - CLOSED	
		• 1CA-86A (U1 TD CA Pump Suction From 1A RN Isol) - CLOSED	
		• 1CA-15A (1A CA Pump Suction From 1A RN Isol) - CLOSED	
		• 1RN-162B (1B RN Assured Supply To U1 CA Isol) - CLOSED	
		• 1CA-116B (U1 TD CA Pump Suction From 1B RN Isol) - CLOSED	
		• 1CA-18B (1B CA Pump Suction From 1B RN Isol) - CLOSED	
	RO (BOP)	(Step 5) Check the following valves – OPEN:	
		• 1CA-11A (1A CA Pump Suction Isol) - OPEN	
		• 1CA-7AC (U1 TD CA Pump Suction Isol) - OPEN	
		• 1CA-9B (1B CA Pump Suction Isol) - OPEN	
	RO (BOP)	(Step 6) GO TO Step 8.	
	RO (BOP)	(Step 8) Check 1CA-2 (U1 CA Pump Suct From CA Storage Tank Isol) – OPEN.	
	RO (BOP)	(Step 9) Check CA pump suction from UST and CA Condensate Storage Tank (service bldg roof tank) valves – CLOSED:	
		• 1CS-18 (U1 UST To CA Pump Suct Hdr Isol) - CLOSED	
		• 1CA-4 (U1 CA Pumps Suct From SUT Isol) - CLOSED	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	59	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• 1CA-6 (U1 CA Pumps Suct From CA CST Isol) – CLOSED.	
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK			
			Examiner NOTE: Examiners NOT following RO (BOP) actions in Enclosure 4, continue **HERE**.
	BOP (RO)	(Step 7.c) Start all available CA pumps.	
	BOP (RO)	(Step 7.d) Check TD CA pump – RUNNING.	**NOTE:** The TDCA Pump is NOT running.
	BOP (RO)	(Step 7.d RNO) Perform the following as necessary:	
		• IF 1SA-48BC (SM From S/G C To TD CA Pump Isol) is closed, THEN…	**NOTE:** 1SA-48BC indicates OPEN.
		• IF 1SA-49AB (SM From S/G B to TD CA Pump Isol) is closed, THEN…	**NOTE:** 1SA-49AB indicates OPEN.
	CRS	• IF "TD CA PUMP STOP VLV NOT OPEN" alarm (1AD-5, F-3) is lit, THEN dispatch operator to reset 1SA-3 (Unit 1 TD CA Pump Turb Stop Valve) PER EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 24 (Resetting TD CA Stop Valve).	**NOTE:** The CRS will dispatch an AO. **Booth Instructor:** Acknowledge as AO. Wait **five minutes** and **report back** that the **TDCA Turbine has tripped on overspeed and will NOT reset**.
	CRS	• IF reason for loss of steam supply to TD CA pump not determined,…	**NOTE:** The CRS will determine from the AO report that the TDCA Pump is unavailable.
	RO/ BOP	(Step 7.e) Check total flow to S/G(s) – GREATER THAN 450 GPM.	**NOTE:** There is no feedwater flow.

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	60 of 70
Event Description:	**Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 7.e RNO) Perform the following:	
		• IF only one MD CA pump is on,…	**NOTE:** There are no MDCA Pumps running.
		• IF any CA pump is running,…	**NOTE:** There are no CA Pumps running.
		• IF any feed flow to at least on S/G is indicated,…	**NOTE:** There is no feedwater flow.
	CRS	• IF no feed flow indicated, THEN perform the following:	
		• IF no CA pump can be started, THEN dispatch operator and maintenance to CA pumps to try to restore one CA pump to service.	**NOTE:** The CRS may call WCC/IAE to address the CA Pump situation. If so, **Booth Instructor** acknowledge as WCC.
		• Dispatch operator to ensure CA valves aligned PER Enclosure 6 (Local CA Valve Alignment).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** Acknowledge as AO. **Booth Instructor:** After **5 minutes** report completion.
	CRS	• GO TO Step 8.	
	RO	(Step 8) Check steam dumps as follows:	
		• Check condenser available as follows:	
		• “C-9 COND AVAILABLE FOR STEAM DUMP” status light (1SI-18) - LIT	

Op Test No.: N16-1	Scenario # 2	Event # 7, 8 & 9	Page 61 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• Any MSIV – OPEN.	**NOTE:** The MSIVs may be OPEN or CLOSED. If the MSIVs are CLOSED, proceed to Step 9.
		• "STEAM DUMP SELECT" – IN T-AVG MODE.	
		• Perform the following to place steam dumps in steam pressure mode:	
		• Ensure "STM PRESS CONTROLLER" setpoint at 1090-1095 PSIG.	
		• Place "STM PRESS CONTROLLER" in manual.	
		• Adjust "STM PRESS CONTROLLER" output to equal "STEAM DUMP DEMAND" signal.	
		• Place "STEAM DUMP SELECT" in steam pressure mode.	
		• Place "STM PRESS CONTROLLER" in auto.	
	BOP	(Step 9) Stop all NC pumps.	
	BOP	(Step 10) Reset Feedwater Isolation as follows:	
		• Check any Condensate Booster pump – ON.	
		• Check the following alarms – DARK.	
		• 1AD-5, G-6 (Inner Doghouse Level Hi)	
		• 1AD-5, H-6 (Outer Doghouse Level Hi).	

Op Test No.: N16-1	Scenario # 2	Event # 7, 8 & 9	Page 62 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	• Dispatch operator to block Feedwater Isolation signal PER Enclosure 7 (Feedwater Isolation Override).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** Acknowledge as AO. **Booth Instructor: dellA MAL-ISE007A = 2 (Upon Demand to Reset FWIS) dellA MAL-ISE007B = 2 (Upon Demand to Reset FWIS) insert MAL-ISE007A = BLK_BOTH (Upon Demand to Reset FWIS)** **insert MAL-ISE007B = BLK_BOTH (Upon Demand to Reset FWIS)** As **AO**, report completion. **Booth instructor: do not delay performance of Enclosure 7**
	BOP	• Check S/I – HAS BEEN ACTUATED.	**NOTE:** SI may have been actuated.
	BOP	• Reset the following:	
		• S/I	
		• Sequencers	
	BOP	• IF AT ANY TIME a B/O signal occurs, THEN restart S/I equipment previously on.	
	BOP	• Do not continue until Enclosure 7 (Feedwater Isolation Override) is completed.	
	BOP	(Step 11) Check CM System in service:	
		• Hotwell pump(s) - ON	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	63 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• Condensate Booster pump(s) – ON.	
	RO/ BOP	(Step 12) Check CF pumps – AT LEAST ONE AVAILABLE TO START.	**NOTE:** Both CF Pumps are available to start.
	CRS	(Step 13) Establish CF flow PER Enclosure 8 (Re-establishing CF Flow).	
			NOTE: The CRS will transition to Enclosure 8.
EP/1/A/5000/FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK ENCLOSURE 8, RE-ESTABLISHING CF FLOW			
	RO/ BOP	(Step 1) Place the following valves in manual and CLOSE:	
		• S/G CF control valves	
		• S/G CF control bypass valves.	
	RO/ BOP	(Step 2) Lower output to 0% for the following valves:	
		• All S/G CF control valves	
		• All S/G CF control bypass valves.	
	RO/ BOP	(Step 3) CLOSE the following CF control isolation valves:	
		• CLOSE 1CF-31 (1A S/G CF Control Inlet Isol).	
		• CLOSE 1CF-33 (1A S/G CF Control Outlet Isol).	
		• CLOSE 1CF-22 (1B S/G CF Control Inlet Isol).	
		• CLOSE 1CF-24 (1B S/G CF Control Outlet Isol).	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	64	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• CLOSE 1CF-19 (1C S/G CF Control Inlet Isol).	
		• CLOSE 1CF-21 (1C S/G CF Control Outlet Isol).	
		• CLOSE 1CF-16 (1D S/G CF Control Inlet Isol).	
		• CLOSE 1CF-18 (1D S/G CF Control Outlet Isol).	
	CRS	(Note prior to Step 4) The following step must be completed even if a Feedwater Isolation signal has not occurred.	
	BOP	(Step 4) Depress and release the Feedwater Isolation reset pushbuttons.	
	RO/ BOP	(Step 5) Check any CF pump – RESET.	
	CRS	(Step 5 RNO) GO TO Step 14.	
	RO/ BOP	(Step 14) Depress “RESET” on “1A OR 1B CF PUMP RECIRC VALVE CLOSURE CIRCUIT” and check “RESET” light lit.	
	RO/ BOP	(Step 15) Reset CF pump turbine that will be placed in service as follows:	
		• Depress “RESET” and hold “RESET” 2-3 seconds after the “RST” light is lit on pump to be started.	
		• Check CF pump turbine to be started RESET.	
	RO	(Step 16) Align AS header as follows:	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	65 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• CLOSE 1AS-9 (U1 C Htr Bleed To AS Hdr Isol).	
	CRS	• Check Unit 2 as follows:	
		• Unit 2 Reactor power – GREATER THAN 15%	**NOTE:** CRS will ask U2 RO to report power level. If so, **Floor Instructor** report 100% as U2 RO.
		• Unit 2 2AS-12 (U2 SM to AS Hdr Control Inlet Isol) - OPEN	**NOTE:** CRS will ask U2 RO to report valve position. If so, **Floor Instructor** report 2AS-12 is OPEN.
	CRS	• Unit 2 – AVAILABLE TO SUPPLY AS HEADER.	**NOTE:** CRS will ask U2 RO to report U2 AS Availability. If so, **Floor Instructor** report U2 AS is available.
	RO/ BOP	• Isolate Unit 1 SM to AS header as follows:	
		• IF AT ANY TIME AS header pressure cannot be maintained greater than 140 PSIG while performing the following step, THEN GO TO Step 16.e.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	RO/ BOP	• Slowly CLOSE 1AS-12 (U1 SM To AS Hdr Control Inlet Isol) while monitoring AS header pressure.	
	CRS	(Step 16.d) GO TO Step 17.	
	RO/ BOP	(Step 17) Check 1HM-95 (U1 Aux Steam Supply to CF Pumps Turbine Isol) – OPEN.	**NOTE:** 1HM-95 is CLOSED.
	RO/ BOP	(Step 17 RNO) Open 1HM-95.	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	66	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 18) CLOSE the following valves:	
		• CLOSE 1CF-35AB (1A S/G CF Cont Outside Isol).	
		• CLOSE 1CF-30AB (1B S/G CF Cont Outside Isol).	
		• CLOSE 1CF-28AB (1C S/G CF Cont Outside Isol).	
		• CLOSE 1CF-26AB (1D S/G CF Cont Outside Isol).	
	RO/ BOP	(Step 19) Check 1A CF pump – TO BE PLACED IN SERVICE.	**NOTE:** The CRS may elect to use the 1B CF Pump, rather than the 1A CF Pump. If so, similar steps are used to those associated with the starting the 1A CF Pump.
	RO/ BOP	(Step 20) Place 1A CF pump in service as follows:	**NOTE:** The CRS may elect to use the 1B CF Pump.
		• Place the following in auto:	
		• 1A CF pump turbine low pressure governor control.	
		• 1A CF pump turbine high pressure governor control.	
		• OPEN stop valves by depressing "RAISE" on "1A CF PUMP TURBINE HP-LP SV" until "MAX" light is lit on the following:	
		• 1SP-15 (1A CFPT Turb Hi Press Step valve)	**NOTE:** If the 1B CF Pump is used, 1SP-17
		• 1HM-157 (1A CFPT Turb Lo Press Step valve)	**NOTE:** If the 1B CF Pump is used, 1HM-159

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	67 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• Adjust 1A CF pump turbine speed using control located on low pressure governor controller to establish "CF HEADER PRESSURE" 50-100 PSIG above S/G pressure.	**NOTE:** S/G pressures are ≈1100 psig.
	CRS	(Step 20.d) GO TO Step 22.	
	RO/ BOP	(Step 22) Check feed and bleed – ESTABLISHED IN BODYOF THIS PROCEDURE.	**NOTE:** Feed and Bleed has NOT been established.
	RO/ BOP	(Step 22 RNO) Perform the following:	
		• WHEN restoring feed flow in next steps, THEN control feed flow as required to raise S/G levels while preventing an uncontrolled NC system cooldown.	
	CRS	• GO TO Step 25.	
	RO	(Step 26) OPEN the following valve(s) for the S/Gs to be fed:	
		• 1CF-126B (1A S/G CF To CA Nozzle Isol)	
		• 1CF-127B (1B S/G CF To CA Nozzle Isol)	
		• 1CF-128B (1C S/G CF TO CA Nozzle Isol)	
		• 1CF-129B (1D S/G CF To CA Nozzle Isol).	
	RO	(Step 27) Establish feed flow to desired S/G(s) as follows:	
		• THROTTLE OPEN S/G CF control bypass valve for S/G(s) to be fed.	

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	68 of 70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

Time	Pos.	Expected Actions/Behavior	Comments
		• Monitor CF pump discharge pressure and adjust CF pump speed as needed to maintain "CF HEADER PRESSURE" 50-100 PSIG above S/G pressure.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• IF AT ANY TIME S/G CF control bypass valves are throttled closed, THEN ensure pump speed is controlled at same time to avoid a CF pump trip on high discharge pressure (1435 PSIG).	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 28) Check Step 24 or 25 in this enclosure – IMPLEMENTED.	**NOTE:** Step 24 or 25 have NOT been implemented.
	RO	(Step 28 RNO) Perform the following:	
		• WHEN S/G N/R level is greater than 11% (32% ACC), THEN control CF flow to maintain N/R level between 11% (32% ACC) and 50%.	

Critical Task:

Manually close the Main Turbine Governor Valves or establish feedwater flow into at least one Steam Generator before Wide Range Level in 3 Steam Generators reaches 24% (36%).

Safety Significance: Failure to trip the Main Turbine when conditions exist that allow the operator to do so, or failure to establish feedwater flow into at least one Steam Generator results in the crew having to rely upon the lower-priority action of having to initiate RCS Bleed and Feed to minimize the possibility of core uncovery. Failure to perform this task, when able to do so, constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 28 RNO b) RETURN TO step in effect in body of this procedure.	
			NOTE: The CRS will transition to Step 14 of FR-H.1.

At the discretion of the Lead Examiner terminate the exam.

Op Test No.:	N16-1	Scenario #	2	Event #	7, 8 & 9	Page	69	of	70

Event Description: **Premature FWIS/Failure of Main Turbine to Trip/Failure of Main Steam Line Isolation/Overspeed Trip of TDCA Pump/1A MDCA Pump trips upon Auto Start**

UNIT 1 STATUS:

Power Level: 90% NCS [B] 960 ppm Pzr [B]: 960 ppm Xe: Per OAC

Power History: At this power level for 24 hours Core Burnup: 251 EFPDs

CONTROLLING PROCEDURE: OP/1/A/6100/003 Controlling Procedure for Unit Operation

OTHER INFORMATION NEEDED TO ASSUME THE SHIFT:

- The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
- A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."

The following equipment is Out-Of-Service:

- The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C.
- The 1B MDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION B.
- MCB Annunciator 1AD-8, A-4, "CF PUMP DISCHARGE HI PRESS," has alarmed spuriously several times over the last hour, and has currently failed ON (IAE is investigating).

Crew Directions:

- Maintain Plant conditions.

Work Control SRO/Offsite Communicator **Jim**

Plant SRO **Joe (FB)**

AO's AVAILABLE

<u>Unit 1</u>	**<u>Unit 2</u>**
Aux Bldg. John	**Aux Bldg. Chris**
Turb Bldg. Bob (FB)	**Turb Bldg. Mike (FB)**
5th Rounds. Carol	

Extra(s) Bill (FB) Ed (FB) Wayne (FB) Tanya Gus (RW)

Facility:	**McGuire**	Scenario No.: **3**	Op Test No.: **N16-1**
Examiners:	____________	Operators:	____________ (SRO)
	____________		____________ (RO)
	____________		____________ (BOP)

Initial Conditions:	The plant is at 75% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The TDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION A. MCB Annunciator 1AD-12, A-4, "B RN PMP DISCHARGE LO PRESS," has alarmed spuriously several times over the last hour, and has currently failed OFF (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	NA	R-RO N-BOP N-SRO	Power Increase
2	1	I(TS)-SRO	Pzr Level Channel 3 fails LOW
3	2	C-RO C-SRO	Steam Dump Valve fails OPEN
4	3	C-RO C-BOP C(TS)-SRO	Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod
5	4	C-BOP C-SRO	1KC-425 fails CLOSED
6	5	M-RO M-BOP M-SRO	Steam Equalization Header Line Rupture
7	6	NA	MSI fails in Auto/Manual/All MSIVs fail OPEN
8	7	C-BOP C-SRO	1A MD CA Pumps fails to start in AUTO
9	7	NA	1B MD CA Pumps fails to start in AUTO/MANUAL

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #3

The plant is at 75% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, "Containment Air Release and Addition System."

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The TDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION A. MCB Annunciator 1AD-12, A-4, "B RN PMP DISCHARGE LO PRESS," has alarmed spuriously several times over the last hour, and has currently failed OFF (IAE is investigating).

Shortly after taking the watch, the operator will commence a load increase to 100% starting with Step 3.37.10 of Enclosure 4.1, Power Increase, of OP/1/A/6100/003, "Controlling Procedure for Unit Operation." The operator will dilute the NC System Boron concentration in accordance with Enclosure 4.3, "Dilute," of OP/1/A/6150/009, "Boron Concentration Control," and raise Turbine load in accordance with OP/1/A/6300/001 A, "Turbine-Generator Load Change."

During the power increase, Pzr Level channel 3 will fail LOW. The DCS will automatically select a non-failed instrument to replace the failed instrument as the controlling channel, and no NCS inventory control upset will result. The operator will address Technical Specification LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation."

After this, the Steam Dump Valve SB-27 will slowly fail to FULL OPEN due to a valve positioner failure. The crew will enter AP/1/A/5500/01, "Steam Leak," stabilize turbine load, attempt to close, and ultimately isolate the valve.

Next, a Zone 1B Lockout causes PCB 11 and 12 to open, as well as the 1B Main Generator Breaker to open and the turbine to automatically runback to 56%. The operator will implement AP/1/A/5500/03, "Load Rejection." During the runback the operator will notice that the rods do not move in auto, and the operator will need to drive rods in manually. When the Control Rods are driven inward, one Control Bank D rod will stick in its original position. After stabilizing the plant, the operator will address AP/1/A/5500/14, "Rod Control Malfunction," to address the Stuck Rod. The operator will address Technical Specification LCO 3.1.4, "Rod Group Alignment Limits," and Technical Specification LCO 3.2.4, "Quadrant Power Tilt Ratio."

Subsequently, 1KC-425, "NC Pumps Ret Hdr Cont Outside Isol)," will fail CLOSED. The operator will respond per OP/1/A/6100/010 G, "Annunciator Response for 1AD-6," B1, A NC PUMP UPPER MTR BRG LO KC FLO, and manually open the valve. The operator may enter AP/1/A/5500/08, "Malfunction of NC Pump."

Following this a steam break will occur on the Main Steam Equalization Header in the Turbine Building. Simultaneously all four MSIVs will fail OPEN resulting in four faulted Steam Generators (Both Auto and Manual actuations of MSI have failed). Additionally, the 1A/1B MD CA Pump will fail to start automatically. The operator will be expected to manually start the 1A MD CA Pump (The 1B MD CA Pump will fail to start manually, as well).

The crew will enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection" and transition to EP/1/A/5000/E-2, "Faulted Steam Generator Isolation." On the other hand, due to the NCS cooldown, an Orange Path could exist on the NCS Integrity Critical Safety Function. If so, the crew will transition to EP/1/A/5000/FR-P.1, “Response to Imminent Pressurized Thermal Shock Condition.”

If the crew made the transition to E-2, the crew will transition to EP/1/A/5000/ECA-2.1 at Step 4 of E-2 when it is determined that all four Steam Generator pressures are lowering. On the other hand, if the crew transitions to FR-P.1, the crew will take the actions required by ECA-2.1, in FR-P.1 (i.e. reduce feed flow to each Steam Generator to 25 gpm each, depressurize NCS and terminate SI).

It is expected that the crew will eventually transition to EP/1/A/5000/FR-P.1, “Response to Imminent Pressurized Thermal Shock Condition.”

The scenario will terminate at Step 11.c of FR-P.1 after the operator has closed 1NI-9A and 10B.

Critical Tasks:

Establish 450 gpm of CA Flow to the Steam Generators during the performance of E-0 such that transition to EP/1/A/5000/FR-H.1 is not required.

Safety Significance: Failure to establish a Secondary Heat Sink through the initiation of CA flow unnecessarily challenges both the HEAT SINK and the CORE COOLING Critical Safety Functions. Additionally, the FSAR Safety Analysis results are predicated on the assumption that at least one train of safeguards actuates and delivers a minimum amount of AFW flow to the Steam Generators. Failure to perform this task, when the ability to do so exists, results in a violation of the Facility License Condition and places the plant in an unanalyzed condition.

Control the CA Flowrate to 25 gpm per SG in order to minimize the NC Cooldown rate in ECA-2.1 or FR-P.1.

Safety Significance: Failure to control the CA flow rate to the SGs, when able to do so, leads to an unnecessary and avoidable severe or extreme challenge to the Integrity CSF. Also, failure to perform the Critical Task increases challenges to the Subcriticality Critical Safety Function which otherwise would not occur. If the action can be taken, and is not taken, this demonstrates “mis-operation” or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).

PROGRAM: McGuire Operations Training

MODULE: Initial License Operator Training Class ILC 16-1

TOPIC: NRC Simulator Exam

Scenario N16-1-3

REFERENCES:

1. OP/1/A/6100/010 N, "Annunciator Response for Panel 1AD-13" (Rev 78)
2. Technical Specification LCO 3.4.15, "RCS Leakage Detection Instrumentation" (Amendment 235/217)
3. Technical Specification LCO 3.7.5, "Auxiliary Feedwater (AFW) System" (Amendment 221/203)
4. OP/1/A/6100/003, "Controlling Procedure for Unit Operation" (Rev 197)
5. OP/1/A/6150/009, "Boron Concentration Control" (Rev 131)
6. OP/1/A/6300/001A, "Turbine Generator Load Change" (Rev 12)
7. Technical Specification LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation" (Amendment 184/166)
8. Crew Expectations Manual (Rev 8/8/12)
9. AP/1/A/5500/01, "Steam Leak" (Rev 18)
10. Technical Specification LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits" (Amendment 219/201)
11. AP/1/A/5500/03, "Load Rejection" (Rev 30)
12. AP/1/A/5500/14, "Rod Control Malfunction" (Rev 16)
13. Technical Specification LCO 3.1.4, "Rod Group Alignment Limits" (Amendment 184/166)
14. Technical Specification LCO 3.2.4, "Quadrant Power Tilt Ratio" (Amendment 184/166)
15. OP/1/A/6100/010 G, "Annunciator Response for Panel 1AD-6" (Rev 68)
16. AP/1/A/5500/08, "Malfunction of NC Pump" (Rev 14)
17. EP/1/A/5000/E-0, "Reactor Trip or Safety Injection" (Rev 34)
18. EP/1/A/5000/E-2, "Faulted Steam Generator Isolation" (Rev 10)
19. EP/1/A/5000/ECA-2.1, "Uncontrolled Depressurization of All Steam Generators" (Rev 20)
20. EP/1/A/5000/F-0, "Critical Safety Function Status Trees" (Rev 6)
21. EP/1/A/5000/FR-P.1, "Response To Imminent Pressurized Thermal Shock Condition" (Rev 14)
22. EP/1/A/5000/ES-1.1, "Safety Injection Termination" (Rev 27)

Validation Time: 87 minutes

Author: David Lazarony, Essential Training & Consulting, LLC

Facility Review: ________________________

Rev. 121415

Facility: **McGuire**	Scenario No.: **3**	Op Test No.: **N16-1**	
Examiners:	Operators:	(SRO)	
		(RO)	
		(BOP)	

Initial Conditions:	The plant is at 75% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, “Containment Air Release and Addition System.”
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The TDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION A. MCB Annunciator 1AD-12, A-4, “B RN PMP DISCHARGE LO PRESS,” has alarmed spuriously several times over the last hour, and has currently failed OFF (IAE is investigating).

Event No.	Malf. No.	Event Type*	Event Description
1	NA	R-RO N-BOP N-SRO	Power Increase
2	1	I(TS)-SRO	Pzr Level Channel 3 fails LOW
3	2	C-RO C-SRO	Steam Dump Valve fails OPEN
4	3	C-RO C-BOP C(TS)-SRO	Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod
5	4	C-BOP C-SRO	1KC-425 fails CLOSED
6	5	M-RO M-BOP M-SRO	Steam Equalization Header Line Rupture
7	6	NA	MSI fails in Auto/Manual/All MSIVs fail OPEN
8	7	C-BOP C-SRO	1A MD CA Pumps fails to start in AUTO
9	7	NA	1B MD CA Pumps fails to start in AUTO/MANUAL

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #3

The plant is at 75% power (MOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift. A Containment Air Release is in progress per OP/1/A/6450/17, “Containment Air Release and Addition System.”

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The TDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION A. MCB Annunciator 1AD-12, A-4, “B RN PMP DISCHARGE LO PRESS,” has alarmed spuriously several times over the last hour, and has currently failed OFF (IAE is investigating).

Shortly after taking the watch, the operator will commence a load increase to 100% starting with Step 3.37.10 of Enclosure 4.1, Power Increase, of OP/1/A/6100/003, “Controlling Procedure for Unit Operation.” The operator will dilute the NC System Boron concentration in accordance with Enclosure 4.3, “Dilute,” of OP/1/A/6150/009, “Boron Concentration Control,” and raise Turbine load in accordance with OP/1/A/6300/001 A, “Turbine-Generator Load Change.”

During the power increase, Pzr Level channel 3 will fail LOW. The DCS will automatically select a non-failed instrument to replace the failed instrument as the controlling channel, and no NCS inventory control upset will result. The operator will address Technical Specification LCO 3.3.1, “Reactor Trip System (RTS) Instrumentation.”

After this, the Steam Dump Valve SB-27 will slowly fail to FULL OPEN due to a valve positioner failure. The crew will enter AP/1/A/5500/01, “Steam Leak,” stabilize turbine load, attempt to close, and ultimately isolate the valve.

Next, a Zone 1B Lockout causes PCB 11 and 12 to open, as well as the 1B Main Generator Breaker to open and the turbine to automatically runback to 56%. The operator will implement AP/1/A/5500/03, “Load Rejection.” During the runback the operator will notice that the rods do not move in auto, and the operator will need to drive rods in manually. When the Control Rods are driven inward, one Control Bank D rod will stick in its original position. After stabilizing the plant, the operator will address AP/1/A/5500/14, “Rod Control Malfunction,” to address the Stuck Rod. The operator will address Technical Specification LCO 3.1.4, “Rod Group Alignment Limits,” and Technical Specification LCO 3.2.4, “Quadrant Power Tilt Ratio.”

Subsequently, 1KC-425, “NC Pumps Ret Hdr Cont Outside Isol),” will fail CLOSED. The operator will respond per OP/1/A/6100/010 G, “Annunciator Response for 1AD-6,” B1, A NC PUMP UPPER MTR BRG LO KC FLO, and manually open the valve. The operator may enter AP/1/A/5500/08, “Malfunction of NC Pump.”

Following this a steam break will occur on the Main Steam Equalization Header in the Turbine Building. Simultaneously all four MSIVs will fail OPEN resulting in four faulted Steam Generators (Both Auto and Manual actuations of MSI have failed). Additionally, the 1A/1B MD CA Pump will fail to start automatically. The operator will be expected to manually start the 1A MD CA Pump (The 1B MD CA Pump will fail to start manually, as well).

The crew will enter EP/1/A/5000/E-0, “Reactor Trip or Safety Injection” and transition to EP/1/A/5000/E-2, “Faulted Steam Generator Isolation.” On the other hand, due to the NCS cooldown, an Orange Path could exist on the NCS Integrity Critical Safety Function. If so, the crew will transition to EP/1/A/5000/FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition."

If the crew made the transition to E-2, the crew will transition to EP/1/A/5000/ECA-2.1 at Step 4 of E-2 when it is determined that all four Steam Generator pressures are lowering. On the other hand, if the crew transitions to FR-P.1, the crew will take the actions required by ECA-2.1, in FR-P.1 (i.e. reduce feed flow to each Steam Generator to 25 gpm each, depressurize NCS and terminate SI).

It is expected that the crew will eventually transition to EP/1/A/5000/FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition."

The scenario will terminate at Step 11.c of FR-P.1 after the operator has closed 1NI-9A and 10B.

<u>Critical Tasks:</u>

Establish 450 gpm of CA Flow to the Steam Generators during the performance of E-0 such that transition to EP/1/A/5000/FR-H.1 is not required.

Safety Significance: Failure to establish a Secondary Heat Sink through the initiation of CA flow unnecessarily challenges both the HEAT SINK and the CORE COOLING Critical Safety Functions. Additionally, the FSAR Safety Analysis results are predicated on the assumption that at least one train of safeguards actuates and delivers a minimum amount of AFW flow to the Steam Generators. Failure to perform this task, when the ability to do so exists, results in a violation of the Facility License Condition and places the plant in an unanalyzed condition.

Control the CA Flowrate to 25 gpm per SG in order to minimize the NC Cooldown rate in ECA-2.1 or FR-P.1.

Safety Significance: Failure to control the CA flow rate to the SGs, when able to do so, leads to an unnecessary and avoidable severe or extreme challenge to the Integrity CSF. Also, failure to perform the Critical Task increases challenges to the Subcriticality Critical Safety Function which otherwise would not occur. If the action can be taken, and is not taken, this demonstrates "mis-operation" or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).

SIMULATOR OPERATOR INSTRUCTIONS

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Sim. Setup	**Rod Step On**	
☐		**Reset to Temp IC 237**	**T = 0 Malfunctions:** **Initiate a Containment Release per Enclosure 4.2 of OP/1/A/6450/17.** **insert XMT-WL_1WLLT5591 = 100 (1WLL-5591, VUCDT Tank Level is OOS)** **insert REM-SA0001 = 0 (Steam 1B Supply to TDCA Pump Closed)** **insert REM-SA0002 = 0 (Steam 1C Supply to TDCA Pump Closed)** **insert OVR-1AD12_A04 = OFF (MCB Annunciator 1AD12/A4)** **<u>Per Lesson Plan 2016 NRC Exam Scenario 3</u>** **insertMAL-ISE006A = BLOCK_BOTH (MSI Fails in AUTO/MANUAL)** **insertMAL-ISE006B = BLOCK_BOTH (MSI Fails in AUTO/MANUAL)** **insertMAL-SM006A = TRUE 1A MSIV Fails OPEN (Cd = H_X01_094_2 EQ1 [1A Rx Trip Breaker OPEN light ON])** **insertMAL-SM006B = TRUE 1B MSIV Fails OPEN (Cd = H_X01_094_2 EQ1 [1A Rx Trip Breaker OPEN light ON])** **insertMAL-SM006C = TRUE 1C MSIV Fails OPEN (Cd = H_X01_094_2 EQ1 [1A Rx Trip Breaker OPEN light ON])** **insertMAL-SM006D = TRUE 1D MSIV Fails OPEN (Cd = H_X01_094_2 EQ1 [1A Rx Trip Breaker OPEN light ON])** **insert CA004A = AUTO (1A MD CA Pump fails to start in AUTO Only)** **insert CA004B = BOTH (1A MD CA Pump fails to start in AUTO and MANUAL)**

	Bench Mark	ACTIVITY	DESCRIPTION
☐		**RUN** **Reset all SLIMs**	**Place Tagout/O-Stick on:** **TDCA Pump (Tagout)** **1WLL-5591 (O-stick)** **MCB Annunciator 1AD-13, C-7 (O-stick)** **MCB Annunciator 1AD-12, A-4 (O-stick)**
☐		**Update** Status Board, **Setup OAC**	**NOTE:** RMWST DO = <1000 ppb.
☐		**Freeze.**	
☐		**Update Fresh Tech. Spec. Log.**	
☐		**Fill out the AO's Available section of Shift Turnover Info.**	
☐	Prior to Crew Briefing	**RUN**	
☐	**Crew Briefing**		

1. Assign Crew Positions based on evaluation requirements

2. Review the Shift Turnover Information with the crew.

3. Provide Enclosure 4.1 of OP/1/A/6100/003 marked up as follows:

   - Step 2.3 initialed.
   - Note prior to Step 3.1 checked.
   - Step 3.1 Checkbox is checked.
   - Step 3.2 initialed.
   - Step 3.3 initialed.
   - Step 3.3.1 Checkbox is checked.
   - Step 3.3.2 Checkbox is checked, Step 3.37.10 is entered.
   - Step 3.3.3 Checkbox is checked.
   - Step 3.3.4 Initialed.
   - Step 3.37.12 is NA.
   - Step 3.37.13 is NA.

4. Provide the crew with OP/1/A/6150/009 (Boron Concentration Control) and OP/1/A/6300/1 A (Turbine-Generator Load Change).

5. Direct the crew to Review the Control Boards taking note of present conditions, alarms.

6. Provide the crew with an “In-progress” copy of Enclosure 4.2 of OP/1/A/6450/17.

	Bench Mark	ACTIVITY	DESCRIPTION
☐	T-0	Begin Familiarization Period	
☐	At direction of examiner	**Execute Lesson Plan for Simulator Scenario N16-1-3.**	
☐	At direction of examiner	**Event 1**	Power Increase
☐	At direction of examiner	**Event 2** **insert XMT-NC_1NCLT5170 = 0**	Pzr Level Channel 3 fails LOW
☐	At direction of examiner	**Event 3** **Insert REM-SB0027 = 1, delay = 0, ramp = 120 seconds** **Cd=X02_183_1 EQ 1 (OFF/RESET Switch to OFF), insert REM-SB0027 = 0**	Steam Dump Valve fails OPEN
☐	At direction of examiner	**Event 4** **insert MAL-EP003C = ACTIVE** **insert MAL-IRE009 = FAIL_OF_AUTO** **Insert MAL IRE010D12 =TRUE**	Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod **NOTE: insertLOA-IPB003 Override when directed.**
☐	At direction of examiner	**Event 5** **Insert REM-KC0425A = 0** **dellA REM-KC0425A = 2, cd=X11_135_1=1**	1KC-425 fails CLOSED
☐	At direction of examiner	**Event 6** **insertMAL-SM009 = 16500000**	Steam Equalization Header Line Rupture

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Post-Rx Trip	**Event 7** **insertMAL-ISE006A** **insertMAL-ISE006B** **insertMAL-SM006A = TRUE** **insertMAL-SM006B = TRUE** **insertMAL-SM006C = TRUE** **insertMAL-SM006D = TRUE**	MSI fails in Auto/Manual/All MSIVs fail OPEN **Note: These Malfunctions are inserted at T=0**
☐	Post-Rx Trip	**Event 8** **insert CA004A = AUTO** **Set in initial conditions.**	1A MD CA Pumps fails to start in AUTO **This malfunction will occur on Reactor Trip.**
☐	Post-Rx Trip	**Event 9** **insert CA004B = AUTO** **Set in initial conditions.**	1B MD CA Pumps fails to start in AUTO/MANUAL **This malfunction will occur on Reactor Trip.**
☐	**Terminate the scenario upon direction of Lead Examiner**		

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	9 of 65
Event Description:		**Power Increase**					

Shortly after taking the watch, the operator will commence a load increase to 100% starting with Step 3.37.10 of Enclosure 4.1, Power Increase, of OP/1/A/6100/003, "Controlling Procedure for Unit Operation." The operator will dilute the NC System Boron concentration in accordance with Enclosure 4.3, "Dilute," of OP/1/A/6150/009, "Boron Concentration Control," and raise Turbine load in accordance with OP/1/A/6300/001 A, "Turbine-Generator Load Change."

Booth Operator Instructions: **NA**

Indications Available: **NA**

Time	Pos.	Expected Actions/Behavior	Comments
		OP/1/A/6100/003, CONTROLLING PROCEDURE FOR UNIT OPERATIONS ENCLOSURE 4.1, POWER INCREASE	
	CRS	(Step 3.37.10) Prior to increasing to greater than 75% RTP, check all governor valves open.	**NOTE:** The power increase will be at 3 MWe/minute.
	RO/ BOP	(Step 3.37.11) WHEN 77-80% RTP, enable, OTDT DCS alarming as follows:	**NOTE:** Based on the extent of the power increase, this action may or may not be taken.
		• On DCS graphics, select "MAINTENANCE MENU".	
		• Select "TAVG, DELTA T INPUTS & ALARM CHECKING" graphic.	
		• Select "ON" for the following:	
		• NCAA 5422	
		• NCAA 5462	
		• NCAA 5502	
		• NCAA 5542	
		• OTDELTAT-FAIL	
	CRS	(Step 3.37.12) IF startup from refueling outage…..	

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	10 of 65
Event Description:	**Power Increase**						

Time	Pos.	Expected Actions/Behavior	Comments
		(Step 3.37.13) IF performing Generator/Automatic Voltage Regulator (AVR) testing at 78% RTP…	
		OP/1/A/6150/009, BORON CONCENTRATION CONTROL ENCLOSURE 4.3, DILUTE	
	BOP	(Step 3.1) Evaluate all outstanding R&RS that may impact performance of this procedure.	**NOTE:** The CRS may call WCC to address the R&Rs. If so, **Booth Instructor** acknowledge as WCC, and report none.
	BOP	(Step 3.2) IF the lowest NCP seal leakoff is less than 2 gpm…	**NOTE:** All NCP Seal leakoffs are normal.
	BOP	(Step 3.3) Evaluate energizing additional pressurizer heaters per OP/1/A/6100/003 (Controlling Procedure For Unit Operation) to enhance system mixing when changing NC System boron concentration. (R.M.)	
	BOP	(Step 3.4) Determine amount of reactor makeup water needed to obtain desired boron concentration using McGuire Data Book, OAC, Reactor Group Guidance, or plant parameters (T-Ave. Steam Pressure, Xenon worth, etc.). (R.M.)	**NOTE:** The BOP will add 200 gallons of MU Water.
		• Total Reactor Makeup Water:	
	BOP	(Step 3.5) Ensure the following reset to zero: (R.M.)	
		• Total Make Up Flow Counter	
		• Boric Acid Flow Counter	
	BOP	(Step 3.6) Set Total Make Up Flow Counter to value determined in Step 3.4.	

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	11	of	65
Event Description:		**Power Increase**							

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3.7) Select “DILUTE” on “NC Sys M/U Controller”.	
	BOP	(Step 3.8) IF AT ANY TIME it is desired to adjust reactor makeup water flow, adjust “Rx M/U Water Flow Control” setpoint to achieve desired flowrate.	
	BOP	(Step 3.9) IF AT ANY TIME it is desired to manually adjust reactor makeup water flow, perform the following:	
		• Place “Rx M/U Water Flow Control” in manual.	
		• Adjust “Rx M/U Water Flow Control” output to control reactor makeup water flowrate.	
	BOP	(Step 3.10) IF AT ANY TIME it is desired to lower VCT level, perform the following:	
		• Monitor Letdown Pressure.	
		• Select “HUT” on 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl).	
		• IF Letdown Pressure increases greater than 20 psig, notify CRS.	
		• AFTER desired level achieved, select “AUTO” on 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl).	
	BOP	(Step 3.11) IF AT ANY TIME plant parameters require termination of dilution, perform the following:	
		• Place “NC System Make Up” to “STOP”. (R.M.)	
		• IF 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl) placed to HUT, place to “AUTO”.	

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	12 of 65
Event Description:	**Power Increase**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3.12) Momentarily select "START" on "NC System Make Up". (R.M.)	
	BOP	(Step 3.13) Check "NC System Make Up" red light lit.	
	BOP	(Step 3.14) Check 1NV-171A (U1 Boric Acid Blender to VCT Inlet Control) open.	
	BOP	(Step 3.15) Check 1NV-252A (Rx M/U Water Supply To U1 BA Blender Cntrl) open or throttled as required.	
	BOP	(Step 3.16) Check Rx M/U Water Pump start.	
	BOP	(Step 3.17) Monitor Total Make Up Flow Counter. (R.M.)	
	BOP	(Step 3.18) HOLD until one of the following occurs:	
		• Amount of reactor makeup recorded per Step 3.4 added	
		• Reactor makeup water addition manually terminated	
	BOP	(Step 3.19) Ensure dilution terminated as follows: (R.M.)	
		• IF in "AUTO", ensure the following off:	
		• 1A Rx M.U Water Pump	
		• 1B Rx M/U Water Pump	
		• Ensure the following closed:	
		• 1NV-171A (U1 Boric Acid Blender to VCT Inlet Control)	

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	13 of 65
Event Description:	**Power Increase**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1NV-252A (Rx M/U Water Supply To U1 BA Blender Cntrl)	
	BOP	(Step 3.20) Ensure “Rx M/U Water Flow Control” in auto. (R.M.)	
	BOP	(Step 3.21) IF “Rx M/U Water Flow Control” adjusted per Step 3.8 OR Step 3.9…	
	BOP	(Step 3.22) Ensure 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl) in “AUTO”.	
	BOP	(Step 3.23) IF desired to flush blender, go to…	
	BOP	(Step 3.24) Select “AUTO” for “NC Sys M/U Controller”.	
	BOP	(Step 3.25) Momentarily select “START” on “NC System Make Up”.	
	BOP	(Step 3.26) Check “NC System Make Up” red light lit.	
	BOP	(Step 3.27) Ensure the following reset to zero:	
		• Total Make Up Flow Counter	
		• Boric Acid Flow Counter	
	BOP	(Step 3.28) Record in Auto Log that final blender content is Rx Makeup Water.	
			NOTE: The BOP may repeat this task as needed during the power increase.

Op Test No.:	N16-1	Scenario #	3	Event #	1	Page	14 of 65
Event Description:		**Power Increase**					

Time	Pos.	Expected Actions/Behavior	Comments
OP/1/A/6300/001A, TURBINE-GENERATOR STARTUP/SHUTDOWN ENCLOSURE 4.1, TURBINE-GENERATOR LOAD CHANGE			
	RO	(Step 3.5) Changing Turbine Load	
		(Step 3.5.1) IF Turbine in "OPERATOR AUTO", perform the following:	
		• (Step 3.5.1.1) Ensure desired change within "Calculated Capability Curve".	
		• (Step 3.5.1.2) IF turbine load will increase or decrease more than 10 MWs, notify Dispatcher of expected load change.	
		• (Step 3.5.1.3) Depress "LOAD RATE".	
		• (Step 3.5.1.4) Enter desired load rate in "VARIABLE DISPLAY".	**NOTE:** the RO will select 3 MWe/Min loading rate.
		• (Step 3.5.1.5) Depress "ENTER".	
		• (Step 3.5.1.6) Depress "REFERENCE".	
		• (Step 3.5.1.7) Enter desired load in "VARIABLE DISPLAY".	
		• (Step 3.5.1.8) Depress "ENTER".	
		• (Step 3.5.1.9) Depress "GO"	
		• (Step 3.5.1.10) Check load changes at selected rate.	
OP/1/A/6100/003, CONTROLLING PROCEDURE FOR UNIT OPERATIONS ENCLOSURE 4.1, POWER INCREASE			
	CRS	(Step 3.37.14) Continue power increase to 95% RTP.	**NOTE:** The power increase will be at 3 MWe/minute.
At the discretion of the Lead Examiner move to Event #2.			

Op Test No.:	N16-1	Scenario #	3	Event #	2	Page	15 of 65
Event Description:	**Pzr Level Channel 3 fails LOW**						

During the power increase, Pzr Level channel 3 will fail LOW. The DCS will automatically select a non-failed instrument to replace the failed instrument as the controlling channel, and no NCS inventory control upset will result. The operator will address Technical Specification LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation."

Booth Operator Instructions: **insert XMT-NC_1NCLT5170 = 0**

Indications Available:

- MCB Annunciator 1AD-2 E8, DCS TROUBLE
- OAC Alarm M1A0976, U1 PZR LEVEL III
- 1NCP-5172, Pzr Level Channel 3 indicates 0%
- DCS Alarm Screen: PZR LVL INPUT TRBL
- Yellow Path on RCS Inventory

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The RO will likely go to HOLD on the Turbine.
			NOTE: The DCS will auto select a non-failed instrument to control the Pzr level system. The CRS will evaluate the effect of the failure on Technical specifications.
		TECHNICAL SPECIFICATION 3.3.1, REACTOR TRIP SYSTEM (RTS) INSTRUMENTATION	
	CRS	LCO 3.3.1 The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.	**NOTE:** The CRS will determine that Function 9 (Pzr Water Level High) of Table 3.3.1-1 is affected by this failure.
	CRS	APPLICABILITY: According to Table 3.3.1-1.	
	CRS	ACTIONS	

Op Test No.:	N16-1	Scenario #	3	Event #	2	Page	16 of 65	
Event Description:		**Pzr Level Channel 3 fails LOW**						

Time	Pos.	Expected Actions/Behavior			Comments
		CONDITION	REQUIRED ACTION	COMPLETION TIME	
		A. One or more Functions with one or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.1-1 for the channel(s).	Immediately	**NOTE:** The CRS will determine that ACTION A.1 must be entered.
		M. One channel inoperable.	M.1 Place channel in trip. OR M.2 Reduce THERMAL POWER to < P-7.	72 hours 78 hours	**NOTE:** The CRS will determine that ACTION M.1 must be entered.
					NOTE: The CRS may call WCC/IAE to address. If so, **Booth Instructor** acknowledge as **WCC/IAE.**
					NOTE: The CRS will likely conduct a Focus Brief.
					NOTE: The CRS will likely re-initiate the power increase.

At the discretion of the Lead Examiner move to Event #3.

Op Test No.:	N16-1	Scenario #	3	Event #	3	Page	17 of	65
Event Description:	Steam Dump Valve fails OPEN							

After this, the Steam Dump Valve SB-27 will slowly fail to FULL OPEN due to a valve positioner failure. The crew will enter AP/1/A/5500/01, "Steam Leak," stabilize turbine load, attempt to close, and ultimately isolate the valve.

Booth Operator Instructions:

Insert REM-SB0027 = 1, delay = 0, ramp = 120 seconds

Cd=X02_183_1 EQ 1 (OFF/RESET Switch to OFF), insert REM-SB0027 = 0

Indications Available:

- 1SB-27 Red status light LIT
- Tavg-Tref deviation rising
- Rods stepping out in AUTO
- Rx Power rising

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The RO will likely go to HOLD on the Turbine, and terminate any dilution in progress.
		CONTROL ROOM CREW EXPECTATIONS MANUAL	
	RO	Transient load changes: Manual is preferred – immediately reduce 20MWe and then reduce as needed to maintain Rx power less than pre-transient condition. After the initial 20 MWe load reduction, it is preferred that the operators use multiple and diverse indications to determine how much more load should be reduced. TPBE on the OAC updates once per minute. Other indications (PR meters and Delta T meters) will indicate reactor response more quickly and will enable the operators to control the plant even more precisely. (This combines the Operator Fundamental of Conservatism and Controlling Plant Evolutions Precisely).	**NOTE:** The crew may diagnose an overpower condition and adjust turbine load per the Crew Expectation Manual.
			NOTE: It is likely that the operator will take actions to isolate the Steam Dump Valve prior to being directed by the CRS. (Step 13)

Op Test No.: N16-1	Scenario # 3	Event # 3	Page 18 of 65		
Event Description:	Steam Dump Valve fails OPEN				

Time	Pos.	Expected Actions/Behavior	Comments
AP/1/A/5500/01, STEAM LEAK			
	CRS	(Step 1) Monitor Foldout page.	
		Manual Reactor Trip Criteria: (IF any of the following occur: (1) Steam leak is jeopardizing personnel safety or plant equipment, (2) T-Avg is less than 551°F AND going down, or (3) UST level is less than 1 ft – NOT Expected).	
	RO	(Step 2) Reduce turbine load to maintain the following:	
		• Excore NI's – LESS THAN OR EQUAL TO 100%.	
		• NC Loop D/T's – LESS THAN 60°F D/T	
		• T-Avg – AT T-REF.	
	CRS	(Step 3) Check containment entry – IN PROGRESS.	**NOTE:** A Containment Entry is NOT in progress.
	CRS	(Step 3 RNO) GO TO Step 5.	
	BOP	(Step 5) Check Pzr pressure prior to event – GREATER THAN P-11 (1955 PSIG).	
	BOP	(Step 6) Check Pzr level – STABLE OR GOING UP.	
	BOP	(Step 7) IF AT ANY TIME while in this procedure Pzr level cannot be maintained stable, THEN RETURN TO Step 6.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 8) GO TO Step 12.	

Op Test No.:	N16-1	Scenario #	3	Event #	3	Page	19 of 65
Event Description:	**Steam Dump Valve fails OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 12) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 13) Identify and isolate leak on Unit 1 as follows:	
		• (Step 13a) Check SM PORVs – CLOSED.	
	RO	• (Step 13.b) Check condenser dump valves – CLOSED.	**NOTE:** Steam Dump Valve 1SB-27 was likely closed at the onset of the event. If NOT, it will be closed here.
	RO	(Step 13b RNO) IF steam dumps required to be closed, THEN perform the following:	
		• Select “OFF RESET” on the following switches:	**NOTE:** Selecting OFF/RESET will close the valve.
		• “STEAM DUMP INTLK BYPASS CHANNEL A”	
		• “STEAM DUMP INTLK BYPASS CHANNEL B”	
		• IF valve will not close, THEN dispatch operator to CLOSE condenser dump valve isolation valve.	**NOTE:** The CRS may dispatch an operator to close the isolation valve. **Booth Instructor** acknowledge as AO. **After 2 Minutes report that the SB-27 inlet isolation valve has been CLOSED (NO LOA).**
	RO	• WHEN leaking condenser dump valve is isolated OR repaired, THEN return the following switches to “ON”:	
		• “STEAM DUMP INTLK BYPASS CHANNEL A”	
		• “STEAM DUMP INTLK BYPASS CHANNEL B”.	

Op Test No.:	N16-1	Scenario #	3	Event #	3	Page	20 of 65
Event Description:	**Steam Dump Valve fails OPEN**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• (Step 13.c) Check containment conditions – NORMAL:	
		• Containment temperature	
		• Containment pressure	
		• Containment humidity	
		• Containment floor and equipment sump level.	
	RO / BOP	• (Step 13.d) Check TD CA pump – OFF.	
	BOP	• (Step 13.e) Check valves on "STEAM LINE DRAIN VALVES" board (1MC-9) – CLOSED.	**NOTE:** One or more of these valves may be cycling. The RNO will direct closing the valves.
	CRS	• (Step 13.f) Check opposite Unit (Unit 2) "STEAM HEADER PRESSURE" – GREATER THAN 200 PSIG.	**NOTE:** CRS may ask U2 RO for AS Header pressure. If so, **Floor Instructor** report as **U2 RO that U2 Steam Header pressure** is **≈1000 psig**.
		• (Step 13.g) Dispatch operator to check for leaks.	**NOTE:** The CRS may dispatch an AO to look for leaks. If so, **Floor Instructor:** acknowledge. **Booth Instructor:** Report back in 3-5 minutes that there are no leaks.
			NOTE: The CRS may NOT dispatch AOs to look for leaks because it is understood that the Steam Dump valve opening was the reason that AP-1 was entered.
	BOP	(Step 14) Check UST level – STABLE OR GOING UP.	
	CRS	(Step 15) Evaluate unit shutdown as follows:	
		• Check unit status – IN MODE 1 OR 2.	

Op Test No.:	N16-1	Scenario # 3	Event # 3	Page 21 of 65	
Event Description:	**Steam Dump Valve fails OPEN**				

Time	Pos.	Expected Actions/Behavior	Comments
		• Determine if unit shutdown or load reduction is warranted based on the following criteria:	**NOTE:** CRS may call WCC/Management to address the startup. If so, **Booth Instructor** acknowledge as WCC.
		• Size of leak	
		• Location of leak	
		• Rate of depletion of secondary inventory	
		• IF steam is leaking from a secondary heater relief OR MSR relief valve, THEN reducing turbine load….	**NOTE:** No Relief Valve is leaking.
		• IF turbine trip will isolate steam leak (such as feedwater heater leak or MSR leak)…	**NOTE:** A Turbine Trip is NOT needed to isolate the steam leak.
		• Check unit shutdown or load reduction – REQUIRED.	**NOTE:** Shutdown/Load Reduction will NOT be required.
	CRS	(Step 15.c RNO) Perform the following:	
		• Maintain present plant conditions until leak can be isolated or repaired.	
		• Exit this procedure.	**NOTE:** The CRS will likely conduct a Focus Brief.
			NOTE: The CRS may address Tech Specs based on plant response.
TECHNICAL SPECIFICATION 3.4.1, RCS PRESSURE, TEMPERATURE, AND FLOW DEPARTURE FROM NUCLEATE BOILING (DNB) LIMITS			
	CRS	LCO 3.4.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the limits specified in Table 3.4.1-1.	**NOTE:** If NC System Pressure drops to < 2216 psig on the failure, then TS 3.4.1 might be entered and exited during the transient.
	CRS	APPLICABILITY: MODE 1.	

Op Test No.:	N16-1	Scenario #	3	Event #	3	Page	22 of 65
Event Description:	**Steam Dump Valve fails OPEN**						

Time	Pos.	Expected Actions/Behavior			Comments
	CRS	ACTIONS			
		CONDITION	REQUIRED ACTION	COMPLETION TIME	
		A. Pressurizer pressure or RCS average temperature DNB parameters not within limits.	A.1 Restore DNB parameter(s) to within limit.	2 hours	
At the discretion of the Lead Examiner move to Event #4.					

Op Test No.: N16-1 Scenario # 3 Event # 4	Page 23 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

Next, a Zone 1B Lockout causes PCB 11 and 12 to open, as well as the 1B Main Generator Breaker to open and the turbine to automatically runback to 56%. The operator will implement AP/1/A/5500/03, “Load Rejection.” During the runback the operator will notice that the rods do not move in auto, and the operator will need to drive rods in manually. When the Control Rods are driven inward, one Control Bank D rod will stick in its original position. After stabilizing the plant, the operator will address AP/1/A/5500/14, “Rod Control Malfunction,” to address the Stuck Rod. The operator will address Technical Specification LCO 3.1.4, “Rod Group Alignment Limits,” and Technical Specification LCO 3.2.4, “Quadrant Power Tilt Ratio.”

Booth Operator Instructions:	**insert MAL-EP003C = ACTIVE delay = 10 seconds** **insert MAL-IRE009 = FAIL_OF_AUTO** **insert MAL IRE010D12 = TRUE**

Indications Available:

- MCB Annunciator 1AD-1, D6, DEH TURBINE RUNBACK, alarms.
- Turbine Generator MWe lowering.
- Tavg-Tref deviation with no Auto Rod motion.
- MCB Annunciator 1AD-11, K3, UNIT 1 LOCKOUT, alarms.
- 1 of 2 Main Generator Breakers is OPEN.
- PCB-11 and 12 OPEN.

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/03, LOAD REJECTION	
	RO	(Step 1) Ensure control rods in auto.	**Immediate Action** **NOTE:** While the RO will see that the Control Rods are in AUTO, it will also be observed that Rods are NOT moving, and that they are required to move. The RO will inform the CRS of the situation, and the CRS will direct that the RO control the rods in MANUAL to maintain Tavg-Tref.

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	24 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 2) Check Turbine Generator response as follows:	
		• Check Generator – TIED TO GRID.	
		• Check Generator output – GOING DOWN AS REQUIRED.	
	RO	(Step 3) Check control rod response as follows:	
		• Check control banks – MOVING IN AS REQUIRED.	**NOTE:** The Control Rods will NOT be moving in as required.
	RO	(Step 3a RNO) IF no rods will move in auto; THEN perform the following:	
		• Place Control Rods in manual.	
		• Insert rods to reduce T-avg equal to programmed T-Ref.	
		• If no rods will move, THEN…..	**NOTE:** The Control Rods will move in MANUAL.
	RO	• Check all rods – ALIGNED WITH ASSOCIATED BANK.	
	RO	(Step 3b RNO) IF two or more control rods are misaligned greater that 24 steps…	**NOTE:** Only one Control Rod (D12) is misaligned from Group D.
	BOP	(Step 4) Check CM system response as follows:	
		• Standby Hotwell and Condensate Booster pumps – RUNNING.	
		• 1CM-420 (Unit 1 Generator Load Rejection Bypass control) – OPEN.	

Op Test No.: N16-1	Scenario # 3	Event # 4	Page 25 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**		

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 5) IF runback to 55% power in effect, THEN ensure turbine inlet pressure going down to less than or equal to 500 PSIG.	
	CRS	(Step 6) Announce: “UNIT 1 LOAD REJECTION, NON-ESSENTIAL PERSONNEL STAY OUT OF UNIT 1 TURBINE BLDG”.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that AP-3 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 7) Check P/R meters – LESS THAN 20%.	
	CRS / RO	(Step 7 RNO) Perform the following:	
		• Designate an operator to continuously monitor reactor power.	
		• IF AT ANY TIME reactor power is less than 20%, THEN perform Step 8 to stabilize reactor power.	**NOTE:** This is a Continuous Action. The CRS will designate the RO to observe this action.
	CRS	• GO TO Step 9.	
	RO	(Step 9) Check condenser dump valves – MODULATING OPEN.	**NOTE:** If the crew did not place Steam Dumps back in service, they will need to perform the RNO, and place Steam Dumps in the Steam Pressure Mode. Otherwise, the crew will go to Step 10.

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	26 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 9 RNO) IF T-Avg is greater than 4°F above T-Ref, THEN transfer steam dumps to steam pressure mode as follows:	**NOTE:** Depending on Tavg-Tref mismatch, the operator may or may not place the Steam Dumps in the Steam Pressure Mode.
		• Ensure "STM PRESS CONTROLLER" setpoint at 1090-1095 PSIG.	
		• Place "STM PRESS CONTROLLER" in manual.	
		• Adjust "STM PRESS CONTROLLER" output to 0%.	
		• Using "STEAM DUMP SELECT" switch, place steam dumps in steam pressure mode.	
		• IF "STEAM HEADER PRESSURE" is greater than 1100 PSIG, THEN manually OPEN steam dumps to control pressure 1090-1095 PSIG.	
		• Place "STM PRESS CONTROLLER" in auto.	
	BOP	(Step 10) Check “IPB AIR FLOW TROUBLE” alarm (1AD-11, J-5) – DARK.	
	RO	(Step 10 RNO) within 15 minutes of lockout initiation, restore 1PB cooling as follows:	
		• IF “MAIN GENERATOR” less than 10,000 amps…	**NOTE:** The Main Generator is NOT < 10,000 amps.
	CRS	• Dispatch operator to check the following areas for signs of fire and notify Control Room of results within 5 minutes:	**NOTE:** The CRS will dispatch an AO.
		• 1A Main Step Up Transformer	
		• 1B Main Step Up Transformer	
		• Unit 1 IPB Fan Enclosure area.	

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	27	of	65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**								

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	• Record approximate time lockout occurred.	
	CRS	• Do not continue until operator has been given sufficient time (approximately 5 minutes) to complete fire inspection.	**Booth Instructor**: Within **3 minutes,** as **AO** report that **there does NOT appear to be a fire around the transformers or IPB Fan area.**
	CRS	• IF operator confirms a fire has occurred…	**NOTE:** No fire has occurred.
	CRS	• IF operator confirms no fire has occurred, THEN dispatch operator to perform the following at the Unit 1 “IPB ALARM PANEL”:	**NOTE:** The CRS will dispatch an AO.
		• Depress “LOCKOUT OVERRIDE” on the fan in “MAN”.	**Booth Instructor: Insert LOA-IPB003 = OVERRIDE**
		• IF IPB fan in “MAN cannot be started, …	**Booth Instructor**: Within **3 minutes,** as **AO** report that **the Lockout Override has been pressed, and the 1A IPB Fan is running.**
	CRS	• IF neither IPB fan can be started, …….	**NOTE:** The 1A IPB Fan is running.
	BOP	(Step 11) Check Pzr pressure control response as follows:	
		• Ensure Pzr heaters are in auto.	
		• Ensure Pzr spray control valves are in auto.	
		• Check Pzr PORVs – CLOSED.	

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	28	of	65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**								

Time	Pos.	Expected Actions/Behavior	Comments
		• Check Pzr spray control valves - CLOSED	
	RO	(Step 12) Check load rejection – DUE TO LOSS OF CF PUMP.	**NOTE:** The load rejection was NOT due to a Loss of CF Pump.
	CRS	(Step 12 RNO) GO TO Step 15	
	RO	(Step 15) Check turbine inlet pressure – LESS THAN 340 PSIG.	**NOTE:** Turbine Inlet pressure is ≈ 470 psig.
	RO	(Step 15 RNO) Perform the following:	
		• IF AT ANY TIME turbine inlet pressure drops to less than 340 PSIG, THEN GO TO Step 16.	
	CRS	• GO TO Step 19.	
	RO	(Step 19) Check Main Generator as follows:	
		• Check Generator Breakers – EITHER GENERATOR BREAKERS CLOSED.	
		• Check Generator – TIED TO GRID.	
		• Check generator power factor – 0.9 TO 1.0 LAGGING.	
	CRS	• GO TO Step 20.	
	CRS	(Step 20) Ensure the following have been implemented:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
		• RP/0/A/5700/000 (Classification of Emergency)	

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	29 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**						

Time	Pos.	Expected Actions/Behavior	Comments
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	RO	(Step 21) WHEN transient is over, THEN perform the following:	
		• Check reactor power – GREATER THAN 40%.	
		• Check the following on in service CF pump(s):	
		• Low pressure governor control – IN AUTO	
		• High pressure governor control – IN AUTO.	
		• Check SM flow on all S/Gs – LESS THAN 75%.	**NOTE:** SM flow is ≈ 55%.
		• Check SM flow on all S/Gs – LESS THAN 25%.	
	RO	(Step 21d RNO) Perform the following:	
		• Check the following CF control bypass valves – CLOSED:	
		• 1CF-104AB (1A S/G CF Control Bypass) - CLOSED	
		• 1CF-105AB (1B S/G CF Control Bypass) - CLOSED	
		• 1CF-106AB (1C S/G CF Control Bypass) - CLOSED	
		• 1CF-107AB (1D S/G CF Control Bypass) - CLOSED	
	RO	• IF any CF control bypass valve is open…	**NOTE:** All CF control bypass valves are closed.
	CRS	• GO TO Step 21.f.	

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	30 of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	• Slowly CLOSE 1CM-420 (Unit 1 Generator Load Rejection Bypass Control) while monitoring Condensate Booster pump suction pressure.	**NOTE:** The BOP will close 1CM-420.
		• WHEN 1CM-420 is closed, THEN check load rejection signal reset (OAC turn on code “CM”).	
		• Reposition manual loader for 1CM-420 to 100% OPEN.	**NOTE:** The BOP will open 1CM-420.
		• IF thermal power is greater than 15%, THEN within 4 hours of reaching stable conditions, ensure each power range channel is within 2% of heat balance.	
		• Check T-Avg – GREATER THAN 561°F.	
		• Check “CONTROL ROD BANK LO LO LIMIT” alarm (1AD-2, B-9) – DARK.	
		• Check “CONTROL ROD BANK LO LIMIT” alarm (1AD-2, A-9) – DARK.	**NOTE:** 1AD-2, A-9 may be LIT. If so, the operator will perform Step 21.I RNO.
			NOTE: The CRS may direct the U2 BOP to conduct a SDM calculation. If so, Floor Instructor acknowledge.
	RO	(Step 21.I RNO) Ensure the “CONTROL ROD BANK LO LIMIT” alarm clears as Xenon builds in.	
	RO	(Step 22) Check load rejection – DUE TO LOSS OF CF PUMP.	**NOTE:** The load rejection was NOT due to a Loss of CF Pump.
	CRS	(Step 22 RNO) GO TO Step 24.	

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	31	of 65
Event Description:	**Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**							

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 24) Shutdown unnecessary running plant equipment as follows:	**NOTE:** The CRS may transition to AP-14 based on the failure of Rods to move in AUTO, and the stuck rod.
	BOP	• Condensate Booster pumps and place in auto.	**NOTE:** The BOP may stop one Condensate Booster Pump.
		• Hotwell pumps and place in auto.	**NOTE:** The BOP may stop one Hotwell Pump.
		• IF desired to secure, THEN dispatch operator to shutdown PER OP/1/B/6250/004 (Feedwater Heater Vents, Drains and Bleed System) Enclosure 4.2 (System Shutdown) the following:	
		• Unit 1 C Heater Drain Tank pumps	
		• Unit 1 G Heater Drain Tank pumps.	
	CRS	(Step 25) IF power change greater than 15% in one hour, THEN notify Primary Chemistry to perform required Tech Spec sampling.	**NOTE:** The CRS may call Chemistry to address the power decrease. If so, **Booth Instructor** acknowledge as Chemistry.
	RO	(Step 26) WHEN condenser dump valves closed AND no longer required for temperature control, THEN reset C-7A using "STEAM DUMP SELECT" switch.	
			NOTE: The CRS may transition to AP-14 based on the failure of Rods to move in AUTO, and the stuck rod, or assign the RO to perform AP14 simultaneously with AP3.

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	32	of	65

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/14, ROD CONTROL MALFUNCTION	
	RO	(Step 1) IF two or more rods are either dropped OR misaligned by great than 24 steps,…	**Immediate Action** **NOTE:** Only one Rod is misaligned during this event.
	RO	(Step 2) Place control rods in manual.	**Immediate Action** **NOTE:** The RO will place the rods in Manual.
	RO	(Step 3) Check rod movement – STOPPED.	**Immediate Action**
	RO	(Step 4) Check all rods – ALIGNED WITH ASSOCIATED BANK.	
	RO	(Step 4 RNO) Perform the following.	
		• IF misaligned rod(s) due to DRPI indication failure only,…	**NOTE:** Only one rod is misaligned.
		• IF T-Avg has gone down,…..	**NOTE:** The RO may adjust load on the Turbine to maintain Tavg-Tref = 1°F.
		• GO TO Enclosure 1 (Response To Dropped or Misaligned Rod)	
			NOTE: The CRS will transition to Enclosure 1.
		AP/1/A/5500/14, ROD CONTROL MALFUNCTION **ENCLOSURE 1, RESPONSE TO DROPPED OR MISALIGNED ROD**	
	CRS	(Step 1) Announce occurrence on paging system.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement that AP-14 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	33 of	65

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 2) Dispatch rod control system qualified IAE to perform the following:	**NOTE:** The CRS may call WCC/IAE to address. If so, **Booth Instructor** acknowledge as **WCC/IAE**. After **2-3 Minutes** call as **IAE** and report that **Control Rod D-12 has a Blown Lift Coil Fuse**.
		• Correct cause of misaligned rod.	
		• Notify Control Room operators when auto or manual rod motion is available for reactivity control.	
	RO	(Step 3) Do not move rods until IAE determines rod movement is available.	
	CRS	(Step 4) IF AT ANY TIME a runback occurs while in this procedure, THEN …..	**NOTE:** A runback has already occurred, and the Control Rods have been moved in MANUAL.
	RO	(Step 5) Check "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10) – DARK.	
	RO	(Step 6) Use OAC point M1P1385 (Reactor Thermal Power, Best Estimate) to determine reactor power in subsequent steps.	
	RO	(Step 7) Check AFD (Tech Spec 3.2.3) – WITHIN TECH SPEC LIMITS.	
	CRS	(Step 8) REFER TO the following Tech Specs while continuing in the enclosure:	
		• Tech Spec 3.1.4 (Rod Group Alignment Limits).	**NOTE:** The CRS may check the TS now and conclude that LCO 3.1.4 must be entered.

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page	34 of 65

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td></td><td></td><td colspan="3">• Tech Spec 3.1.5 (Shutdown Bank Insertion Limits).</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">• Tech Spec 3.1.6 (Control Bank Insertion Limits).</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">• Tech Spec 3.2.4 (QPTR)</td><td>NOTE: The CRS may check the TS now and conclude that LCO 3.2.4 must be entered.</td></tr>
<tr><td></td><td></td><td colspan="3">• Ensure shutdown margin calculation is performed within 1 hour.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td>Examiner NOTE: It is intended that the CRS evaluate the TS at this point. If the CRS requests the WCC evaluate the TS, and continues with Enclosure 1 of AP14, move to the next event, and evaluate the TS after the exam has been completed.</td></tr>
<tr><td colspan="6">TECHNICAL SPECIFICATION 3.1.4, ROD GROUP ALIGNMENT LIMITS</td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">LCO 3.1.4 All shutdown and control rods shall be OPERABLE, with all individual indicated rod positions within 12 steps of their group step counter demand position.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">APPLICABILITY: MODES 1 and 2.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td></td><td colspan="3">ACTIONS</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td></td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td></td></tr>
</table>

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page 35 of 65

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

Time	Pos.	Expected Actions/Behavior			Comments
		B. One rod not within alignment limits.	B.1 Restore rod to within alignment limits. OR B.2.1.1 Verify SDM is within the limit specified in the COLR. OR B.2.1.2 Initiate boration to restore SDM to within limit. AND B.2.2 Reduce THERMAL POWER to ≤ 75% RTP. AND B.2.3 Verify SDM is within the limit specified in the COLR. AND B.2.4 Perform SR 3.2.1.1. AND B.2.5 Perform SR 3.2.2.1. AND B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.	1 hour 1 hour 1 hour 2 hours Once per 12 hours 72 hours 72 hours 5 days	**NOTE:** The CRS will determine that ACTION B.1, B.2.1.1, or B.2.1.2, B.2.2, B.2.3, B.2.4, B.2.5 and B.2.6 must be entered.
TECHNICAL SPECIFICATION 3.2.4, QUADRANT POWER TILT RATIO					
	CRS	LCO 3.2.4 The QPTR shall be ≤1.02.			

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>CRS</td><td colspan="3">APPLICABILITY: MODES 1 with THERMAL POWER >50% RTP.</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td></td><td colspan="3">ACTIONS</td><td></td></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td></td><td></td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td rowspan="2">NOTE: The CRS will determine that ACTIONs A.1 through A.7 must be entered as long as reactor power remains > 50%.</td></tr>
<tr><td></td><td></td><td>A. QPTR not within limit.</td><td>A.1 Reduce THERMAL POWER ≥3% from RTP for each 1% of QPTR >1.02.

<u>AND</u>

A.2 Perform SR 3.2.4.1 and reduce THERMAL POWER ≥3% from RTP for each 1% of QPTR >1.02.

<u>AND</u>

A.3 Perform SR 3.2.1.1 and SR 3.2.2.1.

<u>AND</u>

A.4 Reduce Power Range Neutron Flux – High Trip Setpoint ≥3% for each 1% of QPTR > 1.02.
<u>AND</u>
A.5 Reevaluate safety analyses and confirm results</td><td>2 hours

Once per 12 hours

24 hours

<u>AND</u>

Once per 7 days thereafter

72 hours

Prior to increasing THERMAL POWER above</td></tr>
</table>

Op Test No.:	N16-1	Scenario #	3	Event #	4	Page 37 of 65

Event Description: **Zone 1B Lockout causing Runback/Rods fail to move in AUTO/Stuck Rod**

Time	Pos.	Expected Actions/Behavior			Comments
			remain valid for duration of operation under this condition. AND A.6 Calibrate excore detectors to show zero QPT. AND A.7 Perform SR 3.2.1.1 and SR 3.2.2.1.	the more restrictive limit of Required Action A.1 or A.2 Prior to increasing THERMAL POWER above the more restrictive limit of Required Action A.1 or A.2 Within 24 hours after reaching RTP OR Within 48 hours after increasing THERMAL POWER above the more restrictive limit of Required Action A.1 or A.2	
					NOTE: The CRS will likely conduct a Focus Brief.

At the discretion of the Lead Examiner move to Event #5.

Op Test No.: N16-1	Scenario # 3	Event # 5	Page 38 of 65
Event Description:	**1KC-425 fails CLOSED**		

Subsequently, 1KC-425, "NC Pumps Ret Hdr Cont Outside Isol)," will fail CLOSED. The operator will respond per OP/1/A/6100/010 G, "Annunciator Response for 1AD-6," B1, A NC PUMP UPPER MTR BRG LO KC FLO, and manually open the valve. The operator may enter AP/1/A/5500/08, "Malfunction of NC Pump."

Booth Operator Instructions: **Insert REM-KC0425A = 0**

delIA REM-KC0425A = 2, cd=X11_135_1=1

Indications Available:

- 1KC-425 Green status light LIT, Red status light OFF
- MCB Annunciator 1AD-6, B1-4, A-D NC PUMP UPPER MTR BRG LO KC FLO, alarms
- MCB Annunciator 1AD-6, D1-4, A-D NC PUMP LOWER MTR BRG LO KC FLO, alarms
- OAC Alarm M1Q1320, 1KC425A NC PMPS RET HDR CONT OUTSIDE ISOL CLOSED

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The BOP may recognize that 1KC-425A is in Mid-Position, and attempt to OPEN the valve. If so, the valve will OPEN.
		1AD-6, B1, A NC PUMP UPPER MTR BRG LO KC FLO	
	CRS	(IA Step 1) IF loss of KC, go to AP/1/A/5500/021 (Loss of KC or KC System Leak).	**NOTE:** The KC System is operating as expected.
	BOP	(IA Step 2) Check open:	
		1KC-338B (NC Pump Sup Hdr Cont Outside Isol)	
		1KC-424B (NC Pumps Ret Hdr Cont Inside Isol)	
		1KC-425A (NC Pumps Ret Hdr Cont Outside Isol)	**NOTE:** 1KC-425A has inadvertently closed.
	BOP	(IA Step 3) IF KC flow inadequate:	
		Ensure adequate number of KC Pumps running.	
		Adjust KC flow/pressure.	

Op Test No.:	N16-1	Scenario #	3	Event #	5	Page	39 of 65
Event Description:	**1KC-425 fails CLOSED**						

Time	Pos.	Expected Actions/Behavior	Comments
		IF low flow still exists, go to AP/1/A/5500/008 (Malfunction of NC Pump).	**NOTE:** The crew may elect to go to AP8 to re-open the valve.
1AD-6, D1, A NC PUMP LOWER MTR BRG LO KC FLO			
	CRS	(IA Step 1) IF loss of KC, go to AP/1/A/5500/021 (Loss of KC or KC System Leak).	**NOTE:** The KC System is operating as expected.
	BOP	(IA Step 2) Check open:	
		1KC-338B (NC Pump Sup Hdr Cont Outside Isol)	
		1KC-424B (NC Pumps Ret Hdr Cont Inside Isol)	
		1KC-425A (NC Pumps Ret Hdr Cont Outside Isol)	**NOTE:** 1KC-425A has inadvertently closed.
	BOPO	(IA Step 3) IF 1KC-388 (A NC Pump Motor Lwr Brg Clr Throttle) has been closed, return valve to throttled position.	**NOTE:** 1KC-388 has NOT been closed.
	BOP	(IA Step 4) IF KC flow inadequate:	
		Ensure adequate number of KC Pumps running.	
		Adjust KC flow/pressure.	
		IF low flow still exists, go to AP/1/A/5500/008 (Malfunction of NC Pump).	**NOTE:** The crew may elect to go to AP8 to re-open the valve.
			Examiner NOTE: If at any time, the crew re-opens 1KC-425A, or decides to take action to stop the NC Pumps, MOVE to Events 6-9.
AP/1/A/5500/08, MALFUNCTION OF NC PUMP **CASE II, NC PUMP MOTOR OR MOTOR BEARING MALFUNCTION**			

Op Test No.:	N16-1	Scenario #	3	Event #	5	Page	40 of 65
Event Description:	**1KC-425 fails CLOSED**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 1) Check abnormal NC Pump parameter - KNOWN TO BE VALID.	
	RO/ BOP	(Step 2) Check NC Pump parameters within operating limits:	
		All NC Pump stator winding temperatures - LESS THAN 311°F	
		All NC Pump motor bearing temperatures - LESS THAN 195°F	
		All NC Pump oil reservoir level computer points - INDICATING BETWEEN (-)1.25 AND (+)1.25.	
	CRS	(Step 3) IF AT ANY TIME any operating limit in Step 2 exceeded, THEN GO TO Step 5.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 4) GO TO Step 6.	
	CRS	(Step 6) Announce occurrence on paging system.	**NOTE:** The CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	CRS	(Step 7) Correct any of the following which may affect NC Pump stator or motor bearing cooling:	
		• High ambient temperature • Abnormal NC Pump bus voltage • Interference with ventilation • Abnormal RN alignment and flow • Abnormal KC alignment and flow • High KC temperature	**NOTE:** The BOP will report that abnormal KC flow alignment and flow exists. If 1KC-425A has not been previously opened, it will be opened here.
	RO/ BOP	(step 8) Check all NC Pump oil reservoir level computer alarms - CLEAR.	

Op Test No.:	N16-1	Scenario #	3	Event #	5	Page	41 of 65
Event Description:	**1KC-425 fails CLOSED**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 9) IF abnormal NC Pump parameter(s) still exist, THEN contact Engineering for guidance.	**NOTE:** CRS may call WCC/Engineering to address the situation. If so, **Booth Instructor** acknowledge as WCC.
	RO/ BOP	(Step 10) Monitor the following NC Pump parameters:	
		Stator winding temperatures (OAC) - STABLE OR GOING DOWN	
		Motor bearing temperatures (OAC) - STABLE OR GOING DOWN	
		Vibration – NORMAL	
		Oil reservoir levels (OAC) - STABLE.	
	BOP	(Step 11) Check NC Pumps - ANY RUNNING.	
			NOTE: The CRS will likely conduct a Focus Brief.
At the discretion of the Lead Examiner, move to Events #6-9.			

Op Test No.: N16-1	Scenario # 3	Event # 6, 7, 8 & 9	Page 42 of 65				
Event Description:	**Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**						

Following this a steam break will occur on the Main Steam Equalization Header in the Turbine Building. Simultaneously all four MSIVs will fail OPEN resulting in four faulted Steam Generators (Both Auto and Manual actuations of MSI have failed). Additionally, the 1A/1B MD CA Pump will fail to start automatically. The operator will be expected to manually start the 1A MD CA Pump (The 1B MD CA Pump will fail to start manually, as well). The crew will enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection" and transition to EP/1/A/5000/E-2, "Faulted Steam Generator Isolation." On the other hand, due to the NCS cooldown, an Orange Path could exist on the NCS Integrity Critical Safety Function. If so, the crew will transition to EP/1/A/5000/FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition." If the crew made the transition to E-2, the crew will transition to EP/1/A/5000/ECA-2.1 at Step 4 of E-2 when it is determined that all four Steam Generator pressures are lowering. On the other hand, if the crew transitions to FR-P.1, the crew will take the actions required by ECA-2.1, in FR-P.1 (i.e. reduce feed flow to each Steam Generator to 25 gpm each, depressurize NCS and terminate SI). It is expected that the crew will eventually transition to EP/1/A/5000/FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition." The scenario will terminate at Step 11.c of FR-P.1 after the operator has closed 1NI-9A and 10B.

Booth Operator Instructions: **insert MAL-SM009 = 16500000**

Indications Available:

- Steam flows higher than expected for current plant conditions
- Pzr pressure is lowering
- MSIVs are all OPEN
- SI Actuation

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: Crew will carry out Immediate Actions of E-0, prior to the CRS addressing the EP.
		EP/1/A/5000/E-0, REACTOR TRIP OR SAFETY INJECTION	
	RO/ BOP	(Step 1) Monitor Foldout page.	
		NC Pump Trip Criteria:	
		CA Suction Sources:	
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recirc Isol):	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	43 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		Ruptured S/G Aux Feedwater Isolation Criteria:	
		Faulted S/G Aux Feedwater Isolation Criteria:	
	RO	(Step 2) Check Reactor trip:	**Immediate Action**
		• All rod bottom lights – LIT	
		• Reactor trip and bypass breakers – OPEN	
		• I/R amps – GOING DOWN.	
	RO	(Step 3) Check Turbine Trip:	**Immediate Action**
		• All throttle valves – CLOSED.	
	BOP	(Step 4) Check 1ETA and 1ETB – ENERGIZED.	**Immediate Action**
	RO/ BOP	(Step 5) Check if S/I is actuated:	**Immediate Action**
		• “A SAFETY INJECTION ACTUATED” status light (1SI-18) – LIT.	
		• Both LOCA Sequencer Actuated status lights (1SI-14) – LIT.	
	CRS	(Step 6) Announce “Unit 1 Safety Injection”.	**NOTE:** CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 7) Check all Feedwater Isolation status lights (1SI-4) – LIT.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	44 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 8) Check Phase A "RESET" lights – DARK.	
	BOP	(Step 9) Check ESF Monitor Light Panel on energized train(s):	
		• Groups 1, 2, 5 – DARK.	
		• Group 3 – LIT.	
		• Group 4 – LIT AS REQUIRED.	
		• Group 6 - LIT	
		• GO TO Step 10	
	RO/ BOP	(Step 10) Check proper CA pump status:	
		• MD CA pumps - ON	**NOTE:** Both MDCA Pumps have failed to Auto-start.
	RO/ BOP	(Step 10.a RNO) Start pumps.	**NOTE:** The crew will be able to start the 1A MDCA Pump manually.
		• N/R level in at least 3 S/Gs – GREATER THAN 17%.	
	RO/ BOP	(Step 10.b RNO) Ensure TD CA pump on.	**NOTE:** The TD CA Pump is OOS.
	BOP	(Step 11) Check all KC pumps – ON.	
	BOP	(Step 12) Check both RN pumps – ON.	
	CRS	(Step 13) Notify Unit 2 to perform the following:	**Floor Instructor:** As U2 RO report "2A RN Pump is running."

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	45	of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Start 2A RN pump.	
	RO	• THROTTLE Unit 2 RN flow to minimum for existing plant conditions.	**Booth Instructor:** **insert LOA-RN087 (Start 2A RN Pump)** **insert LOA-RN083 8050.000000 delay=0 ramp=10 (Unit 2 Train A Demand Flow)**
	RO	(Step 14) Check all S/G pressures – GREATER THAN 775 PSIG.	
	RO	(Step 14 RNO) Perform the following:	**NOTE:** ALL SG Pressures are decreasing uncontrollably.
		• Check the following valves closed:	
		• All MSIVs	**NOTE:** All MSIVs are OPEN, and cannot be closed.
		• All MSIV Bypass Valves	
		• All SM PORVs	
		• IF any valve open, THEN perform the following:	
		• Initiate Main Steam Isolation signal.	
		• IF any valve still open, THEN CLOSE valve.	
	RO/ BOP	(Step 15) Check containment pressure – HAS REMAINED LESS THAN 3 PSIG.	
	BOP	(Step 16) Check S/I flow:	
		• Check "NV PMPS TO COLD LEG FLOW" gauge – INDICATING FLOW.	
		• Check NC pressure – LESS THAN 1600 PSIG.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	46	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Check NI pumps - INDICATING FLOW.	
		• Check NC pressure - LESS THAN 275 PSIG.	
	BOP	(Step 16.d RNO) Perform the following:	
		• Ensure ND pump miniflow valve on running pump(s) OPEN:	
		• 1ND-68A (1A ND Pump & Hx Mini Flow Isol)	
		• 1ND-67B (1B ND Pump & Hx Mini Flow Isol).	
		• IF valve(s) open on all running ND pumps, THEN GO TO Step 17.	
	CRS	(Step 17) Notify OSM or other SRO to perform EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 22 (OSM Actions Following an S/I) within 10 minutes.	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.
	RO/ BOP	(Step 18) Check CA flow:	
		• Total CA flow – GREATER THAN 450 GPM.	
	BOP	• Check VI header pressure – GREATER THAN 60 PSIG.	
	RO	• WHEN each S/G N/R level is greater than 11% (32% ACC), THEN control CA flow to maintain that S/G N/R level between 11% (32% ACC) and 50%.	

Op Test No.: N16-1	Scenario # 3	Event # 6, 7, 8 & 9	Page 47 of 65
Event Description:	**Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**		

Time	Pos.	Expected Actions/Behavior	Comments
Critical Task: **Establish 450 gpm of CA Flow to the Steam Generators during the performance of E-0 such that transition to EP/1/A/5000/FR-H.1 is not required.** Safety Significance: Failure to establish a Secondary Heat Sink through the initiation of CA flow unnecessarily challenges both the HEAT SINK and the CORE COOLING Critical Safety Functions. Additionally, the FSAR Safety Analysis results are predicated on the assumption that at least one train of safeguards actuates and delivers a minimum amount of AFW flow to the Steam Generators. Failure to perform this task, when the ability to do so exists, results in a violation of the Facility License Condition and places the plant in an unanalyzed condition.			
	RO	(Step 19) Check NC temperatures:	
		• IF all NC pumps off, THEN check NC T-Colds – STABLE OR TRENDING TO 557°F.	
	RO	(Step 19 RNO) Perform the following based on plant conditions:	**NOTE:** The CRS may assign the RO to perform this action. If so, **RO Examiner** follow actions of **Enclosure 3**. **Others** should move ahead to Step 20 on **Page 49** to continue in E-0.
		• IF temperature less than 557°F AND going down, THEN attempt to stop cooldown PER Enclosure 3 (Uncontrolled NC System Cooldown).	
E-0, REACTOR TRIP OR SAFETY INJECTION ENCLOSURE 3, UNCONTROLLED NC SYSTEM COOLDOWN			
	RO	(Step 1) Check steam dump valves – CLOSED.	**Examiner NOTE:** Follow the actions associated with Enclosure 3 if RO is assigned by CRS to perform.

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	48 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 2) Check all SM PORVs – CLOSED.	
	RO	(Step 3) Check MSR "RESET" light – LIT.	
	RO	(Step 4) Check any NC pump – ON.	
	RO	(Step 5) Check NC T-avg – GOING DOWN	
	RO	(Step 6) Control feed flow as follows:	
		• IF S/G N/R level is less than 11% (32% ACC) in all S/Gs, THEN THROTTLE feed flow to achieve the following:	
		• Minimize cooldown	
		• Maintain total feed flow greater than 450 GPM.	
		• WHEN N/R level is greater than 11% (32% ACC) in at least one S/G, THEN THROTTLE feed flow further to:	
		• Minimize cooldown	
		• Maintain at least one S/G N/R level greater than 11% (32% ACC).	
	RO	(Step 7) Check MSIVs – ANY OPEN.	**NOTE:** All MSIVs will be OPEN.
	RO	(Step 8) CLOSE 1SM-15 (U1 SM To MSR 2nd Stg Tube Bundles Isol).	
	RO	(Step 9) Check any NC pump - ON.	
	RO	(Step 10) Check NC T-Avg - STABLE.	

Op Test No.: N16-1	Scenario # 3	Event # 6, 7, 8 & 9	Page 49 of 65				

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 10 RNO) IF cooldown continues, THEN CLOSE the following valves:	
		• All MSIVs	**NOTE:** All MSIVs have failed OPEN.
		• All MSIV Bypass Valves.	
	RO	(Step 11) Notify Control Room Supervisor of the following:	
		• NC temperature trend	
		• Status of MSIV and Bypass Valves.	
E-0, REACTOR TRIP OR SAFETY INJECTION			
			Examiner NOTE: Examiners NOT following RO actions in Enclosure 3, continue **HERE**.
	BOP	(Step 20) Check Pzr PORV and spray valves:	
		• All Pzr PORVs – CLOSED.	
	BOP	• Normal Pzr spray valves – CLOSED.	
		• At least one Pzr PORV isolation valve – OPEN.	
	BOP	(Step 21) Check NC subcooling based on core exit T/Cs – GREATER THAN 0°F.	
	BOP	(Step 22) Check if main steamlines intact:	
		• All S/G pressures – STABLE OR GOING UP	**NOTE:** All SG pressures are lowering uncontrollably.
		• All S/Gs – PRESSURIZED.	
	BOP	(Step 22 RNO) IF any S/G is faulted, THEN perform the following:	

Op Test No.: N16-1	Scenario # 3	Event # 6, 7, 8 & 9	Page 50 of 65				

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	• Implement EP/1/A/5000/F-0 (Critical Safety Function Status Trees).	
	CRS	• GO TO EP/1/A/5000/E-2 (Faulted Steam Generator Isolation).	**NOTE:** The CRS will transition to E-2.
			Examiner NOTE: If at any time, a RED or ORANGE Path on INTEGRITY occurs, proceed to the Actions of FR-P.1 on **Page 58**.
EP/1/A/5000/E-2, FAULTED STEAM GENERATOR ISOLATION			
	RO/ BOP	(Step 1) Monitor Foldout page.	
		Cold Leg Recirc Switchover Criteria:	
		CA Suction Sources:	
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recirc Isol):	
	CRS	(Step 2) Maintain any faulted S/G or secondary break isolated during subsequent recovery actions unless needed for NC System cooldown.	
	RO	(Step 3) Check the following – CLOSED:	
		• All MSIVs	**NOTE:** All MSIVs have failed OPEN.
		• All MSIV bypass valves.	
	RO	(Step 4) Check at least one S/G pressure – STABLE OR GOING UP.	**NOTE:** ALL SG pressures will be lowering.
	CRS	(Step 4 RNO) IF all S/Gs faulted, THEN GO TO EP/1/A/5000/ECA-2.1 (Uncontrolled Depressurization Of All Steam Generators).	**NOTE:** The CRS will transition to ECA-2.1.

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	51	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
			Examiner NOTE: If at any time, a RED or ORANGE Path on INTEGRITY occurs, proceed to the Actions of FR-P.1 on **Page 58**.
EP/1/A/5000/ECA-2.1, UNCONTROLLED DEPRESSURIZATION OF ALL STEAM GENERATORS			
	RO/ BOP	(Step 1) Monitor Foldout page.	
		NC Pump Trip Criteria	
		S/I Reinitiation Criteria	
		E-2 Transition Criteria	
		SGTR Transition Criteria	
		Cold Leg Recirc Switchover Criteria	
		CA Suction Sources	
		Position Criteria for 1NV-150B and 1NV-151A (NV Pumps Recirculation)	
	RO/ BOP	(Step 2.a.1) Check secondary pressure boundary:	
		• For 1A S/G:	
		• Check 1A S/G MSIV - CLOSED.	**NOTE:** The MSIV has failed OPEN.
	RO/ BOP	(Step 2.a.1 RNO) Perform the following:	
		• CLOSE valve.	
		• IF MSIV cannot be closed, THEN dispatch operator to CLOSE valve PER Enclosure 2 (Local Closure Of MSIVs).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** as **AO**, acknowledge.

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	52 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	RO/ BOP	(Step 2.a.2-6) Check 1A S/G MSIV bypass valve - CLOSED.	
		• Check 1A SM PORV - CLOSED.	
		• Check "S/G A FDW ISOLATED" status light (1SI-4) - LIT.	
		• Check the following BB valves - CLOSED:	
		• 1BB-1B (1A S/G Blowdown Cont Outside Isol Control)	
		• 1BB-5A (A S/G BB Cont Inside Isol).	
		• CLOSE 1SM-83 (A SM Line Drain Isol).	
	RO/ BOP	(Step 2.b.1) Check secondary pressure boundary:	
		• For 1B S/G:	
		• Check 1B S/G MSIV - CLOSED.	**NOTE:** The MSIV has failed OPEN.
	RO/ BOP	(Step 2.b.1 RNO) Perform the following:	
		• CLOSE valve.	
		• IF MSIV cannot be closed, THEN dispatch operator to CLOSE valve PER Enclosure 2 (Local Closure Of MSIVs).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** as **AO**, acknowledge.
	RO/ BOP	(Step 2.b.2-9) Check 1B S/G MSIV bypass valve - CLOSED.	
		• Check 1B SM PORV - CLOSED.	
		• Check "S/G B FDW ISOLATED" status light (1SI-4) - LIT.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	53	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Check the following BB valves ‑ CLOSED:	
		• 1BB‑2B (1B S/G Blowdown Cont Outside Isol Control)	
		• 1BB‑6A (B S/G BB Cont Inside Isol).	
		• CLOSE 1SM‑89 (B SM Line Drain Isol).	
		• Check 1A or 1B CA pump ‑ AVAILABLE.	
		• Dispatch operator to trip Unit 1 TD CA pump stop valve.	**NOTE:** The TDCA Pump is OOS.
		• Dispatch operator to unlock and CLOSE the following valves:	
		• 1SA‑2 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Maint Isol) (Unit 1 interior doghouse, 767+12, FF‑53)	**NOTE:** The TDCA Pump is OOS.
		• 1SA‑78 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Loop Seal Isol) (Unit 1 interior doghouse, 767+10, FF‑53).	
	RO/ BOP	(Step 2.c.1) Check secondary pressure boundary:	
		• For 1C S/G:	
		• Check 1C S/G MSIV ‑ CLOSED.	**NOTE:** The MSIV has failed OPEN.
	RO/ BOP	(Step 2.c.1 RNO) Perform the following:	
		• CLOSE valve.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	54	of 65
Event Description:	**Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**							

Time	Pos.	Expected Actions/Behavior	Comments
		• IF MSIV cannot be closed, THEN dispatch operator to CLOSE valve PER Enclosure 2 (Local Closure Of MSIVs).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** as **AO**, acknowledge.
	RO/ BOP	(Step 2.c.2-9) Check 1C S/G MSIV bypass valve - CLOSED.	
		• Check 1C SM PORV - CLOSED.	
		• Check "S/G C FDW ISOLATED" status light (1SI-4) - LIT.	
		• Check the following BB valves - CLOSED:	
		• 1BB-3B (1C S/G Blowdown Cont Outside Isol Control)	
		• 1BB-7A (C S/G BB Cont Inside Isol).	
		• CLOSE 1SM-95 (C SM Line Drain Isol).	
		• Check 1A or 1B CA pump - AVAILABLE.	
		• Dispatch operator to trip Unit 1 TD CA pump stop valve.	**NOTE:** The TDCA Pump is OOS.
		• Dispatch operator to unlock and CLOSE the following valves:	
		• 1SA-1 (1C S/G SM Supply to Unit 1 TD CA Pump Turb Maint Isol) (Unit 1 interior doghouse, 767+10, FF-53, above ladder)	**NOTE:** The TDCA Pump is OOS.
		• 1SA-77 (1C S/G SM Supply to Unit 1 TD CA Pump Turb Loop Seal Isol) (Unit 1 interior doghouse, 767+10, FF-53).	
	RO/ BOP	(Step 2.d.1) Check secondary pressure boundary:	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	55	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• For 1D S/G:	
		• Check 1D S/G MSIV ‑ CLOSED.	**NOTE:** The MSIV has failed OPEN.
	RO/ BOP	(Step 2.d.1 RNO) Perform the following:	
		• CLOSE valve.	
		• IF MSIV cannot be closed, THEN dispatch operator to CLOSE valve PER Enclosure 2 (Local Closure Of MSIVs).	**NOTE:** The CRS will dispatch an AO. **Floor Instructor/Booth Instructor:** as **AO**, acknowledge.
	RO/ BOP	(Step 2.d.2-6) Check 1D S/G MSIV bypass valve ‑ CLOSED.	
		• Check 1D SM PORV ‑ CLOSED.	
		• Check "S/G D FDW ISOLATED" status light (1SI‑4) ‑ LIT.	
		• Check the following BB valves ‑ CLOSED:	
		• 1BB‑4B (1D S/G Blowdown Cont Outside Isol Control)	
		• 1BB‑8A (D S/G BB Cont Inside Isol).	
		• CLOSE 1SM‑101 (D SM Line Drain Isol).	
	RO/ BOP	(Step 2.e) WHEN any S/G pressure boundary restored, THEN ensure "E‑2 Transition Criteria" on foldout page is evaluated.	
	BOP	(Step 3) Reset the following:	
		• S/I.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	56 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Sequencers.	
		• Phase A Isolation.	
		• Phase B Isolation.	
		• IF AT ANY TIME a B/O signal occurs, THEN restart S/I equipment previously on.	
	BOP	(Step 4) Establish VI to containment as follows:	
		• OPEN the following valves:	
		• 1VI-129B (VI Supply to A Cont Ess VI Hdr Outside Isol).	
		• 1VI-160B (VI Supply to B Cont Ess VI Hdr Outside Isol).	
		• 1VI-150B (Lwr Cont Non-Ess Cont Outside Isol).	
		• Check VI header pressure - GREATER THAN 85 PSIG.	
	CRS	(Step 5) WHEN TSC is staffed, THEN request TSC to evaluate obtaining samples and monitor shutdown margin during cooldown as follows:	**NOTE:** The CRS may call WCC/TSC to address the samples. If so, **Booth Instructor** acknowledge as WCC and report that the TSC is NOT staffed yet.
		• Evaluate obtaining samples as follows:	
		• Consider available cooling of sample Hx's as follows:	
		• KC will remain isolated to normal sample Hx's for 10 hours, until KC is realigned to normal sample Hx's and KF per AP/1/A/5500/41 (Loss Of Spent Fuel Cooling or Level).	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	57	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• IF sample is desired prior to aligning KC to KC aux bldg. non-essential header, AND fuel damage is not expected, THEN evaluate obtaining sample PER OP/1/A/6200/128 (Unit 1 Primary Systems Emergency Response Sampling), Enclosure 4.4 (1NC Hot Leg with KC Non-essential Header Isolated).	
		• Evaluate obtaining periodic NC System boron sample to check shutdown margin during cooldown.	
		• WHEN each NC boron sample obtained, THEN perform the following:	
		• Perform shutdown margin calculation for Cold Shutdown PER OP/0/A/6100/006 (Reactivity Balance Calculation).	
		• Check shutdown margin - ADEQUATE.	
	RO/ BOP	(Step 6) Control feed flow to minimize NC System cooldown as follows:	
		Check all S/G N/R levels - GREATER THAN 11% (32% ACC).	**NOTE:** All S/G NR levels are likely < 11%. If not, the crew will proceed to Step 6.b.
	RO/ BOP	(Step 6 RNO) Maintain at least 25 GPM feed flow to any S/G with a N/R level less than 11% (32% ACC).	
	RO/ BOP	(Step 6.b) Check cooldown rate in NC T-Colds - LESS THAN 100°F IN AN HOUR.	
	RO/ BOP	(Step 6.b RNO) Perform the following:	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	58	of	65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Reduce feed flow to 25 GPM to each S/G.	
		• GO TO Step 6.d.	

Critical Task:

Control the CA Flowrate to 25 gpm per SG in order to minimize the NC Cooldown rate in ECA-2.1 or FR-P.1.

Safety Significance: Failure to control the CA flow rate to the SGs, when able to do so, leads to an unnecessary and avoidable severe or extreme challenge to the Integrity CSF. Also, failure to perform the Critical Task increases challenges to the Subcriticality Critical Safety Function which otherwise would not occur. If the action can be taken, and is not taken, this demonstrates "mis-operation" or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).

Time	Pos.	Expected Actions/Behavior	Comments
			Examiner NOTE: if the crew has established 25 gpm to each S/G here, and not entered FR-P.1, terminate Exam.

EP/1/A/5000/FR-P.1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITION

Time	Pos.	Expected Actions/Behavior	Comments
			Examiner NOTE: The crew may enter this procedure at any time after exiting E-0, based on a RED or ORANGE Path on INTEGRITY.
	RO	(Step 1) Check NC pressure – GREATER THAN 275 PSIG.	
	RO/ BOP	(Step 2) Monitor Foldout Page.	
		Cold Leg Recirc Switchover Criteria:	
		CA Suction Sources:	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	59 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recirc Isol):	
	RO	(Step 3) Check NC T-Colds – STABLE OR GOING UP.	
	RO	(Step 3 RNO) Try to stop NC System cooldown as follows:	
		• Ensure SM PORVs CLOSED.	
		• IF any SM PORV cannot be closed, THEN….	**NOTE:** The SM PORVs are CLOSED.
		• Ensure condenser dump valves CLOSED.	
		• IF ND in RHR mode, THEN …..	**NOTE:** The plant is NOT in the ND Mode.
		• Identify faulted S/G(s) as follows:	
		• Any S/G pressure going down in an uncontrolled manner.	
		OR	
		• Any S/G depressurized.	**NOTE:** All SGs are Faulted.
		• IF VI is not available for CA flow control in subsequent steps, THEN…	
		• Control feed flow to non-faulted S/G(s) to stop NC System cooldown as follows:	**NOTE:** All SGs are Faulted.
		• Minimize cooldown from faulted S/G(s) as follows:	
		• Ensure the following valves CLOSED for each faulted S/G:	
		• MSIV	**NOTE:** All MSIVs have failed OPEN.
		• MSIV bypass valve.	
		• IF TD CA pump is the only source of feedwater, THEN maintain steam flow to it from at least one S/G.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	60 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• IF S/G B or C faulted, THEN dispatch operator to unlock and CLOSE isolation valves on faulted S/G(s):	**NOTE:** BOTH the 1B and 1C SGs are Faulted.
		• S/G B:	**NOTE:** The CRS will dispatch an AO. **Floor Instructor:** as **AO**, acknowledge. **Booth Instructor: insert REM-SA0002 = 0 (Close SA-2)**
		• 1SA-2 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Maint Isol) (Unit 1 interior doghouse, 767+12, FF-53)	
		• 1SA-78 (1B S/G SM Supply to Unit 1 TD CA Pump Turb Loop Seal Isol) (Unit 1 interior doghouse, 767+10, FF-53).	
		• S/G C:	**NOTE:** The CRS will dispatch an AO. **Floor Instructor:** as **AO**, acknowledge. **Booth Instructor: insert REM-SA0001 = 0 (Close SA-1)**
		• 1SA-1 (1C S/G SM Supply to Unit 1 TD CA Pump Turb Maint Isol) (Unit 1 interior doghouse, 767+10, FF-53, above ladder)	
		• 1SA-77 (1C S/G SM Supply to Unit 1 TD CA Pump Turb Loop Seal Isol) (Unit 1 interior doghouse, 767+10, FF-53).	
		• CLOSE 1AS-12 (U1 SM TO AS Hdr Control Inlet Isol).	
		• IF 1AS-12 will not close AND…	
		• IF 1AS-12 will not close AND…	
		• IF all S/Gs faulted, THEN perform the following:	**NOTE:** All SGs are Faulted.

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	61	of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• THROTTLE feed flow to 25 GPM to each S/G.	
		• GO TO Step 4.	
			NOTE: This action will create a Red Path on FR-H.1. The CRS is expected to address FR-H.1, and immediately return to FR-P.1.
<u>Critical Task:</u> **Control the CA Flowrate to 25 gpm per SG in order to minimize the NC Cooldown rate in ECA-2.1 or FR-P.1.** Safety Significance: Failure to control the CA flow rate to the SGs, when able to do so, leads to an unnecessary and avoidable severe or extreme challenge to the Integrity CSF. Also, failure to perform the Critical Task increases challenges to the Subcriticality Critical Safety Function which otherwise would not occur. If the action can be taken, and is not taken, this demonstrates “mis-operation” or incorrect operation that could unnecessarily challenge a fission product barrier (NCS).			
	BOP	(Step 4) Check Pzr PORV isolation valves:	
		• Power to all Pzr PORV isolation valves – AVAILABLE.	
		• At least one Pzr PORV isolation valve – OPEN.	
	BOP	(Step 5) Check if Pzr should be closed:	
		• Check “LOW PRESS” mode – SELECTED.	
	CRS	(Step 5.a RNO) GO TO Step 5.d.	
	BOP	• Check Pzr pressure – LESS THSN 2335 PSIG.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	62 of 65

Event Description: **Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
		• Check all Pzr PORVs – CLOSED.	
		• IF AT ANY TIME any Pzr PORV opens due to high pressure, THEN after pressure goes below reseat pressure, ensure PORV CLOSES or is isolated.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	BOP	(Step 6) Check if S/I in service using any of the following:	
		• Any NI Pump – ON.	
		OR	
		• 1NI-9A (NC Cold Leg Inj From NV) – OPEN.	
		OR	
		• 1NI-10B (NC Cold Leg Inj From NV) – OPEN.	
	RO/ BOP	(Step 7) Check if S/I can be terminated:	
		• NC subcooling based on core exit T/Cs – GREATER THAN 50°F.	
		• Check RVLIS indication:	
		• IF all NC pumps off, THEN check “REACTOR VESSEL LR LEVEL” – GREATER THAN 60%.	**NOTE:** The RCPs will likely be OFF.
		• IF at least one NC pump on, THEN check "REACTOR VESSEL D/P" - GREATER THAN REQUIRED DELTA P FROM TABLE BELOW:	**NOTE:** If the RCPs are ON, the CRS will evaluate the Table.
	BOP	(Step 8) Reset the following:	
		• S/I.	
		• Sequencers.	
		• Phase A Isolation.	
		• Phase B Isolation.	

Op Test No.:	N16-1	Scenario #	3	Event #	6, 7, 8 & 9	Page	63 of 65
Event Description:	**Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF AT ANY TIME a B/O signal occurs, THEN restart S/I equipment previously on.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	BOP	(Step 9) Establish VI to containment as follows:	
		• OPEN the following valves:	
		• 1VI-129B (VI Supply to A Cont Ess VI Hdr Outside Isol).	
	BOP	• 1VI-160B (VI Supply to B Cont Ess VI Hdr Outside Isol).	
		• 1VI-150B (Lwr Cont Non-Ess Cont Outside Isol).	
		• Check VI header pressure – GREATER THAN 85 PSIG.	
	BOP	(Step 10) Stop S/I pumps as follows:	
		• All but one NV pump.	
		• Both NI pumps.	
		• Check running ND pumps suction – ALIGNED TO FWST.	
		• Stop both ND pumps.	
	BOP	(Step 11) Isolate NV S/I flowpath as follows:	
		• Check the following valves – OPEN.	
		• 1NV-221A (U1 NV Pump Suct From FWST Isol).	
		• 1NV-222B (U1 NV Pump Suct From FWST Isol).	
		• Check the following valves – OPEN.	
		• 1NV-150B (U1 NV Pump Recirc Isol)	
		• 1NV-151A (U1 NV Pump Recirc Isol)	

Op Test No.: N16-1 Scenario # 3 Event # 6, 7, 8 & 9	Page 64 of 65
Event Description:	**Steam Equalization Header Line Rupture/MSI fails in Auto/Manual/All MSIVs fail OPEN/1A MD CA Pumps fails to start in AUTO/1B MD CA Pumps fails to start in AUTO/MANUAL**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 11.b RNO) Perform the following:	
		• OPEN valves.	
		• IF both valves open, THEN GO TO Step 11.c.	
	BOP	• CLOSE the following valves:	
		• 1NI-9A (NC Cold Leg Inj From NV).	
		• 1NI-10B (NC Cold Leg Inj From NV).	
At the discretion of the Lead Examiner terminate the exam.			

UNIT 1 STATUS:

Power Level: 75% NCS [B] 1038 ppm Pzr [B]: 1038 ppm Xe: Per OAC

Power History: At this power level for 3 days Core Burnup: 250 EFPDs

CONTROLLING PROCEDURE: OP/1/A/6100/003 Controlling Procedure for Unit Operation

OTHER INFORMATION NEEDED TO ASSUME THE SHIFT:

- The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
- A Containment Air Release is in progress per OP/1/A/6450/17, “Containment Air Release and Addition System.”

The following equipment is Out-Of-Service:

- The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C.
- The TDCA Pump is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.7.5 ACTION A.
- MCB Annunciator 1AD-12, A-4, “B RN PMP DISCHARGE LO PRESS,” has alarmed spuriously several times over the last hour, and has currently failed OFF (IAE is investigating).

Crew Directions:

- The crew will raise power to 100% on this shift, starting with Step 3.37.10 of Enclosure 4.1 of OP/1/A/6100/003 Controlling Procedure for Unit Operation.
- The loading rate will be 1 MWe/minute.
- RE has recommended a 200 gallon initial dilution using Enclosure 4.3 (Dilute) of OP/1/A/6150/009 (Boron Concentration Control).
- RMWST Dissolved O_2 is greater than 1000 ppb.

Work Control SRO/Offsite Communicator **Jim**

Plant SRO **Joe (FB)**

AO's AVAILABLE

<u>Unit 1</u>	**<u>Unit 2</u>**
Aux Bldg. John	**Aux Bldg. Chris**
Turb Bldg. Bob (FB)	**Turb Bldg. Mike (FB)**
5th Rounds. Carol	

Extra(s) Bill (FB) Ed (FB) Wayne (FB) Tanya Gus (RW)

Facility:	**McGuire**	Scenario No.: **4**	Op Test No.: **N16-1**
Examiners:	____________	Operators:	____________ (SRO)
	____________		____________ (RO)
	____________		____________ (BOP)

Initial Conditions:	The plant is at 4% power (BOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1A EGD is OOS for fuel pump replacement. ACTION has been taken in accordance with Technical Specification LCO 3.8.1 ACTION B. MCB Annunciator 1AD-1, F-9, “DEH/MSR SYSTEM MALFUNCT,” spuriously alarmed several times during the shift, and is currently failed OFF (IAE is investigating). The crew will hold power steady until on-going maintenance is completed, however a rod height/C_B adjustment will be made at the start of the shift at the request of Reactor Engineering.

Event No.	Malf. No.	Event Type*	Event Description
1	NA	R-RO N-BOP N-SRO	Rod Height Adjustment
2	1	I-BOP I(TS)-SRO	Power Range N-41 Upper Detector failure
3	2	C-BOP C(TS)-SRO	Ground Fault on 1ETA
4	3	C-RO C-SRO	C-9 Failure causing failure of 1B SG PORV (Manual Control avail)
5	4	C-RO C-BOP C-SRO	1A NCP Pump Bearing Oil Cooler Leak
6	5	M-RO M-BOP M-SRO	ATWS
7	6	C-BOP	Loss of Switchyard to Unit 1/1B EDG fails to START

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #4

The plant is at 4% power (BOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1A EGD is OOS for fuel pump replacement. ACTION has been taken in accordance with Technical Specification LCO 3.8.1 ACTION B. MCB Annunciator 1AD-1, F-9, “DEH/MSR SYSTEM MALFUNCT,” spuriously alarmed several times during the shift, and is currently failed OFF (IAE is investigating). The crew will hold power steady until on-going maintenance is completed, however a rod height/C_B adjustment will be made at the start of the shift at the request of Reactor Engineering.

Shortly after taking the watch, the crew will dilute in accordance with Enclosure 4.3, “Dilute” of OP/0/A/6150/009, “Boron Concentration Control”, to adjust Control Bank D rod height to 132 Steps.

After this, Power Range Channel N41 Upper Detector will fail. The operator will enter AP/1/A/5500/16, “Malfunction of Nuclear Instrumentation,” and perform Case III, “Power Range Malfunction.” The operator will address Technical Specification 3.3.1, “Reactor Trip Instrumentation.”

Following this, a ground fault will occur on 1ETA causing the bus to de-energize. The operator will enter AP/1/A/5500/07, “Loss of Electrical Power,” and start the equipment on the B Train. The operator will address Technical Specification 3.8.1, “AC Sources Operating,” 3.8.4, “DC Sources - Operating,” and 3.8.9 “Distribution Systems - Operating.”

Afterwards, the C-9 Interlock will fail causing the Steam Dump Valves to close. The SG PORVs will open to maintain Steam Generator pressure at setpoint. As these valves open, the 1B SG PORV Controller will fail such that the valve slowly opens. The operator will implement AP/1/A/5500/01, “Steam Leak” and take manual control of the 1B SG PORV.

Shortly after this, a leak will develop on the 1A NCP Upper Bearing Oil Reservoir. The operator will respond in accordance with AP/1/A/5500/08, “Malfunction of NC Pump,” and the operator will be required to trip the reactor, stop the 1A NCP, and go to EP/1/A/5000/E-0, “Reactor Trip and/or Safety Injection.”

When the operator attempts to manually trip the reactor, an ATWS will occur. The operator will enter EP/1/A/5000/E-0, “Reactor Trip or Safety Injection,” and then transition to EP/1/A/5000/FR-S.1, “Response to Nuclear Power Generation/ATWS.” During the performance of FR-S.1, the operator will continuously drive rods in manually, and successfully trip the Reactor locally.

After the crew has locally tripped the reactor but still implementing FR-S.1, a loss of the Unit 1 Switchyard will occur, and the 1B Emergency Diesel Generator will fail to start. The operator will immediately transition to EP/1/A/5000/ECA-0.0, “Loss of All AC Power.” The operator will restore power to 1ETB per Unit 2 6900V busses through SATB per Enclosure 14 “Energizing Unit 1 4160V Bus From Unit 2 - SATA or SATB.”

The scenario will terminate when one ESF Bus has been re-energized.

Critical Tasks:

Manually drive rods inward before completing the immediate actions of FR-S.1 (Step 2).

Safety Significance: failure to insert negative reactivity, under the postulated plant conditions, results in an unnecessary situation in which the reactor remains critical or returns to a critical condition. Performance of the critical task would move the reactor towards a subcritical condition to prevent a subsequent return to criticality. A failure to insert negative reactivity constitutes a mis-operation or incorrect crew performance which leads to incorrect reactivity control.

Energize at least one AC Emergency Bus From Unit 2.

Safety Significance: Failure to energize an AC Emergency Bus when able to do so constitutes "mis-operation" or incorrect performance which leads to degraded emergency power capacity. Failure to perform the Critical Task may result in a needless challenge and/or degradation of a fission product barrier at the point of the remaining intact RCP Seals, and will result in the inability to add inventory through the ECCS during the existing and potentially subsequent small break LOCA(s). Since the conditions existed to re-energize an ESF Bus from Unit 2 via the SATA or SATB, not taking this action constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

PROGRAM: McGuire Operations Training

MODULE: Initial License Operator Training Class ILC 16-1

TOPIC: NRC Simulator Exam

Scenario N16-1-4

REFERENCES:

1. OP/1/A/6100/010 N, “Annunciator Response for Panel 1AD-13” (Rev 78)
2. Technical Specification LCO 3.4.15, “RCS Leakage Detection Instrumentation” (Amendment 235/217)
3. Technical Specification 3.8.1, “AC Sources – Operating” (Amendment 221/203)
4. OP/1/A/6150/009, “Boron Concentration Control” (Rev 131)
5. AP/1/A/5500/16, “Malfunction of Nuclear Instrumentation” (Rev 15)
6. Technical Specification 3.3.1, “Reactor Trip Instrumentation” (Amendment 184/166)
7. AP/1/A/5500/07, “Loss of Electrical Power” (Rev 36)
8. EP/1/A/5000-G-1, “Generic Enclosures” (Rev 38)
9. Technical Specification 3.8.4, “DC Sources – Operating” (Amendment 274/254)
10. Technical Specification 3.8.9, “Distribution Systems – Operating” (Amendment 184/166)
11. AP/1/A/5500/12, “Loss of Letdown, Charging or Seal Injection” (Rev 24)
12. AP/1/A/5500/01, “Steam Leak” (Rev 18)
13. Technical Specification 3.7.4, “Steam Generator Power Operated Relief valves (SG PORVs)” (Amendment 221/203)
14. Technical Specification LCO 3.4.1, “RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits” (Amendment 219/201)
15. AP/1/A/5500/08, “Malfunction of NC Pump” (Rev 14)
16. EP/1/A/5000/E-0, “Reactor Trip or Safety Injection” (Rev 34)
17. EP/1/A/5000/FR-S.1, “Response to Nuclear Power Generation/ATWS” (Rev 15)
18. EP/1/A/5000/ECA-0.0, “Loss of All AC Power” (Rev 37)

Validation Time: 103 minutes

Author: David Lazarony, Essential Training & Consulting, LLC

Facility Review: ________________________

Rev. 120515

Facility: **McGuire**		Scenario No.: **4**	Op Test No.: **N16-1**
Examiners:	____________	Operators:	____________ (SRO)
	____________		____________ (RO)
	____________		____________ (BOP)

Initial Conditions:	The plant is at 4% power (BOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
Turnover:	The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1A EGD is OOS for fuel pump replacement. ACTION has been taken in accordance with Technical Specification LCO 3.8.1 ACTION B. MCB Annunciator 1AD-1, F-9, “DEH/MSR SYSTEM MALFUNCT,” spuriously alarmed several times during the shift, and is currently failed OFF (IAE is investigating). The crew will hold power steady until on-going maintenance is completed, however a rod height/C_B adjustment will be made at the start of the shift at the request of Reactor Engineering.

Event No.	Malf. No.	Event Type*	Event Description
1	NA	R-RO N-BOP N-SRO	Rod Height Adjustment
2	1	I-BOP I(TS)-SRO	Power Range N-41 Upper Detector failure
3	2	C-BOP C(TS)-SRO	Ground Fault on 1ETA
4	3	C-RO C-SRO	C-9 Failure causing failure of 1B SG PORV (Manual Control avail)
5	4	C-RO C-BOP C-SRO	1A NCP Pump Bearing Oil Cooler Leak
6	5	M-RO M-BOP M-SRO	ATWS
7	6	C-BOP	Loss of Switchyard to Unit 1/1B EDG fails to START

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

McGuire 2016 NRC Scenario #4

The plant is at 4% power (BOL). The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.

The following equipment is Out-Of-Service: The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C. The 1A EGD is OOS for fuel pump replacement. ACTION has been taken in accordance with Technical Specification LCO 3.8.1 ACTION B. MCB Annunciator 1AD-1, F-9, "DEH/MSR SYSTEM MALFUNCT," spuriously alarmed several times during the shift, and is currently failed OFF (IAE is investigating). The crew will hold power steady until on-going maintenance is completed, however a rod height/C_B adjustment will be made at the start of the shift at the request of Reactor Engineering.

Shortly after taking the watch, the crew will dilute in accordance with Enclosure 4.3, "Dilute" of OP/0/A/6150/009, "Boron Concentration Control", to adjust Control Bank D rod height to 132 Steps.

After this, Power Range Channel N41 Upper Detector will fail. The operator will enter AP/1/A/5500/16, "Malfunction of Nuclear Instrumentation," and perform Case III, "Power Range Malfunction." The operator will address Technical Specification 3.3.1, "Reactor Trip Instrumentation."

Following this, a ground fault will occur on 1ETA causing the bus to de-energize. The operator will enter AP/1/A/5500/07, "Loss of Electrical Power," and start the equipment on the B Train. The operator will address Technical Specification 3.8.1, "AC Sources Operating," 3.8.4, "DC Sources - Operating," and 3.8.9 "Distribution Systems - Operating."

Afterwards, the C-9 Interlock will fail causing the Steam Dump Valves to close. The SG PORVs will open to maintain Steam Generator pressure at setpoint. As these valves open, the 1B SG PORV Controller will fail such that the valve slowly opens. The operator will implement AP/1/A/5500/01, "Steam Leak" and take manual control of the 1B SG PORV.

Shortly after this, a leak will develop on the 1A NCP Upper Bearing Oil Reservoir. The operator will respond in accordance with AP/1/A/5500/08, "Malfunction of NC Pump," and the operator will be required to trip the reactor, stop the 1A NCP, and go to EP/1/A/5000/E-0, "Reactor Trip and/or Safety Injection."

When the operator attempts to manually trip the reactor, an ATWS will occur. The operator will enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection," and then transition to EP/1/A/5000/FR-S.1, "Response to Nuclear Power Generation/ATWS." During the performance of FR-S.1, the operator will continuously drive rods in manually, and successfully trip the Reactor locally.

After the crew has locally tripped the reactor but still implementing FR-S.1, a loss of the Unit 1 Switchyard will occur, and the 1B Emergency Diesel Generator will fail to start. The operator will immediately transition to EP/1/A/5000/ECA-0.0, "Loss of All AC Power." The operator will restore power to 1ETB per Unit 2 6900V busses through SATB per Enclosure 14 "Energizing Unit 1 4160V Bus From Unit 2 - SATA or SATB."

The scenario will terminate when one ESF Bus has been re-energized.

Critical Tasks:

Manually drive rods inward before completing the immediate actions of FR-S.1 (Step 2).

Safety Significance: failure to insert negative reactivity, under the postulated plant conditions, results in an unnecessary situation in which the reactor remains critical or returns to a critical condition. Performance of the critical task would move the reactor towards a subcritical condition to prevent a subsequent return to criticality. A failure to insert negative reactivity constitutes a mis-operation or incorrect crew performance which leads to incorrect reactivity control.

Energize at least one AC Emergency Bus From Unit 2.

Safety Significance: Failure to energize an AC Emergency Bus when able to do so constitutes "mis-operation" or incorrect performance which leads to degraded emergency power capacity. Failure to perform the Critical Task may result in a needless challenge and/or degradation of a fission product barrier at the point of the remaining intact RCP Seals, and will result in the inability to add inventory through the ECCS during the existing and potentially subsequent small break LOCA(s). Since the conditions existed to re-energize an ESF Bus from Unit 2 via the SATA or SATB, not taking this action constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.

SIMULATOR OPERATOR INSTRUCTIONS

	Bench Mark	ACTIVITY	DESCRIPTION
☐	Sim. Setup	**Rod Step On**	
☐		**Reset to Temp IC 238**	**T = 0 Malfunctions:** **insert XMT-WL_1WLLT5591 = 100 (1WLL-5591, VUCDT Tank Level is OOS)** **insertMAL-EPQ001A = ACTIVE** **insertLOA-DG011 = RACKED_OUT** **insertLOA-DG020 = RACKED OUT** **insert OVR-1AD1_F09 = OFF (MCB Annunciator 1AD1/F9)** **<u>Per Lesson Plan 2016 NRC Exam Scenario 4</u>** **Insert MAL-IPE001A = TRUE (ATWS)** **Insert MAL-IPE001B = TRUE (ATWS)** **Insert MAL-IPE002A = TRUE (ATWS)** **Insert MAL-IPE002B = TRUE (ATWS)**
☐		**RUN** **Reset all SLIMs**	**Place Tagout/O-Stick on:** **1A EDG (Tagout)** **1WLL-5591 (O-stick)** **MCB Annunciator 1AD-13, C-7 (O-stick)** **MCB Annunciator 1AD-1, F-9 (O-stick)**
☐		**Update** Status Board, **Setup OAC**	**NOTE:** RMWST DO = <1000 ppb.
☐		**Freeze.**	
☐		**Update Fresh Tech. Spec. Log.**	
☐		**Fill out the AO's Available section of Shift Turnover Info.**	

<table>
<tr><th></th><th>Bench Mark</th><th>ACTIVITY</th><th>DESCRIPTION</th></tr>
<tr><td>☐</td><td>Prior to Crew Briefing</td><td>RUN</td><td></td></tr>
<tr><td>☐</td><td colspan="3">Crew Briefing
1. Assign Crew Positions based on evaluation requirements
2. Review the Shift Turnover Information with the crew.
3. Provide the crew with a Blank Copy of Enclosure 4.3 (Dilute) of OP/1/A/6150/009 (Boron Concentration Control)
4. Direct the crew to Review the Control Boards taking note of present conditions, alarms.</td></tr>
<tr><td>☐</td><td>T-0</td><td>Begin Familiarization Period</td><td></td></tr>
<tr><td>☐</td><td>At direction of examiner</td><td>Execute Lesson Plan for Simulator Scenario N16-1-4.</td><td></td></tr>
<tr><td>☐</td><td>At direction of examiner</td><td>Event 1
NA</td><td>Rod Height Adjustment</td></tr>
<tr><td>☐</td><td>At direction of examiner</td><td>Event 2
insert MAL-ENB013A = LOSS</td><td>Power Range N-41 Upper Detector failure</td></tr>
<tr><td>☐</td><td>At direction of examiner</td><td>Event 3
insert MAL-EP008A ACTIVE
insert 1AD11_A01= ON</td><td>Ground Fault on 1ETA
<u>AP-7 Actions</u>
insertLOA-RN087 = ON delay = 60 seconds (Start 2A RN Pump)
insertREM-RN0040A_1 = 0 (Close 1RN-40A)
insert REM-KC0003A = 0 (Close 1KC-3A)
insert REM-KC0230A = 0 (Close 1KC-230A)</td></tr>
<tr><td>☐</td><td>At direction of examiner</td><td>Event 4
Insert MAL-IPE004H = FALSE
insert XMT-SM_1SMPT55100 = 1150</td><td>C-9 Failure causing failure of 1B SG PORV (Manual Control avail)</td></tr>
</table>

	Bench Mark	ACTIVITY	DESCRIPTION
☐	At direction of examiner	**Event 5** **Insert MAL-NCP007AU = TRUE**	1A NCP Pump Bearing Oil Cooler Leak
☐	Upon Attempt to Manually Trip the Rx	**Event 6** **Insert MAL-IPE001A = TRUE (ATWS)** **Insert MAL-IPE001B = TRUE (ATWS)** **Insert MAL-IPE002A = TRUE (ATWS)** **Insert MAL-IPE002B = TRUE (ATWS)**	ATWS **Note: These Malfunctions are inserted at T=0**
☐	At direction of examiner while in FR-S.1	**Event 7** **Insert MAL-EP002 AND EP002B = TRIP** **Insert MAL-DG001B = TRUE**	Loss of Switchyard to Unit 1/1B EDG fails to START
☐	**Terminate the scenario upon direction of Lead Examiner**		

Op Test No.:	N16-1	Scenario #	4	Event #	1	Page	8 of 63
Event Description:		**Rod Height Adjustment**					

Shortly after taking the watch, the crew will dilute in accordance with Enclosure 4.3, “Dilute” of OP/0/A/6150/009, “Boron Concentration Control”, to adjust Control Bank D rod height to 132 Steps.
Booth Operator Instructions: **NA**
Indications Available: **NA**

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The RO will manually insert control rods.
		OP/1/A/6150/009, BORON CONCENTRATION CONTROL **ENCLOSURE 4.3, DILUTE**	
	BOP	(Step 3.1) Evaluate all outstanding R&RS that may impact performance of this procedure.	**NOTE:** The CRS may call WCC to address the R&Rs. If so, **Booth Instructor** acknowledge as WCC, and report none.
	BOP	(Step 3.2) IF the lowest NCP seal leakoff is less than 2 gpm…	**NOTE:** All NCP Seal leakoffs are normal.
	BOP	(Step 3.3) Evaluate energizing additional pressurizer heaters per OP/1/A/6100/003 (Controlling Procedure For Unit Operation) to enhance system mixing when changing NC System boron concentration. (R.M.)	
	BOP	(Step 3.4) Determine amount of reactor makeup water needed to obtain desired boron concentration using McGuire Data Book, OAC, Reactor Group Guidance, or plant parameters (T-Ave. Steam Pressure, Xenon worth, etc.). (R.M.)	**NOTE:** The BOP will add 200 gallons of MU Water.
		• Total Reactor Makeup Water:	
	BOP	(Step 3.5) Ensure the following reset to zero: (R.M.)	

Op Test No.:	N16-1	Scenario #	4	Event #	1	Page	9 of 63
Event Description:	**Rod Height Adjustment**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Total Make Up Flow Counter	
		• Boric Acid Flow Counter	
	BOP	(Step 3.6) Set Total Make Up Flow Counter to value determined in Step 3.4.	
	BOP	(Step 3.7) Select "DILUTE" on "NC Sys M/U Controller".	
	BOP	(Step 3.8) IF AT ANY TIME it is desired to adjust reactor makeup water flow, adjust "Rx M/U Water Flow Control" setpoint to achieve desired flowrate.	
	BOP	(Step 3.9) IF AT ANY TIME it is desired to manually adjust reactor makeup water flow, perform the following:	
		• Place "Rx M/U Water Flow Control" in manual.	
		• Adjust "Rx M/U Water Flow Control" output to control reactor makeup water flowrate.	
	BOP	(Step 3.10) IF AT ANY TIME it is desired to lower VCT level, perform the following:	
		• Monitor Letdown Pressure.	
		• Select "HUT" on 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl).	
		• IF Letdown Pressure increases greater than 20 psig, notify CRS.	
		• AFTER desired level achieved, select "AUTO" on 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl).	

Op Test No.:	N16-1	Scenario #	4	Event #	1	Page	10	of 63
Event Description:		Rod Height Adjustment						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3.11) IF AT ANY TIME plant parameters require termination of dilution, perform the following:	
		• Place "NC System Make Up" to "STOP". (R.M.)	
		• IF 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl) placed to HUT, place to "AUTO".	
	BOP	(Step 3.12) Momentarily select "START" on "NC System Make Up". (R.M.)	
	BOP	(Step 3.13) Check "NC System Make Up" red light lit.	
	BOP	(Step 3.14) Check 1NV-171A (U1 Boric Acid Blender to VCT Inlet Control) open.	
	BOP	(Step 3.15) Check 1NV-252A (Rx M/U Water Supply To U1 BA Blender Cntrl) open or throttled as required.	
	BOP	(Step 3.16) Check Rx M/U Water Pump start.	
	BOP	(Step 3.17) Monitor Total Make Up Flow Counter. (R.M.)	
	BOP	(Step 3.18) HOLD until one of the following occurs:	
		• Amount of reactor makeup recorded per Step 3.4 added	
		• Reactor makeup water addition manually terminated	
	BOP	(Step 3.19) Ensure dilution terminated as follows: (R.M.)	

Op Test No.:	N16-1	Scenario #	4	Event #	1	Page	11	of 63
Event Description:	**Rod Height Adjustment**							

Time	Pos.	Expected Actions/Behavior	Comments
		• IF in “AUTO”, ensure the following off:	
		• 1A Rx M.U Water Pump	
		• 1B Rx M/U Water Pump	
		• Ensure the following closed:	
		• 1NV-171A (U1 Boric Acid Blender to VCT Inlet Control)	
		• 1NV-252A (Rx M/U Water Supply To U1 BA Blender Cntrl)	
	BOP	(Step 3.20) Ensure “Rx M/U Water Flow Control” in auto. (R.M.)	
	BOP	(Step 3.21) IF “Rx M/U Water Flow Control” adjusted per Step 3.8 OR Step 3.9…	
	BOP	(Step 3.22) Ensure 1NV-137A (U1 NC Filter Otlt to VCT 3-Way Diversion Cntrl) in “AUTO”.	
	BOP	(Step 3.23) IF desired to flush blender, go to…	
	BOP	(Step 3.24) Select “AUTO” for “NC Sys M/U Controller”.	
	BOP	(Step 3.25) Momentarily select “START” on “NC System Make Up”.	
	BOP	(Step 3.26) Check “NC System Make Up” red light lit.	
	BOP	(Step 3.27) Ensure the following reset to zero:	
		• Total Make Up Flow Counter	
		• Boric Acid Flow Counter	

Op Test No.: N16-1 Scenario # 4 Event # 1

Event Description: **Rod Height Adjustment**

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 3.28) Record in Auto Log that final blender content is Rx Makeup Water.	
			NOTE: The CRS will likely conduct a Focus Brief.
At the discretion of the Lead Examiner move to Event #2.			

Op Test No.:	N16-1	Scenario #	4	Event #	2	Page	13	of 63
Event Description:		**Power Range Channel N41 Upper Detector failure**						

After this, Power Range Channel N41 Upper Detector will fail. The operator will enter AP/1/A/5500/16, "Malfunction of Nuclear Instrumentation," and perform Case III, "Power Range Malfunction." The operator will address Technical Specification 3.3.1, "Reactor Trip Instrumentation."

Booth Operator Instructions: **insert MAL-ENB013A = LOSS**

Indications Available:

- MCB Annunciator, 1AD2 A1, P/R HI FLUX RATE ALERT
- MCB Annunciator, 1AD2 A2, P/R HI FLUX LO STPT ALERT
- MCB Annunciator, 1AD2 A3, P/R HI FLUX HI STPT ALERT
- MCB Annunciator, 1AD2 B3, P/R CHANNEL DEVIATION
- MCB Annunciator, 1AD2 B8, OPDT RUNBACK RUNBACK/ROD STOP ALERT
- MCB Annunciator, 1AD2 C8, P/R OVERPOWER ROD STOP
- MCB Annunciator, 1AD6 F8, OPDT PROTECTION ALERT
- N41 indicates HIGH
- PR41 AFD is off-scale HIGH

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The CRS will enter to AP-16 Case III.
		AP/1/A/5500/16, MALFUNCTION OF NUCLEAR INSTRUMENTATION CASE III, POWER RANGE MALFUNCTION	
	RO	(Step 1) Place control rods in manual.	**NOTE:** The control rods are already in MANUAL.
	RO/ BOP	(Step 2) Check S/G levels - AT PROGRAMMED LEVEL.	
	CRS	(Step 3) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 4) Check P/R channels - ONLY ONE CHANNEL FAILED.	
	CRS	(Step 5) Secure any power increase in progress.	

Op Test No.:	N16-1	Scenario #	4	Event #	2	Page	14 of 63
Event Description:	**Power Range Channel N41 Upper Detector failure**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 6) Check the following interlocks - IN REQUIRED STATE FOR EXISTING PLANT CONDITIONS:	
		• P-7 Lo Power Rx Trips Blocked	**NOTE:** Status light is LIT (Correct position).
		• P-8 Hi Pwr Lo Flo Rx Trip Blocked	**NOTE:** Status light is LIT (Correct position).
		• P-10 Nuclear at Power.	**NOTE:** Status light is DARK (Correct position).
	BOP	(Step 7) Perform the following actions at the "MISCELLANEOUS CONTROL AND INDICATION PANEL" drawer:	
		• Place the appropriate "ROD STOP BYPASS" switch to the failed channel position.	
		• Place the "POWER MISMATCH BYPASS" switch to the failed channel position.	
	BOP	(Step 8) Perform the following actions at the "DETECTOR CURRENT COMPARATOR" drawer:	
		• Place the "UPPER SECTION" switch to the failed channel position.	
		• Check the "CHANNEL DEFEAT" light for the upper section - LIT.	
		• Place the "LOWER SECTION" switch to the failed channel position.	
		• Check the "CHANNEL DEFEAT" light for the lower section - LIT.	
	BOP	(Step 9) Perform the following actions at the "COMPARATOR AND RATE" drawer:	
		• Place the "COMPARATOR CHANNEL DEFEAT" switch to the failed channel position.	

Op Test No.:	N16-1	Scenario #	4	Event #	2	Page	15 of 63
Event Description:	**Power Range Channel N41 Upper Detector failure**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Check the "COMPARATOR DEFEAT" light - LIT.	
	BOP	(Step 10) Trip bistables of failed channel as follows:	
		• Remove Control Power fuses from "POWER RANGE A" drawer for failed channel.	
		• IF Power Range Cabinet shows evidence of damage (i.e. visible smoke or flame), THEN remove Instrument Power fuses from "POWER RANGE B" drawer.	**NOTE:** There is no sign of damage.
	RO	(Step 11) Check the following status lights for the failed channel - LIT:	
		• "NUC OVERPOWER ROD STOP CH I(II,III,IV) BYP" (1SI-19)	
		• "P/R HI FLUX LO STPT" (1SI-2)	
		• "P/R HI FLUX HI STPT" (1SI-2)	
		• "P/R HI FLUX RATE" (1SI-3).	
	RO	(Step 12) Check the following annunciator lights - LIT:	
		• "P/R HI VOLTAGE FAILURE" (1AD-2, F-3)	
		• "P/R HI FLUX HI STPT ALERT" (1AD-2, A-3)	
		• "P/R HI FLUX RATE ALERT" (1AD-2, A-1).	
	RO	(Step 13) Check the following status lights on 1SI-18 - LIT:	
		• "P/R LO SETPOINT TRAIN A TRIP BLOCKED"	

Op Test No.:	N16-1	Scenario #	4	Event #	2	Page	16 of	63
Event Description:	**Power Range Channel N41 Upper Detector failure**							

Time	Pos.	Expected Actions/Behavior	Comments
		• "P/R LO SETPOINT TRAIN B TRIP BLOCKED".	
	RO/ CRS	(Step 13 RNO) Perform the following:	
		• Check "P/R HI FLUX LO STPT ALERT" alarm (1AD-2, A-2) - LIT.	
		• IF alarm is dark, THEN …...	
	RO/ BOP	(Step 14) Check all CF control valves - IN AUTO.	
	RO	(Step 15) Adjust control rods to maintain T-Avg at T-Ref.	
	RO	(Step 15 RNO) IF rods will not move in manual, THEN adjust turbine load to maintain T-Avg at T-Ref.	
	RO	(Step 16) WHEN T-Avg within 1°F of T-Ref, AND auto rod control desired, THEN return control rods to auto.	**NOTE:** Due to plant mode of operation the rods will be left in MANUAL.
	CRS	(Step 17) Instruct IAE to trip the following bistables associated with failed P/R channel within 72 hours of failure PER IP/1/A/3090/014 (Tripping Inoperable Protection Channels):	**NOTE:** The CRS may call WCC/IAE to address the malfunction. If so, **Booth Instructor** acknowledge as WCC.
		• OPDT	
		• OTDT.	
	CRS	(Step 18) IF AT ANY TIME failed P/R channel is repaired prior to IAE tripping bistables, THEN…..	

Event Description: **Power Range Channel N41 Upper Detector failure**

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The CRS will check the Technical Specifications.
TECHNICAL SPECIFICATION 3.3.1, REACTOR TRIP SYSTEM INSTRUMENTATION			
	CRS	LCO 3.3.1 The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.	
	CRS	APPLICABILITY: According to Table 3.3.1-1	
	CRS	ACTIONS	

Time	Pos.	CONDITION	REQUIRED ACTION	COMPLETION TIME	Comments
		A. One or more Functions with one or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.1-1 for the channel(s).	IMMEDIATELY	
		D. One channel inoperable.	NOTE: One channel may be bypassed for up to 12 hours for surveillance testing and setpoint adjustment. D.1.1 NOTE: Only required to be performed when the Power Range Neutron Flux input to QPTR is inoperable Perform SR 3.2.4.2 <u>AND</u> D.1.2 Place channel in trip. <u>OR</u> D.2 Be in MODE 3.	12 hours from discovery of THERMAL POWER > 75% RTP <u>AND</u> Once per 12 hours thereafter 72 hours 78 hours	**NOTE:** The CRS will determine that Function 2.a (Power Range Neutron Flux - HIGH), 2.b (Power Range Neutron Flux - LOW), 3 (Power Range Neutron Flux Rate), 6 (Overtemperature ΔT), 7 (Overpower ΔT), and 16.d (Power Range Neutron Flux – P10) are affected. The CRS will determine that Actions D.1.1 AND D.1.2, or D.2 are required to be taken.

Op Test No.:	N16-1	Scenario #	4	Event #	2	Page 18 of 63
Event Description:	**Power Range Channel N41 Upper Detector failure**					

Time	Pos.	Expected Actions/Behavior			Comments
		E. One channel inoperable.	NOTE: One channel may be bypassed for up to 12 hours for surveillance testing. E.1 Place channel in trip. <u>OR</u> E.2 Be in MODE 3.	72 hours 78 hours	CRS will determine that Actions E.1 OR E.2 are required to be taken.
		S. One or more channel(s) inoperable.	S.1 Verify interlock is in required state for existing unit conditions. <u>OR</u> S.2 Be in MODE 3.	1 hour 7 hours	CRS will determine that Actions S.1 OR S.2 are required to be taken.
					NOTE: The CRS will likely conduct a Focus Brief.
At the discretion of the Lead Examiner move to Event #3.					

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	19 of 63
Event Description:	**Ground Fault on 1ETA**						

Following this, a ground fault will occur on 1ETA causing the bus to de-energize. The operator will enter AP/1/A/5500/07, "Loss of Electrical Power," and start the equipment on the B Train. The operator will address Technical Specification 3.8.1, "AC Sources Operating," 3.8.4, "DC Sources - Operating," and 3.8.9 "Distribution Systems - Operating."

Booth Operator Instructions: **insert MAL-EP008A ACTIVE**

Insert 1AD11_A01=ON

Indications Available:

- 1SI-14 Status Light for ETA LOSS/UNDERVOLTAGE PHASE X is LIT
- 1SI-14 Status Light for ETA LOSS/UNDERVOLTAGE PHASE Y is LIT
- 1SI-14 Status Light for ETA LOSS/UNDERVOLTAGE PHASE Z is LIT
- MCB Annunciator 1AD-11/A-2U ETA 600V LC TROUBLE
- MCB Annunciator 1AD-11/A-3U ETA 600V/120V TROUBLE
- 1ETA Normal Supply Breaker Green status light is LIT

Time	Pos.	Expected Actions/Behavior	Comments
		AP/1/A/5500/07, LOSS OF ELECTRICAL POWER CASE II, LOSS OF NORMAL POWER TO EITHER 1ETA OR 1ETB	
	BOP	(Step 1) Check affected bus(s) - ENERGIZED AND SEQUENCER APPLYING LOADS.	**Immediate Action**
	BOP	(Step 1 RNO) Perform the following:	**Immediate Action**
		• IF both busses deenergized…	**NOTE:** 1ETB is energized.
		• Ensure the following pumps running on energized bus:	
		• NV pump	**NOTE:** The BOP will start the 1B NV Pump.
		• KC pumps	**NOTE:** The 1B1 and 1B2 KC Pumps are running.
		• RN pump.	**NOTE:** The BOP will start the 1B RN Pump.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	20 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 2) Ensure NC pump thermal barrier isolation valves on energized train(s) – OPEN.	**Immediate Action**
	RO	(Step 3) Maintain reactor power less than or equal to 100%.	
	BOP	(Step 4) Check 1ETA and 1ETB – BOTH ENERGIZED.	**NOTE:** ONLY 1ETB is energized.
	CRS	(Step 4 RNO) GO TO Step 6.	
	BOP	(Step 6) Check – S/I HAS OCCURRED DURING THIS EVENT.	**NOTE:** SI has NOT occurred.
	BOP	(Step 6 RNO) Perform the following:	
		• IF both NV pumps off,…	**NOTE:** The 1B NV is running.
	CRS	• IF any pump was manually started per AP07 Immediate Actions, THEN GO TO Step 8.	**NOTE:** The 1B NV Pump was manually started.
	CRS	(Step 8) Check D/Gs – OFF.	
	BOP	(Step 9) Check ND System status:	
		• ND System – IN RHR MODE AT TIME OF B/O.	**NOTE:** ND is NOT in RHR Mode.
	CRS	(Step 9a RNO) GO TO Step 10.	
	BOP	(Step 10) Check any RN pump – RUNNING.	**NOTE:** The 1B RN Pump is running.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	21	of	63
Event Description:	**Ground Fault on 1ETA**								

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 11) Align KC as follows:	
	BOP	• Place recirc valve on operating train in "AUTO":	
		• 1KC-54B (Train B Recirc Isol).	
		• Ensure KC flow remains less than 4000 GPM per operating KC pump while performing next step.	
		• Ensure the following valves on energized train are OPEN:	
		• B Train:	
		• OPEN 1KC-18B (Trn B Rx Bldg Non Ess Ret Isol)	
		• OPEN 1KC-228B (Trn B Rx Bldg Non Ess Sup Isol)	
		• OPEN 1KC-364B (B NC Pump Therm Bar Otlt)	
		• OPEN 1KC-413B (D NC Pump Therm Bar Otlt).	
	BOP	(Step 12) Check any charging pump – RUNNING.	
	BOP	(Step 13) Align RN as follows:	
		• Check 1A RN pump – RUNNING.	**NOTE:** The 1A RN is OFF.
	BOP	(Step 13a RNO) Align 1B RN as follows:	
		• Ensure 1RN-187B (B KC Hx Inlet Isol) is OPEN.	
		• THROTTLE 1RN-190B (RN To B KC Hx Control) for desired KC cooling, while maintaining the following:	
		• 1B RN pump flow – LESS THAN 14,000 GPM.	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	22 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1B RN pump discharge pressure – GREATER THAN 50 PSIG.	
	BOP	• Start all available RV pumps.	**NOTE:** Two additional RV pumps will be started.
	CRS	• GO TO Step 14.	
	CRS	(Step 14) Notify Unit 2 RO to start 2A RN pump.	**Floor Instructor:** As U2 RO report "2A RN Pump is running." **Booth Instructor:** **insertLOA-RN087 = ON delay = 60 seconds (Start 2A RN Pump)**
	BOP	(Step 15) Check VCT makeup control system.	
		• Ensure boric acid transfer pump on energized train running.	
		• Ensure NC System makeup controller in auto.	
		• Place NC System makeup switch to start.	
	BOP	(Step 16) Check – B/O ON 1ETA.	
	BOP	(Step 17) Check B and D Pzr heater group supply breakers on vertical board – CLOSED.	**Examiner NOTE:** IF NV Pump not started on B Train within 20 seconds of BO, loss of letdown/ Pzr heaters off will occur, and require RNO actions. If NV Pump started within 20 seconds, move forward to Step 18.

Op Test No.: N16-1	Scenario # 4	Event # 3	Page 23 of 63
Event Description:	**Ground Fault on 1ETA**		

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 17 RNO) Perform the following:	
		• IF Pzr level is less than 17%,……	**NOTE:** Pzr level is most likely > 17%.
		• IF S/I has occurred, …...	**NOTE:** SI has NOT occurred.
		• Place the following Pzr heater groups in manual:	
		• B	
		• D	
		• Close the following Pzr heater group supply breakers:	
		• B	
		• D	
		• Close C Pzr heater group supply breaker.	
		• Return the following Pzr heater groups to auto:	
		• B	
		• D	
	BOP	(Step 18) Perform one of the following to isolate RN train crosstie:	
		• Dispatch operator to close 1RN-40A (Train A To Non Ess Hdr Isol) (aux bldg, 716+7, GG-55 beside Unit 1 side stairway to 695 elevation).	**NOTE:** The CRS will dispatch an AO to close 1RN-40A. **Floor Instructor/Booth Instructor:** acknowledge as appropriate. **insertREM-RN0040A_1 = 0, delay = 5 min (Close 1RN-40A)** After closing valve, **Booth Instructor** report action taken to Control Room.
		OR	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	24	of	63
Event Description:		**Ground Fault on 1ETA**							

Time	Pos.	Expected Actions/Behavior	Comments
		Caution: Closing 1RN-41B (Train B To Non Ess Hdr Isol) will isolate 1B Train RN flow to NC pumps and other non essential loads.	
		• Evaluate CLOSING 1RN-41B (Train B To Non Ess Hdr Isol).	
	CRS	(Step 19) WHEN RN train crosstie is isolated, THEN 1RN-190B (RN To B KC Hx Control) may be throttled further OPEN, while maintaining the following:	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• 1B RN pump flow – LESS THAN 14,000 GPM.	
		• 1B RN pump discharge pressure – GREATER THAN 50 PSIG.	
	CRS	(Step 20) Dispatch operator to close the following valves:	**NOTE:** CRS will dispatch an AO to close 1KC-230A and 1KC-3A. **Floor Instructor/Booth Instructor:** acknowledge as appropriate. **insert REM-KC0003A = 0, delay = 5 min (Close 1KC-3A)** **insert REM-KC0230A = 0, delay = 5 min (Close 1KC-230A)** After closing valves, **Booth Instructor** report action taken to Control Room.
	BOP	• 1KC-230A (Trn A Rx Bldg Non Ess Sup Isol) (aux bldg, 750+12, JJ-55, above north end of KC HX 1A)	
	BOP	• 1KC-3A (Trn A Rx Bldg Non Ess Ret Isol) (aux bldg, 733+8, HH-55, north of column HH-55).	
	BOP	(Step 21) Check 1A ND Train – WAS IN RHR MODE.	

Op Test No.: N16-1	Scenario # 4	Event # 3	Page 25 of 63
Event Description:	**Ground Fault on 1ETA**		

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 21 RNO) GO TO Step 36.	
	BOP	(Step 36) Check normal letdown – IN SERVICE.	**NOTE:** If normal letdown is in service, the CRS will proceed to Step 37.
	CRS	(Step 36 RNO) IF desired to establish normal or excess letdown, THEN have any available operator establish letdown PER AP/1/A/5500/12 (LOSS OF LETDOWN, CHARGING OR SEAL INJECTION) while continuing with this procedure.	**Examiner NOTE:** Normal Letdown may have isolated. **If so**, the CRS may direct **BOP** to restore Letdown per AP12. If so, follow actions on **Page 34**, while **crew continues in AP7**.
	BOP	(Step 37) Check any Unit 1 6900V bus - ENERGIZED.	
	CRS	(Step 38) GO TO Step 45.	
	BOP	(Step 45) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that the Unit 1 has entered AP-7. If so, **Floor Instructor** acknowledge as U2 RO.
	BOP	(Step 46) Check - S/I HAS OCCURRED DURING THIS EVENT.	
	CRS	(Step 46 RNO) Perform the following:	
		• Initiate EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 13 (VC And VA System Operation) within 30 minutes of B/O.	**NOTE:** The CRS may ask U2 BOP to perform Enclosure 13. If so, **Floor Instructor** acknowledge and indicate that U2 BOP is unavailable.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	26 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: The CRS will likely assign the BOP to perform this action. If so, **BOP Examiner** follow actions of Enclosure 13. **Other Examiners** follow **AP-7** Actions, **Step 47**, on **Page 29**.
		EP/1/A/5000/G-1, GENERIC ENCLOSURES **ENCLOSURE 13, VC AND VA SYSTEM OPERATION**	
			Examiner NOTE: Follow the actions associated with Enclosure 13 if BOP is assigned by CRS to perform.
	BOP	(Step 1) Check the following HVAC annunciator alarms - LIT:	
		• "VC/YC TRAIN A SAFETY ACTUATION" (0AD-11, G-1)	
		• "VC/YC TRAIN B SAFETY ACTUATION" (0AD-11, G-2).	
	BOP	(Step 1 RNO) Depress VC/YC Safety Actuation "INITIATE" pushbutton(s).	
	BOP	(Step 2) Check the following VC equipment - ON:	
		• "B CONTROL ROOM AHU"	
		• "A CONTROL ROOM AHU"	
		• Train selected YC pump.	
	BOP	(Step 2 RNO) Start equipment.	
	BOP	(Step 3) Check train selected Control Room Area Chiller - ON.	
	BOP	(Step 3 RNO) Perform the following:	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	27 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
		• IF the "STOP" pushbutton is depressed on selected train, THEN…….	
		• IF train selected chiller is off, THEN start opposite train chiller as follows:	
		• Ensure RN pump aligned to desired chiller is running.	
		• Perform one of the following:	
		• IF desired to start A VC/YC chiller, THEN place the "VC/YC TRN A MODE SELECT" switch to "TRN A".	
		OR	
		• IF desired to start B VC/YC chiller, THEN place the "VC/YC TRN B MODE SELECT" switch to "TRN B".	
		• Depress "START" on chiller to be started.	
		• Check chiller starts within 2 minutes.	
		• IF neither chiller can be started, THEN…..	
		• Stop undesired train by performing the following:	
		• Depress "STOP" on chiller to be stopped.	
		• WHEN chiller "ON" indication dark, THEN select "OFF" on associated VC/YC mode select switch.	
	BOP	(Step 4) Check the following VC fans - ON:	
		• "B TRAIN CR OUTSIDE AIR PRESS FAN"	
		• "A TRAIN CR OUTSIDE AIR PRESS FAN".	
	BOP	(Step 4 RNO) Start equipment.	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	28 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 5) Check "OPEN" lights on the following dampers - DARK:	
		• CRA-OAD-4 (CR Area Otsd Air Fans Damper)	
		• CRA-OAD-3 (CR Area Otsd Air Fans Damper).	
	BOP	(Step 5 RNO) CLOSE dampers.	
	BOP	(Step 6) Check the following fans - OFF.	
		• "#1 CRA OTSD AIR FAN"	
		• "#2 CRA OTSD AIR FAN".	
	BOP	(Step 7) Check the following VC equipment for train selected - ON:	
		B Train:	
		• 1B SWGR AHU (1ETA Supply)	
		• 2B SWGR AHU (2ETA Supply)	
		• 1D SWGR AHU (1ETB Supply)	
		• 2D SWGR AHU (2ETB Supply)	
		• "B CR AREA AHU"	
		• "BATT ROOM B EXH FAN"	
	BOP	(Step 8) Check the following AHUs - ON:	
		• 1B NS AHU	
		• 1B ND AHU	
		• 1B KF AHU	
	BOP	(Step 9) Ensure VA filter units remain in filter mode as follows:	
		• Place the following switches in "TEST":	
		• "1B VA FILTER UNITS TEST"	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	29 of 63
Event Description:		Ground Fault on 1ETA					

Time	Pos.	Expected Actions/Behavior	Comments
		• "1A VA FILTER UNITS TEST"	
		• Check the following closed:	
		• 1ABF-D-3 (1B VA Filter Exh Bypass Damper)	
		• 1ABF-D-3 (1A VA Filter Exh Bypass Damper)	
	BOP	(Step 10) Restart the following EMF Sample Blowers as required:	
		• EMF 41 (Aux Bldg Ventilation)	
		• EMF-43A (Control Room Air Intake Loc A)	
		• 1EMF-35, 36, 37 (Unit Vent Particulate, Gas, Iodine)	
		• 1EMF-42 (Fuel Bldg Ventilation)	
		• EMF-43B (Control Room Air Intake Loc B).	
	BOP	(Step 11) WHEN time and manpower allow, THEN dispatch operator to ensure VA System remains in proper alignment as follows:	**NOTE:** The BOP will contact or dispatch an AO to continue the local actions. If so, **Floor Instructor/Booth Instructor** acknowledge as AO.
AP/1/A/5500/07, LOSS OF ELECTRICAL POWER CASE II, LOSS OF NORMAL POWER TO EITHER 1ETA OR 1ETB			
			Examiner NOTE: Examiners following the **CRS/RO** continue **HERE**.
	CRS	(Step 47) Have available licensed operator initiate Enclosure 7 (DC Bus Alignment) within 30 minutes of B/O.	**NOTE:** The CRS may ask WCCS for an available Licensed Operator to perform Enclosure 7. If so, **Floor Instructor** acknowledge as WCCS, and perform.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	30 of 63
Event Description:		**Ground Fault on 1ETA**					

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 48) Check D/G on bus that was blacked out - ON.	**NOTE:** The 1A D/G is OOS.
	BOP	(Step 48 RNO) Perform the following on affected D/G:	
		• IF D/G was stopped using emergency stop pushbutton,……	**NOTE:** The 1A D/G is OOS.
		• IF bus known to be locked out, THEN GO TO Step 50.	
			NOTE: The CRS will NOT stop to look at Tech Specs while in AP-07. Tech Spec review should occur after completion of scenario. Therefore, **at the discretion of the lead examiner, move to Event 4**
TECHNICAL SPECIFICATION 3.8.1, AC SOURCES - OPERATING			
	CRS	3.8.1 AC Source - Operating	
	CRS	LCO 3.8.1 The following AC electrical sources shall be OPERABLE:	
		• Two qualified circuits between the offsite transmission network and the Onsite Essential Auxiliary Power System AND • Two diesel generators (DGs) capable of supplying the Onsite Essential Auxiliary Power Systems AND • The automatic load sequencers for Train A and Train B shall be OPERABLE.	
	CRS	APPLICABILITY: MODES 1, 2, 3, and 4.	
	CRS	ACTIONS	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page 31 of 63
Event Description:	**Ground Fault on 1ETA**					

<table>
<tr><th>Time</th><th>Pos.</th><th colspan="3">Expected Actions/Behavior</th><th>Comments</th></tr>
<tr><td></td><td></td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">CRS</td><td>CONDITION</td><td>REQUIRED ACTION</td><td>COMPLETION TIME</td><td rowspan="2">NOTE: The CRS will determine that one offsite line and one DG are inoperable because neither are capable of supplying the Emergency Bus (TS Basis pB3.8.1-2).
Consequently, ACTION A.1, A.2 and A.3 must be entered.
Additionally, The CRS will determine that ACTION B.1, B.2, either B.3.1 or B.3.2 and B.4 must be entered.</td></tr>
<tr><td>A. One offsite circuit inoperable.</td><td>A.1 Perform SR 3.8.1.1 for OPERABLE offsite circuit.
AND
A.2 Declare required features with no offsite power available inoperable with its redundant required feature(s) is inoperable.
AND
A.3 Restore offsite circuit to OPERABLE status.</td><td>1 hour
AND
Once per 8 hours thereafter

24 hours from discovery of no offsite power to one train concurrent with inoperability of redundant required feature(s).

72 hours
AND
6 days from failure to meet LCO.</td></tr>
</table>

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	32 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior			Comments
		B. One DG inoperable.	B.1 Perform SR 3.8.1.1 for OPERABLE offsite circuit. AND B.2 Declare required features supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable. AND B.3.1 Determine inoperable DG is not inoperable due to common cause failure. OR B.3.2 Perform SR 3.8.1.2 for OPERABLE DG. AND B.4 Restore DG to OPERABLE status	1 hour AND Once per 8 hours thereafter. 4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s). 24 hours 24 hours 72 hours AND 6 days from failure to meet LCO.	
TECHNICAL SPECIFICATION 3.8.4, DC SOURCES - OPERATING					
	CRS	LCO 3.8.4 The four channels of DC sources shall be OPERABLE.			
	CRS	APPLICABILITY: MODES 1, 2, 3, and 4.			
	CRS	ACTIONS			

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	33 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
		CONDITION / REQUIRED ACTION / COMPLETION TIME: A.. One channel of DC source inoperable. — A.1 Restore channel of DC source to OPERABLE status. (2 hours) OR A.2.1 Verify associated bus tie breakers are closed between DC channels. (2 hours) AND A.2.2 Restore channel of DC source to OPERABLE status. (72 hours)	**NOTE:** The CRS will determine that the AC Battery Chargers are inoperable. (TS Basis pB3.8.4-3). Consequently, ACTION A.1, or A.2.1 and A.2.2 must be entered.
TECHNICAL SPECIFICATION 3.8.9, DISTRIBUTION SYSTEMS - OPERATING			
	CRS	LCO 3.8.9 Train A and Train B AC, four channels of DC, and four AC vital buses electrical power distribution subsystems shall be OPERABLE.	
	CRS	APPLICABILITY: MODES 1, 2, 3, and 4.	
	CRS	ACTIONS	
		CONDITION / REQUIRED ACTION / COMPLETION TIME: A. One or more AC electrical power distribution subsystem(s) inoperable. — A.1 Restore AC electrical power distribution subsystem(s) to OPERABLE status. — 8 hours AND 16 hours from discovery of failure to meet LCO.	**NOTE:** The CRS will determine that 1ETA is inoperable. Consequently, ACTION A.1 must be entered.

Nested action tables:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A.. One channel of DC source inoperable.	A.1 Restore channel of DC source to OPERABLE status.	2 hours
	OR	
	A.2.1 Verify associated bus tie breakers are closed between DC channels.	2 hours
	AND	
	A.2.2 Restore channel of DC source to OPERABLE status.	72 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more AC electrical power distribution subsystem(s) inoperable.	A.1 Restore AC electrical power distribution subsystem(s) to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	34	of	63
Event Description:		Ground Fault on 1ETA							

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: If normal letdown is isolated, the CRS may direct the BOP to perform AP-12, while the remainder of the crew continues with AP-7. If so, **BOP Examiner** follow the AP-12 steps below.
AP/1/A/5500/12, LOSS OF LETDOWN, CHARGING OR SEAL INJECTION			
	BOP	(Step 1) Check if charging is aligned to Regenerative Hx as follows:	
		• Charging flow – GREATER THAN 20 GPM	**NOTE:** The BOP may take MANUAL control of 1NV-238 to control Charging flow.
		• 1NV-241 (U1 Seal Water Inj Flow Control) – THROTTLED OPEN	
		• 1NV-244A (U1 Charging Hdr Cont Outside Isol) - OPEN	
		• 1NV-245B (U1 Charging Hdr Cont Outside Isol) – OPEN.	
	BOP	(Step 2) Check Pzr Level – LESS THAN 96%.	
	BOP	(Step 3) Stop any power or temperature changes in progress.	
	BOP	(Step 4) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that AP-12 has been entered. If so, **Floor Instructor** acknowledge as U2 RO.
	BOP	(Step 5) IF this AP entered due to loss of letdown only, THEN GO TO Step 37.	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	35	of	63
Event Description:	**Ground Fault on 1ETA**								

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 37) Ensure the following valves are CLOSED:	
		• 1NV-458A (U1 75 GPM L/D Orifice Otlt Cont Isol)	
		• 1NV-457A (U1 45 GPM L/D Orifice Otlt Cont Isol)	
		1NV-35A (U1 Variable L/D Orifice Otlt Cont Isol).	
	BOP	(Step 38) Ensure NC System makeup controller is in AUTO.	
	BOP	(Step 39) Ensure charging flow going down to maintain Pzr at program level.	**NOTE:** The BOP may take MANUAL control of 1NV-238 to control Charging flow.
	BOP	(Step 40) Check "LETDN RELIEF HI TEMP" alarm (1AD-7, I-4) – HAS REMAINED DARK.	
	BOP	(Step 41) Check 1NV-21A (U1 NV Supply to U1 Aux PZR Spray Isol) – CLOSED.	
	BOP	(Step 42) Operate Pzr heaters as follows:	
		• Check A, B, and D Pzr heater group supply breakers on vertical board – CLOSED.	
		• Check normal Pzr spray – AVAILABLE.	
	BOP	Place the following Pzr heater groups in manual and "ON" to maximize spray flow:	
		• A	
		• B	
		• D	
	BOP	(Step 43) Check the following valves – OPEN:	**NOTE:** If normal Letdown has been isolated, it is likely that these valves are CLOSED.

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	36	of 63
Event Description:	**Ground Fault on 1ETA**							

Time	Pos.	Expected Actions/Behavior	Comments
		• 1NV-1A (U1 NC L/D Isol To Regenerative Hx)	
		• 1NV-2A (U1 NC L/D Isol To Regenerative Hx).	
	BOP	(Step 43 RNO) Perform the following:	
		• IF normal letdown known to be unavailable, …….	**NOTE:** If Pzr level has been restored, Normal Letdown is available.
		• Prior to opening 1NV-1A or 1NV-2A in subsequent step, attempt to evacuate all personnel from lower containment (potential water hammer event).	
		• Observe Caution prior to Step 45 and GO TO Step 45.	
	BOP	(Caution prior to Step 45) Establishing normal letdown without local pressurization may cause some water hammer.	
	BOP	Determine if conditions allow immediate restoration of normal letdown as follows:	
		• Check both 1NV-1A (U1 NC L/D Isol To Regenerative Hx) and 1NV-2A (U1 NC L/D Isol To Regenerative Hx) – OPEN WITHIN THE LAST 60 MINUTES.	
		• Check orifice isolation valves – AUTO CLOSED	
	BOP	• Determine exact time each NV letdown valve went closed on the OAC by performing the following:	
		○ Enter turn on code "ARCHIVE".	
		○ Ensure OAC automatically populates "START TIME" and STOP TIME" (previous hour).	
		○ Enter group name "AP12".	
		○ Click "F3 - VIEW PID".	

Op Test No.:	N16-1	Scenario #	4	Event #	3		Page	37	of	63
Event Description:	**Ground Fault on 1ETA**									

Time	Pos.	Expected Actions/Behavior	Comments
		• Check if orifice isolation valves reached fully closed - PRIOR TO 1NV-1A OR 1NV-2A CLOSING.	
	BOP	(Step 46) GO TO Step 49.	
	BOP	(Step 49) Establish normal letdown as follows:	
		• Ensure 1NV-459 (U1 Variable L/D Orifice Outlet Flow Cntrl) is CLOSED.	
		• Place 1NV-124 (U1 Letdown Press Control) in manual with output between 40-45% OPEN.	
		• Check OAC – IN SERVICE.	
		• Check valve position on OAC for 1NV-124 – INDICATING THROTTLED.	
		• Check the following valves – OPEN:	**NOTE:** Both valves are expected to be CLOSED.
		• 1NV-1A (U1 NC L/D Isol To Regenerative Hx)	
		• 1NV-2A (U1 NC L/D Isol To Regenerative Hs).	
		• IF time allows, THEN wait until all personnel are evacuated from lower containment.	
		• Establish cooling to Regenerative Hx by performing the following concurrently:	
	BOP	• Establish at least 65 GPM charging flow by THROTTLING OPEN 1NV-238 (U1 Charging Hdr Control) or raising PD pump speed.	**NOTE:** The BOP will take MANUAL control of 1NV-238 to control Charging flow.
		• THROTTLE 1 NV-241 (U1 Seal Water Inj Flow Control) to establish approximately 8 GPM seal injection flow to each NC pump.	
	BOP	• OPEN letdown line isolation valves as follows:	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	38	of	63
Event Description:	**Ground Fault on 1ETA**								

Time	Pos.	Expected Actions/Behavior	Comments
		• OPEN 1NV-7B (U1 Letdown Cont Outside Isol).	
		• OPEN 1NV-1A (U1 NC L/D Isol To Regenerative Hx).	
		• OPEN 1NV-2A (U1 NC L/D Isol To Regenerative Hx).	
		• OPEN 1NV-35A (U1 Variable L/D Orifice Otlt Cont Isol).	
	BOP	• Slowly THROTTLE OPEN 1NV-459 (U1 Variable L/D Orifice Outlet Flow Cntrl) until one of the following conditions met:	
		• Letdown flow - GOES UP	
		OR	
		• 1NV-459 valve demand - AT 60%.	
	BOP	• Do not continue until one of the above conditions is met.	
	BOP	• Check letdown flow - HAS GONE UP.	
	BOP	• THROTTLE CLOSED 1NV-124 (U1Letdown Press Control) until one of the following conditions is met:	
		• Letdown pressure is between 250-350 PSIG.	
		OR	
		• 1NV-124 is 10-20% OPEN.	
	BOP	• Adjust charging flow as needed in subsequent steps while maintaining the following:	
		• NC pump seal injection flow greater than 6 GPM	
		• Regenerative Hx letdown temperature less than 380°F.	
	BOP	• Establish desired letdown flow (normally greater than or equal to 75 GPM) by completing the following concurrently:	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	39 of 63
Event Description:	**Ground Fault on 1ETA**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Slowly THROTTLE OPEN 1NV-459 (U1 Variable L/D Orifice Outlet Flow Orifice Outlet Flow Cntrl) to achieve desired letdown flow.	
		• As letdown pressure rises, THROTTLE 1NV-124 (U1 Letdown Press Control) to maintain letdown pressure between 250 PSIG and 350 PSIG.	
	BOP	• Do not continue until desired flow rate is established.	
	BOP	• Check setpoint for 1NV-124 (U1 Letdown Press Control) – SET BETWEEN 348-352 PSIG.	
	BOP	• THROTTLE 1NV-124 to obtain letdown pressure between 348-352 PSIG.	
	BOP	• Place 1NV-124 in auto.	
	BOP	• Ensure letdown pressure controlling between 348-352 PSIG.	
	BOP	• IF more letdown flow required…..	**NOTE:** Additional Letdown flow will NOT be required.
	BOP	• Adjust charging flow as desired while maintaining the following:	
		• NC pump seal injection flow greater than 6 GPM	
		• Regenerative Hx letdown temperature less than 380°F	
		• Pzr level at program level.	
	BOP	• Check 1A or 1B NV pump - SUPPLYING NORMAL CHARGING.	**NOTE:** The 1B NV Pump is running.
	BOP	• WHEN Pzr level matches program level, THEN perform the following:	
		• Place 1NV-238 (U1 Charging Hdr Control) in auto.	
		• On DCS workstation, place "PZR LEVEL MASTER" in auto.	

Op Test No.:	N16-1	Scenario #	4	Event #	3	Page	40 of 63
Event Description:		Ground Fault on 1ETA					

Time	Pos.	Expected Actions/Behavior	Comments
		• THROTTLE 1NV-241 (U1 Seal Water Inj Flow Control) as necessary to maintain approximately 8 GPM seal injection flow to each NC pump.	
	BOP	• Notify Chemistry that normal letdown is in service.	**NOTE:** The BOP may contact WCCS/Chemistry for this notification. If so, **Booth Instructor** acknowledge as WCCS/Chemistry.
	BOP	• Check position of 1NV-127A (U1 L/D Hx 3-Way Temp Control) - ALIGNED TO "DEMIN".	
	BOP	• Operate Pzr heaters as desired.	
	BOP	• WHEN time allows, THEN notify engineering to document the following transients:	**NOTE:** The BOP may contact WCCS/RE for this notification. If so, **Booth Instructor** acknowledge as WCCS/RE.
		• Letdown isolation	
		• Potential charging nozzle transient	
		• IF NV Aux Spray was in service, THEN spray nozzle transient.	
	BOP	• Check excess letdown - ISOLATED.	
	BOP	• RETURN TO procedure and step in effect.	**NOTE:** The BOP will inform the CRS that Normal Letdown has been restored.

At the discretion of the Lead Examiner move to Event #4.

Op Test No.:	N16-1	Scenario #	4	Event #	4	Page	41 of 63
Event Description:	C-9 Failure causing failure of 1B SG PORV (Manual Control avail)						

Afterwards, the C-9 Interlock will fail causing the Steam Dump Valves to close. The SG PORVs will open to maintain Steam Generator pressure at setpoint. As these valves open, the 1B SG PORV Controller will fail such that the valve slowly opens. The operator will implement AP/1/A/5500/01, “Steam Leak” and take manual control of the 1B SG PORV.

Booth Operator Instructions:

Insert MAL-IPE004H = True

insert XMT-SM_1SMPT5510 = 1150

Indications Available:

- OAC Alarm: 1SV1 1B SM PORV OPEN
- 1SI-18 C-9 COND AVAILABLE FOR STM DUMP
- 1SV-13AB Red status light is LIT

Time	Pos.	Expected Actions/Behavior	Comments
			NOTE: It is likely that the operator will take actions to close the 1B SG PORV prior to being directed by the CRS. (Step 13)
		AP/1/A/5500/01, STEAM LEAK	
	RO/ BOP	(Step 1) Monitor Foldout page.	
	RO	(Step 2) Reduce turbine load to maintain the following:	**NOTE:** The Turbine is NOT operating.
		• Excore NI’s – LESS THAN OR EQUAL TO 100%.	
		• NC Loop D/T’s – LESS THAN 60°F D/T	
		• T-Avg – AT T-REF.	
	CRS	(Step 3) Check containment entry – IN PROGRESS.	**NOTE:** A Containment Entry is NOT in progress.
	CRS	(Step 3 RNO) GO TO Step 5.	

Op Test No.:	N16-1	Scenario #	4	Event #	4	Page	42 of 63
Event Description:	**C-9 Failure causing failure of 1B SG PORV (Manual Control avail)**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 5) Check Pzr pressure prior to event – GREATER THAN P-11 (1955 PSIG).	
	BOP	(Step 6) Check Pzr level – STABLE OR GOING UP.	**NOTE:** Pzr level will most likely be stable.
	BOP	(Step 7) IF AT ANY TIME while in this procedure Pzr level cannot be maintained stable, THEN RETURN TO Step 6.	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 8) GO TO Step 12.	
	CRS	(Step 12) Announce occurrence on paging system.	**NOTE:** CRS may ask U2 RO to make Plant Announcement that the Unit 1 has entered AP-1. If so, **Floor Instructor** acknowledge as U2 RO.
	RO	(Step 13) Identify and isolate leak on Unit 1 as follows:	
		• (Step 13a) Check SM PORVs – CLOSED.	**NOTE:** The SG PORVs may be Open.
	RO	(Step 13a RNO) IF S/G pressure is less than 1092 PSIG, THEN	
		• CLOSE affected S/G SM PORV manual loader.	**NOTE:** Closing the Manual Loader will CLOSE the valve.
		• IF SM PORV is still open, THEN…	**NOTE:** The 1B SG PORV is CLOSED.
	RO	• (Step 13.b) Check condenser dump valves – CLOSED.	
	BOP	• (Step 13.c) Check containment conditions – NORMAL:	
		• Containment temperature	
		• Containment pressure	

Op Test No.:	N16-1	Scenario #	4	Event #	4	Page	43 of 63
Event Description:	**C-9 Failure causing failure of 1B SG PORV (Manual Control avail)**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Containment humidity	
		• Containment floor and equipment sump level.	
	RO / BOP	• (Step 13.d) Check TD CA pump – OFF.	
	BOP	• (Step 13.e) Check valves on "STEAM LINE DRAIN VALVES" board (1MC-9) – CLOSED.	
	CRS	• (Step 13.f) Check opposite Unit (Unit 2) "STEAM HEADER PRESSURE" – GREATER THAN 200 PSIG.	**NOTE:** CRS may ask U2 RO for AS Header pressure. If so, **Floor Instructor** report as **U2 RO that U2 Steam Header pressure** is **≈1000 psig**.
		• (Step 13.g) Dispatch operator to check for leaks.	**NOTE:** The CRS may dispatch an AO to look for leaks. If so, **Floor Instructor:** acknowledge. **Booth Instructor:** Report back in 3-5 minutes that there are no leaks.
			NOTE: The CRS may NOT dispatch AOs to look for leaks because it is understood that the SM PORV opening was the reason that AP-1 was entered.
	BOP	(Step 14) Check UST level – STABLE OR GOING UP.	
	CRS	(Step 15) Evaluate unit shutdown as follows:	
		• Check unit status – IN MODE 1 OR 2.	
		• Determine if unit shutdown or load reduction is warranted based on the following criteria:	**NOTE:** CRS may call WCC/Management to address the startup. If so, **Booth Instructor** acknowledge as WCC. If needed, as Station Management direct that the crew continue to hold at this power level.

Op Test No.:	N16-1	Scenario #	4	Event #	4	Page	44 of 63
Event Description:	**C-9 Failure causing failure of 1B SG PORV (Manual Control avail)**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Size of leak	
		• Location of leak	
		• Rate of depletion of secondary inventory	
		• IF steam is leaking from a secondary heater relief OR MSR relief valve THEN…	
		• IF turbine trip will isolate steam leak (such as feedwater heater leak or MSR leak THEN…	
		• Check unit shutdown or load reduction – REQUIRED.	**NOTE:** Shutdown/Load Reduction will NOT be required.
	CRS	(Step 15.c RNO) Perform the following:	
		• Maintain present plant conditions until leak can be isolated or repaired.	
		• Exit this procedure.	
			NOTE: The CRS will likely conduct a Focus Brief.

At the discretion of the Lead Examiner, move to Event #5.

Op Test No.:	N16-1	Scenario #	4	Event #	5	Page	45 of 63
Event Description:	**1A NCP Pump Bearing Oil Cooler Leak**						

Shortly after this, a leak will develop on the 1A NCP Upper Bearing Oil Reservoir. The operator will respond in accordance with AP/1/A/5500/08, “Malfunction of NC Pump,” and the operator will be required to trip the reactor, stop the 1A NCP, and go to EP/1/A/5000/E-0, “Reactor Trip and/or Safety Injection.”

Booth Operator Instructions: **insert MAL-NCP007AU = TRUE**

Indications Available:

- OAC Alarm M1A1500 1A NC PUMP UPPER OIL RESERVOIR LEVEL

Time	Pos.	Expected Actions/Behavior	Comments
OAC ALARM M1A1500 1A NC PUMP UPPER OIL RESERVOIR LEVEL			
	CRS	(LO-LO Step 1) Go To AP/1/A/5500/08, Malfunction of NC Pump.	
			NOTE: The CRS will enter AP-08.
AP/1/A/5500/08, MALFUNCTION OF NC PUMP **CASE II, NC PUMP MOTOR BEARING MALFUNCTION**			
	BOP	(Step 1) Check abnormal NC pump parameter – KNOWN TO BE VALID.	**NOTE:** The BOP will use Enclosure 1 to determine that the parameter is known to be valid. (NOT scripted)
	BOP	(Step 2) Check NC pump parameters within operating limits:	
		• All NC pump stator winding temperatures – LESS THAN 311°F.	
		• All NC pump motor bearing temperatures – LESS THAN 195°F.	
		• All NC pump oil reservoir level computer points – INDICATING BETWEEN (-)1.25 AND (+)1.25.	**NOTE:** The oil reservoir level is NOT within band.
	BOP	(Step 2 RNO) IF trip criteria valid, THEN GO TO Step 5.	

Op Test No.:	N16-1	Scenario #	4	Event #	5	Page	46 of 63
Event Description:	**1A NCP Pump Bearing Oil Cooler Leak**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 5) Stop affected NC pump as follows:	
	BOP	• IF A or B NC pump is the affected pump, THEN CLOSE associated spray valve:	**NOTE:** The 1A NC Pump is the affected NC Pump.
		• 1NC-27C (A NC Loop PZR Spray Control).	
		• Check unit status – IN MODE 1 OR 2.	
	RO	• Trip reactor.	
	BOP	• WHEN reactor power less than 5%, THEN stop affected NC pump.	**NOTE:** The plant power is currently < 5%.
	CRS	• GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
At the discretion of the Lead Examiner, move to Events #6-7.			

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	47 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

When the operator attempts to manually trip the reactor, an ATWS will occur. The operator will enter EP/1/A/5000/E-0, "Reactor Trip or Safety Injection," and then transition to EP/1/A/5000/FR-S.1, "Response to Nuclear Power Generation/ATWS." During the performance of FR-S.1, the operator will continuously drive rods in manually, and successfully trip the Reactor locally. After the crew has locally tripped the reactor but still implementing FR-S.1, a loss of the Unit 1 Switchyard will occur, and the 1B Emergency Diesel Generator will fail to start. The operator will immediately transition to EP/1/A/5000/ECA-0.0, "Loss of All AC Power." The operator will restore power to 1ETB per Unit 2 6900V busses through SATB per Enclosure 14 "Energizing Unit 1 4160V Bus From Unit 2 - SATA or SATB." The scenario will terminate when one ESF Bus has been re-energized.

Booth Operator Instructions:

Insert MAL-IPE001A = TRUE (ATWS)
Insert MAL-IPE001B = TRUE (ATWS)
Insert MAL-IPE002A = TRUE (ATWS)
Insert MAL-IPE002B = TRUE (ATWS)

NOTE: These malfunctions are entered at T=0

Indications Available:

- MCB Annunciator 1FO-1, MANUAL RX TRIP, is LIT.
- Both Rx Trip Breakers are CLOSED (red status lights are LIT)
- DRPI indicates that all Control Rods are NOT on the bottom of the core.

Time	Pos.	Expected Actions/Behavior	Comments
		EP/1/A/5000/E-0, REACTOR TRIP OR SAFETY INJECTION	
	RO/ BOP	(Step 1) Monitor Foldout page.	**NOTE:** Crew will carry out Immediate Actions of E-0, prior to the CRS addressing the EP.
	RO	(Step 2) Check Reactor Trip:	**Immediate Action**
		• All rod bottom lights – LIT	
		• Reactor trip and bypass breakers – OPEN	
		• I/R amps – GOING DOWN.	
	RO	(Step 2 RNO) Perform the following:	**Immediate Action**
		• Trip reactor.	

Op Test No.: N16-1	Scenario # 4	Event # 6 & 7	Page 48 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**		

Time	Pos.	Expected Actions/Behavior	Comments
	RO	• IF reactor will not trip, THEN perform the following:	**NOTE:** The CRS may dispatch an AO to locally trip the reactor. If so, **Booth Instructor** After **2 Minutes insert:** **LOA-IPE011=TRIP (Rx Trip Bkr 1A)** **LOA-IPE012=TRIP (Rx Trip Bkr 1B)** **As an Alternate Insert:** **LOA-IRE001A = OPEN (MG Set 1A Gen Output Bkr)** **LOA-IRE002A = OPEN (MG Set 1B Gen Output Bkr)**
		• Implement EP/1/A/5000/F-0 (Critical Safety Function Status Trees).	
	CRS	• GO TO EP/1/A/5000/FR-S.1 (Response To Nuclear Power Generation/ATWS).	**NOTE:** The CRS will transition to FR-S.1.
EP/1/A/5000/FR-S.1, RESPONSE TO NUCLEAR POWER GENERATION/ATWS			
	RO	(Step 1) Check Reactor Trip:	**Immediate Action**
		• All rod bottom lights - LIT	
		• Reactor trip and bypass breakers - OPEN	
		• I/R amps – GOING DOWN.	
	RO	(Step 1 RNO) Perform the following:	**Immediate Action**
		• Trip the reactor.	
		• IF reactor will not trip, THEN manually insert rods.	**NOTE:** The RO will manually drive Rods inward.

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	49 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
<u>Critical Task:</u> **Manually drive rods inward before completing the immediate actions of FR-S.1 (Step 2).** Safety Significance: failure to insert negative reactivity, under the postulated plant conditions, results in an unnecessary situation in which the reactor remains critical or returns to a critical condition. Performance of the critical task would move the reactor towards a subcritical condition to prevent a subsequent return to criticality. A failure to insert negative reactivity constitutes a mis-operation or incorrect crew performance which leads to incorrect reactivity control.			
	BOP	(Step 2) Check Turbine Trip:	
		• All throttle valves – CLOSED.	
	RO/ BOP	(Step 3) Monitor Foldout page.	
		Cold Leg Recirc Switchover Criteria	
		CA Suction Sources	
		Position Criteria for 1NV-150B and 1NV-151A (U1 NV Pump Recirc Isol)	
	BOP	(Step 4) Check proper CA pump status:	
		• MD CA pumps – ON.	**NOTE:** The 1A MDCA Pump does not have power.
	BOP	(Step 4.a RNO) Start pumps.	**NOTE:** The BOP will NOT attempt to start the 1A MD CA Pump.
	BOP	• Check N/R Level in at least 3 S/Gs – GREATER THAN 17%.	
	BOP	(Step 5) Initiate emergency boration of NC System as follows:	
		• Ensure one NV pump - ON	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	50 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Align boration flowpath as follows:	
		• Open 1NV-265B (Boric Acid To NV Pumps).	
		• Start both boric acid transfer pumps.	**NOTE:** Only the 1B Boric Acid Pump will start.
		• Check emergency boration flow – GREATER THAN 30 GPM.	
		• Check if NV flowpath aligned to NC System:	
		• 1NV-244A (Charging Line Cont Outside Isol) – OPEN.	
		• 1NV-245B (Charging Line Cont Outside Isol) – OPEN.	
		• Ensure charging flow is greater than emergency Boration flow.	
		• Check Pzr pressure – LESS THAN 2335 PSIG.	
	BOP	(Step 6) Close the following VQ valves:	
		• CLOSE 1VQ-1A (U1 Cont Air Release Inside Isol)	
		• CLOSE 1VQ-6A (U1 Cont Air Addition Inside Isol)	
		• CLOSE 1VQ-2B (U1 Cont Air Release Outside Isol)	
		• CLOSE 1VQ-5B (U1 Cont Air Addition Outside Isol)	
	BOP	(Step 7) IF AT ANY TIME while in this procedure an S/I signal exists or occurs, THEN perform the following:	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Have another Licensed Operator check S/I equipment PER Enclosure 3 (Subsequent S/I Actions).	
	CRS	• Continue with this procedure.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	51 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
	RO	(Step 8) Check if the following trips have occurred:	
		• Reactor trip.	
Booth Operator Instructions:			**Insert MAL-EP002 AND EP002B = TRIP** **Insert MAL-DG001B = TRUE**
Indications Available: • Control Room lights dim. • 1B EDG does NOT start as required.			
			NOTE: The CRS will transition to ECA-0.0.
EP/1/A/5000/ECA-0.0, LOSS OF ALL AC POWER			
			NOTE: Crew will carry out Immediate Actions of ECA-0.0, prior to the CRS addressing the EP.
	CRS	(Step 1) CSF Status trees should be monitored for information only. EPs referenced by them should not be implemented.	
	RO	(Step 2) Check Reactor Trip:	**Immediate Action**
		• All rod bottom lights – LIT	**NOTE:** DRPI is NOT available on the LOOP.
		• Reactor trip and bypass breakers – OPEN	
		• I/R amps – GOING DOWN.	
	RO	(Step 3) Check Turbine Trip:	**Immediate Action**
		• All throttle valves – CLOSED.	
	CRS	(Step 4) Establish NC pump seal injection from the SSF as follows:	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	52 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	• Immediately dispatch operator to SSF to perform the following:	**NOTE:** The CRS will dispatch an AO to complete Enclosure 2. **Booth Instructor** acknowledge as appropriate, after ten minutes **insert ECA-0.0 (Enclosure 2 SSF Actions) and report that Enclosure 2 is complete.**
		• Obtain Brown Folder at SSF and complete Enclosure 2 (Unit 1 SSF - ECA-0.0 Actions).	
	CRS	• Dispatch operator to 1ETA room as follows:	
		• Check if operator will enter aux bldg – FROM MG SET ROOM.	
		• Give operator dosimeter from Unit 2 SRO desk.	
	CRS	• Dispatch operator to perform Enclosure 3 (Unit 1 ETA And ETB Rooms – ECA-0.0 Actions).	**NOTE:** The CRS will dispatch an AO to complete Enclosure 3. If so, **Booth Instructor** acknowledge as appropriate. **Booth Instructor:** wait **2 minutes**, then **insert ECA-0.0 ENCLOSURE 3, then report that Enclosure 3 is complete.**
	CRS	• Use any of the following to notify security to immediately dispatch officer with key to SSF to ensure operator can access SSF:	**NOTE:** The CRS will dispatch a Security Officer to the SSF. **Booth Instructor:** Acknowledge as Security.
		• Security ringdown phone (located on Unit 2 SRO desk)	
		• 2688	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	53 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 4900.	**Floor Instructor:** If asked, U2 does NOT have normal power, and both DGs are running.
	RO/ BOP	(Step 5) Monitor Foldout Page	
		Alternate Low Pressure Feedwater (applies after Step 8 in body of the procedure)	
		Loss of Vital Instrumentation or Control Power	
		Low Decay Heat Temperature Control	
		CA Suction Sources (applies after Step 11 in body of the procedure)	
	BOP	(Step 6) Check NC System – ISOLATED:	
	BOP	• Check the following letdown orifice isolation valves – CLOSED.	
		• 1NV-458A (U1 75 GPM L/D Orifice Outlet Cont Isol).	
		• 1NV-457A (U1 45 GPM L/D Orifice Outlet Cont Isol).	
		• 1NV-35A (U1 Variable L/D Orifice Outlet Cont Isol).	
	BOP	• CLOSE the following valves:	
		• 1NV-1A (U1 NC L/D Isol To Regenerative Hx)	
		• 1NV-2A (U1 NC L/D Isol To Regenerative Hx).	
	BOP	• Check Pzr PORVs – CLOSED.	
	BOP	• Check the following excess letdown isolation valves – CLOSED:	
		• 1NV-24B (1C NC Loop To Excess L/D Hx Isol)	

Op Test No.: N16-1	Scenario # 4	Event # 6 & 7	Page 54 of 63				
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• 1NV-25B (1C NC Loop To Excess L/D Hx Isol).	
	BOP	• Check 1NV-121 (U1 ND Letdown Control) – CLOSED.	
	RO	(Step 7) Check total CA flow – GREATER THAN 450 GPM.	**NOTE:** it is likely that the BOP has throttled back CA flow.
	BOP	(Step 8) Try to restore power to 1ETA or 1ETB as follows:	
		• Place both trains D/G mode select switches to control room.	
		• Perform the following for any D/G(s) that are off:	
		• Depress, then release, “RESET” on sequencer.	
		• Start D/G.	
		• Check both D/Gs – RUNNING.	
	BOP	(Step 8.c RNO) Perform the following:	
		• Initiate S/I	
		• Notify Unit 2 to immediately ensure flow path for 2B RN pump PER Enclosure 5 (Unit 2 Actions).	**NOTE:** The CRS will notify U2. **Floor Instructor:** Acknowledge as U2 RO.
	CRS	• IF at least one D/G starts, THEN …	**NOTE:** The 1A D/G is OOS, and the 1B D/G will NOT start.
	CRS	• GO TO Step 9	
	CRS	(Step 9) Ensure the following have been implemented:	**NOTE:** The CRS may ask OSM to address. If so, **Floor Instructor** acknowledge as OSM.

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	55 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• RP/0/A/5700/000 (Classification of Emergency)	
		• RP/0/A/5700/010 (NRC Immediate Notification Requirements).	
	RO/ BOP	(Step 10) Control intact S/G levels as follows:	
		• Check N/R level in any intact S/G - GREATER THAN 11% (32% ACC).	
		• THROTTLE CA control valves to maintain all intact S/G N/R levels between 11% (32% ACC) and 50%.	
		• IF AT ANY TIME CA flow control is lost, THEN perform RNO for Step 10.b	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
	CRS	(Step 11) Monitor CA Storage Tank (water tower) level and ensure CA suction source as follows:	
		• Check if external event that has the potential to damage CA Storage Tank (water tower) (such as seismic or tornado) - HAS OCCURRED.	
	CRS	(Step 11.a RNO) Observe Note prior to Step 11.c and GO TO Step 11.c.	
	BOP	(Step 11.c-e) Monitor CA Storage Tank (water tower) level using available Control Room indication.	
		• IF AT ANY TIME CA Storage Tank (water tower) level indication is lost (invalid reading), THEN dispatch operator to locally monitor level PER EP/1/A/5000/G -1 (Generic Enclosures), Enclosure 31 (Local CA Storage Tank (Water Tower) Level Monitoring).	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Ensure CA Suction Sources is monitored on Foldout Page.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	56 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 12) Have Unit 2 perform Enclosure 5 (Unit 2 Actions).	**NOTE:** The CRS will ask U2 to address. If so, **Floor Instructor** acknowledge as U2 BOP.
	RO	(Step 13) Check unit status - IN MODE 3.	
	RO/ BOP	(Step 14) Stabilize S/G pressures using SM PORVs as follows:	**NOTE:** Only the 1A, 1C and 1D SG PORVs are available.
		• Reset Main Steam Isolation.	
		• Reset SM PORVs.	
		• Close all SM PORV manual loaders.	
		• Place SM PORVs in manual.	
		• Control S/G pressure between 1000 and 1100 PSIG using SM PORVs.	
	BOP	(Step 15) Ensure VC/YC cooling available as follows:	
		• Check VC/YC alignment using Unit 1 status board - AT LEAST ONE OPERABLE VC/YC TRAIN ALIGNED TO AN ENERGIZED UNIT 2 4160V BUS.	
		• Notify an available operator to initiate EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 13 (VC and VA System Operation) within 30 minutes of loss of power.	**NOTE:** The CRS will dispatch an AO. If so, **Floor Instructor** acknowledge. **Booth Instructor:** as **AO**, acknowledge
	CRS	(Step 16) IF event has occurred that could have caused damage to mechanical systems internal to plant (seismic, tornado, etc), THEN….	**NOTE:** No such event has occurred.
	RO/ BOP	(Step 17) Check if S/I is actuated as follows:	**NOTE:** SI was actuated in an attempt to start the 1B D/G.

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	57 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• "SAFETY INJECTION ACTUATED" status light (1SI-18) - LIT.	
		• Reset S/I.	
	CRS	(Step 18) Dispatch operator to open the following breakers to sequencer DC control power:	**NOTE:** The CRS will dispatch an AO. **Booth Instructor** acknowledge as appropriate, **after three minutes insert MAL-EQB002A and EQB002B = FAILURE and report that the Sequencer DC Control Breakers have been opened.**
		• A Train - 1EVDA Breaker 6	
		• B Train - 1EVDD Breaker 8.	
	CRS	(Step 19) IF AT ANY TIME operator dispatched to perform Enclosure 3 (Unit 1 ETA And ETB Rooms - ECA-0.0 Actions) determines that lockout exists, THEN perform the following:	**NOTE:** This is a Continuous Action. The CRS will make both board operators aware.
		• Have IAE clear or isolate fault from bus.	
		• WHEN fault cleared or isolated from bus, THEN reset lockout.	**NOTE:** The CRS will dispatch an AO. **Booth Instructor** acknowledge as appropriate, **after one minute report that the there is a Lockout on 1ETA and there is NOT a lockout on 1ETB.**
	CRS	(Step 20) Restore power to 1ETA or 1ETB using any of the following while continuing with this procedure:	
		• Local reset and start of D/G PER Enclosure 12 (Energizing Unit 1 4160V Bus With D/G)	
		OR	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	58	of	63
Event Description:	ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START								

Time	Pos.	Expected Actions/Behavior	Comments
		• Unit 1 offsite power PER Enclosure 13 (Energizing Unit 1 4160V Bus From Unit 1)	
		OR	
		• Unit 2 6900V busses through SATA or SATB PER Enclosure 14 (Energizing Unit 1 4160V Bus From Unit 2 - SATA or SATB).	**NOTE:** This is the only option for re-powering 1ETB.
			The CRS will address Enclosure 14, or hand the Enclosure off to the BOP, and continue in ECA-0.0 with the RO.
EP/1/A/5000/ECA-0.0, LOSS OF ALL AC POWER ENCLOSURE 14, ENERGIZING UNIT 1 4160V BUS FROM UNIT 2 – SATA OR SATB			
	CRS	(Step 1) Perform one of the following:	
		• IF 1ETA is to be energized from Unit 2, THEN observe Note prior to Step 22 and GO TO Step 22.	
		OR	
		• IF 1ETB is to be energized from Unit 2, THEN observe Note prior to Step 2 and GO TO Step 2.	
	BOP	(Step 2) Ensure SATB is not supplying Unit 2 2ETB.	**NOTE:** The CRS/BOP will ask U2 to address. If so, **Floor Instructor** acknowledge as U2 BOP, and report that Unit 2 SATB Feeder Breaker is not supplying Unit 2 2ETB.
	BOP	(Step 3) Check the following 4160V breakers - OPEN.	
		• 1ETB Normal Breaker	
		• 1ETB Standby Breaker	
		• 1ETB Emergency Breaker.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	59	of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**							

Time	Pos.	Expected Actions/Behavior	Comments
	CRS	(Step 4) Have Unit 2 RO check Unit 2 SATB Feeder Breaker - CLOSED.	**NOTE:** The CRS will ask U2 to address. If so, **Floor Instructor** acknowledge as U2 BOP, and report that Unit 2 SATB Feeder Breaker is CLOSED.
	CRS	(Step 5) GO TO Step 8.	
	CRS	(Step 8) Dispatch operator to 1ETB room to perform the following:	**NOTE:** The CRS will dispatch an AO. **Booth Instructor** acknowledge as appropriate, **after three minutes** insert **ECA-0.0 (Enclosure 14) and report that 1ETB-1 has been racked out, and 1ETB-2 has been racked in.**
		• Obtain a copy of OP/0/A/6350/008 (Operation of Station Breakers), Enclosure 4.2 (Operation of 4.16KV Essential Switchgear Breakers) to bring to 1ETB room.	
		• Check 1ETB-1 (Incoming Breaker Fed From Norm Transf. No. 1ATD) - RACKED IN.	
		• Rack out 1ETB-1 PER OP obtained in Step 8.a.	
		• Remove kirk-key from 1ETB-1 as follows:	
		• Push plunger (located below kirk-key) toward back of cubicle and hold.	
		• Rotate kirk-key to extend bolt.	
		• Remove kirk-key.	
		• Release plunger.	
		• Insert kirk-key (removed from 1ETB-1) into 1ETB-2 (Incoming Breaker Fed From Stby. Transf. No. SATB), making sure number on key matches number on lock.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	60 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
		• Check kirk-keys in 1ETB-2 - TWO INSERTED.	
		• Operate kirk-key device inside 1ETB-2 as follows:	
		• Push plunger (located below kirk-keys) toward back of cubicle and hold.	
		• Rotate both kirk-keys to retract bolt.	
		• Release plunger and allow it to move outward.	
		• Pull plunger outward as necessary to ensure fully extended.	
		• Rack in 1ETB-2 breaker PER OP obtained in step 8.a.	
	CRS	(Step 9) Do not continue until the following is performed:	
		• Ensure Steps 2 through 8 are completed.	
		• Ensure operators are away from breakers.	
	CRS	(Step 10) Have Unit 2 RO check Unit 2 SATB Feeder Breaker - CLOSED.	**NOTE:** The CRS will ask U2 to address. If so, **Floor Instructor** acknowledge as U2 BOP, and report that Unit 2 SATB Feeder Breaker is CLOSED.
	BOP	(Step 11) Check if S/I is actuated as follows:	
		• "SAFETY INJECTION ACTUATED" status light (1SI-18) - LIT.	**NOTE:** SI was previously reset.
	CRS	(Step 11.a RNO) GO TO Step 12.	
	CRS	(Step 12) Check "SEQ B LOSS OF CONTROL PWR" alarm (1AD-11, E-2) - LIT.	
	BOP	(Step 13) Open 1B CA pump breaker.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	61 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
	BOP	(Step 13 RNO) Open breaker by depressing 1B CA pump "START" and "STOP" at same time.	
	RO/ BOP	(Step 14) Open the remaining pump breakers:	
		• 1B NV pump	
		• 1B ND pump	
		• 1B NI pump	
		• 1B1 KC pump	
		• 1B2 KC pump	
		• 1B RN pump	
		• 1B KF pump	
		• 1B NS pump	
	BOP	(Step 15) Open the following 600 V essential load center feeder breakers:	
		• 1ELXB	
		• 1ELXD	
		• 1ELXF	
	BOP	(Step 16) Check 1B D/G Mode Select switch - IN CONTROL ROOM POSITION.	
	BOP	(Step 17) Close 1ETB Standby Breaker.	
	BOP	(Step 18) Place 1B D/G Mode Select switch to "AUTO" position.	
	BOP	(Step 19) Check 1ETB bus - ENERGIZED.	
	BOP	(Step 20) Notify Control Room Supervisor to GO TO Step 47 in body of this procedure.	

Op Test No.:	N16-1	Scenario #	4	Event #	6 & 7	Page	62 of 63
Event Description:	**ATWS/ Loss of Switchyard to Unit 1/1B EDG fails to START**						

Time	Pos.	Expected Actions/Behavior	Comments
Critical Task: **Energize at least one AC Emergency Bus From Unit 2.** Safety Significance: Failure to energize an AC Emergency Bus when able to do so constitutes “mis-operation” or incorrect performance which leads to degraded emergency power capacity. Failure to perform the Critical Task may result in a needless challenge and/or degradation of a fission product barrier at the point of the remaining intact RCP Seals, and will result in the inability to add inventory through the ECCS during the existing and potentially subsequent small break LOCA(s). Since the conditions existed to re-energize an ESF Bus from Unit 2 via the SATA or SATB, not taking this action constitutes incorrect performance that leads to degradation of the RCS and/or fuel cladding fission product barriers.			
At the discretion of the Lead Examiner terminate the exam.			

UNIT 1 STATUS:

Power Level: 4% NCS [B] 1988 ppm Pzr [B]: 1988 ppm Xe: Per OAC

Power History: At this power level for 2 hours Core Burnup: 25.1 EFPDs

CONTROLLING PROCEDURE: OP/1/A/6100/003 Controlling Procedure for Unit Operation

OTHER INFORMATION NEEDED TO ASSUME THE SHIFT:

- The area has experienced steady light rain for the past 8 hours, with light wind from the South at 2-5 mph, and this is expected to continue throughout the shift.
- The crew will hold power steady until on-going maintenance is completed, however a rod height/C_B adjustment will be made at the start of the shift at the request of Reactor Engineering.

The following equipment is Out-Of-Service:

- The VUCDT Level indication is OOS. ACTION has been taken in accordance with Technical Specification LCO 3.4.15 ACTION C.
- The 1A Emergency Diesel Generator is OOS for bearing replacement. ACTION has been taken in accordance with Technical Specification LCO 3.5.2 ACTION A.
- MCB Annunciator 1AD-1, F-9, "DEH/MSR SYSTEM MALFUNCT," spuriously alarmed several times during the shift, and is currently failed OFF (IAE is investigating).

Crew Directions:

- The crew will hold power steady until on-going maintenance is completed.
- RE has requested that the Control Rods be placed at 132 Steps on Bank D, and recommended a 200 gallon dilution to adjust C_B to 1984 ppm.

Work Control SRO/Offsite Communicator **Jim**

Plant SRO **Joe (FB)**

AO's AVAILABLE

Unit 1	**Unit 2**
Aux Bldg. John	**Aux Bldg. Chris**
Turb Bldg. Bob (FB)	**Turb Bldg. Mike (FB)**
5th Rounds. Carol	

Extra(s) Bill (FB) Ed (FB) Wayne (FB) Tanya Gus (RW)

SIM JPM A

Facility:	McGuire	Task No.:	
Task Title:	Emergency Borate the Reactor Coolant System Using the PD Pump	JPM No.:	2016 Systems - Control Room JPM A (Alternate Path)
K/A Reference:	EPE 029 EA2.10 (3.1/3.4)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: __X__

Classroom ______ Simulator __X__ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Ensure Handout 1 is on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

Initial Conditions:

- Unit 1 was at 100% power with “A” NV pump and the “A” Boric Acid Transfer Pump tagged for maintenance.
- A lockout occurred on Zone “1B”. Due to a relaying failure, busses 1TB and 1TD failed to swap to their alternate power source. The “1B” Diesel Generator started and loaded 1ETB.
- The reactor coolant pumps tripped on under frequency.
- An automatic reactor trip FAILED to occur. EP/1/A/5000/FR-S.1 (Response To Nuclear Power Generator/ATWS) has been implemented and completed through Step 4.
- Normal Letdown has just automatically isolated.
- The reactor has just been tripped locally.

Initiating Cue: The CRS has directed you to emergency borate the NC System in accordance with Step 5 of EP/1/A/5000/FR-S.1, Response To Nuclear Generation/ATWS.

Task Standard:	The operator will attempt to start the 1B NV Pump, and when it fails to start, start the PD Pump, and then commence emergency boration with the 1B Boric Acid Transfer Pumps running and 30 gpm or greater emergency boration flow indicated.
Required Materials:	None
General References:	EP/1/A/5000/FR-S.1 (Response To Nuclear Power Generation/ATWS), Rev 15 EP/1A/5000/G-1 (Generic Enclosure -17, PD Pump Start), Rev 38
Handouts:	Handout 1: Control Room Copy of EP/1/A/5000/FR-S.1, Response To Nuclear Power Generation/ATWS, marked up for place-keeping through Step 4. Handout 2: Blank copy of Step 5 of EP/1/A/5000/FR-S.1 (Pages 3-4 of 29). Handout 3: Blank copy of Generic Enclosure -17, PD Pump Start
Time Critical Task:	NO
Validation Time:	18 minutes

Critical Step Justification	
Step 1	This step is critical because pressing the START pushbutton for the 1B NV Pump is necessary to attempt to start the 1B NV Pump.
Step 25	This step is critical because depressing the 1NV-265B OPEN pushbutton is necessary to commence emergency boration with the 1A Boric Acid Transfer Pumps running and 30 gpm or greater emergency boration flow indicated.
Step 29	This step is critical because using the UP arrow on the PD Pump SLIMs is necessary to commence emergency boration with the 1A Boric Acid Transfer Pumps running and 30 gpm or greater emergency boration flow indicated.
Alternate Path Critical Step Justification	
Step 7	This step is critical because depressing the 1RN-252B and 1RN-277B CLOSE pushbuttons is necessary to start the PD Pump.
Step 14	This step is critical because depressing the 1RN-63B and 1RN-64A OPEN pushbuttons is necessary to start the PD Pump.
Step 20	This step is critical because depressing the PD Pump START pushbutton is necessary to start the PD Pump.
Step 22	This step is critical because using the UP arrow on the PD Pump SLIMs is necessary to adjust flow of the PD Pump to maximum.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset to IC # 39, 100% Power, MOL. Go to RUN.

2. Insert:

   a. MALF-IPE001A = TRUE Failure of Auto Reactor Trips – Train A
   MALF-IPE001B = TRUE Failure of Auto Reactor Trips – Train B

   b. MALF-IPE002A = TRUE Failure of Manual Reactor Trips – Train A
   MALF-IPE002B = TRUE Failure of Manual Reactor Trips – Train B

   c. LOA-NV046 = RACKED OUT Rack out 1A NV pump
   LOA-NV046A = RACKED OUT Rack out 1A NV Pump Control Power

   d. MALF-EP006B = ACTIVE Failure of 1TB to auto swap
   MALF-EP006D = ACTIVE Failure of 1TD to auto swap

   e. MALF-EP003C = ACTIVE Zone 1B Lockout

   f. LOA-NV043 = RACKED OUT 1A BA Transfer Pump Breaker Rackout

3. Go To RUN and execute

4. Insert MALF-NV029B = TRUE NV pump trips on over current

5. Perform steps 1 through 4 of EP/1/A/5000/FR-S.1.

6. Trip the reactor 1 minute after starting the JPM by deleting:
   - MALF-IPE001A, Failure of Auto Reactor Trips – Train A
   - MALF-IPE001B, Failure of Auto Reactor Trips – Train B

7. Ensure Letdown isolated.

8. Allow plant time to stabilize and then Freeze Simulator.

OR

1. Reset Simulator to Temporary Snap IC-242 (October, 2015).
2. Momentarily place Simulator in Run to acknowledge alarms/Reset SLIMS.
3. Leave Simulator in FREEZE until operator is ready to begin.
4. Place Control Board Sticker on 1A NV Pump.

NOTE: **During the performance of this JPM, the simulator operator will need to control CA flow to avoid NCS Cooldown and SI actuation.**

(Denote Critical Steps with an asterisk)*

Ensure Handout 1 is on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
*1	(Step 5) Initiate emergency boration of the NC System: (Step 5.a) Ensure one NV Pump – ON.	The operator presses the START pushbutton for the 1B NV Pump, and observes that the Green status light remains LIT, and the Red status light is OFF. The operator recognizes that there are no NV Pumps operating and proceeds to Step 5.a RNO **(Alternate Path)**.		
2	(Step 5.a RNO) Place PD pump in service PER EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 17 (PD Pump Startup).	The operator obtains EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 17. **CUE:** **WHEN the operator has located Generic Enclosure 17, provide Handout 3.**		
3	(Enclosure 17, Step 1) Check power to PD pump – AVAILABLE.	The operator observes that the Green status light is LIT, and determines that power is available to the PD Pump.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(Steps 2.a-d) Reset the following: S/I Sequencers Phase B Isolation If at any time a B/O signal occurs then start S/I equipment previously on.	The operator observes that the SI reset lights are LIT. The operator observes that the A Train Sequencer reset light is LIT. The operator depresses the B Train Sequencer reset pushbutton and observes that the Sequencer reset light is LIT. The operator observes that the Phase B Isolation reset lights are LIT.		
5	(Step 3) Close the following: Close 1RN-279B (AB Vent Sys Return Isol). Close 1RN-299A (AB Vent Sys Return Isol). Close 1RV-79A (U1 VU AHUS RV Cont Outside Supply Hdr Isol). Close 1RV-101A (U1 VU AHUS RV Cont Inside Return Hdr Isol). Close 1RV-32A (U1 VL/VT AHUS RV Cont Outside Supply Hdr Isol).	The operator observes the 1RN-279B Green status light LIT, Red status light OFF. The operator depresses the 1RN-299A CLOSE pushbutton and observes Green status light LIT, Red status light OFF. The operator depresses the 1RV-79A CLOSE pushbutton and observes Green status light LIT, Red status light OFF. The operator depresses the 1RV-101A CLOSE pushbutton and observes Green status light LIT, Red status light OFF. The operator depresses the 1RV-32A CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5 (Cont'd)	Close 1RV-76A (U1 VL/VT AHUS RV Cont Inside Return Hdr Isol).	The operator depresses the 1RV-76A CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
	Close 1RV-80B (U1 VU AHUS RV Cont Inside Supply Hdr Isol).	The operator depresses the 1RV-80B CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
	Close 1RV-102B (U1 VU AHUS RV Cont Outside Return Hdr Isol).	The operator depresses the 1RV-102B CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
	Close 1RV-33B (U1 VL/VT AHUS RV Cont Inside Supply Hdr Isol).	The operator depresses the 1RV-33B CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
	Close 1RV-77B (U1 VL/VT AHUS RV Cont Outside Return Hdr Isol).	The operator depresses the 1RV-77B CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
		Note: **Since these steps are bulleted, the operator need not wait for the valve to completely cycle before taking action with the next valve.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	(Step 4) Check any NC pump -ON	The operator observes the NC Pump Safety breakers Green status light LIT, Red status lights OFF, determines that no NC pumps are on and proceeds to the Step 4 RNO.		
*7	(Step 4 RNO) Close the following: 1RN-252B (RB Non Ess Sup Cont Outside Isol) 1RN-277B (RB Non Ess Ret Cont Outside Isol)	The operator depresses the 1RN-252B CLOSE pushbutton and observes Green status light LIT, Red status light OFF. The operator depresses the 1RN-277B CLOSE pushbutton and observes Green status light LIT, Red status light OFF.		
8	(Step 5) Place the following RF pumps in "MAN" and ensure they are off: A Jockey pump B Jockey pump	The operator depresses the A RF Jockey Pump MAN pushbutton and observes the Green status light is LIT, Red status light OFF. The operator depresses the B RF Jockey Pump MAN pushbutton and observes the Green status light is LIT, Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	(Step 6) Dispatch operator to close 2RL-267 (Unit 2 6900V Swgr Room AHU Supply From RN Inlet Isol) (service bldg, 739+5, U-31, NE corner of service bldg over pit, near KR storage tank).	The operator contacts an AO and directs that 2RL-267 be closed. **BOOTH Instructor:** **When asked, report an operator has been dispatched to close 2RL-267.**		
10	(Caution prior to Step 7) Both trains RN valves must be aligned in Step 7 unless specified otherwise, even if power is lost.	The operator reads Caution and proceeds to Note prior to Step 7.		
11	(Note prior to Step 7) If OAC is unavailable to check any deenergized valve positions, RNO contains required actions if position unknown.	The operator reads Note and proceeds to Step 7.		
12	(Steps 7/7.a) Align RN to “AB Non Essential Header” as follows: Ensure 1A RN pump – ON.	The operator observes that the 1A RN Pump Red Breaker status light is LIT.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	(Step 7.b) Check at least one of the following valves - CLOSED: 1RN-41B (Train B To Non Ess Hdr Isol) OR 1RN-43A (Train B To Non Ess Hdr Isol).	The operator observes that the Green status light is LIT, and the Red status light is OFF. The operator observes that the Red status light is LIT, and the Green status light is OFF (May not be performed if 1RN-41B is observed first).		
14 * *	(Step 7.c.1-4) Open the following valves: Open 1RN-40A (Train A to Non Ess Hdr Isol) Open 1RN-42A (AB Non Ess Supply Isol) Open 1RN-63B (AB Non Ess Return Isol) 1RN-64A (AB Non Ess Return Isol)	The operator observes the 1RN-40A Red status light LIT, Green status light OFF. The operator observes the 1RN-42A Red status light LIT, Green status light OFF. The operator depresses the 1RN-63B OPEN pushbutton and observes Red status light LIT, Green status light OFF. The operator depresses the 1RN-64A OPEN pushbutton and observes Red status light LIT, Green status light OFF.		
15	(Step 7.d) GO TO Step 8.	The operator proceeds to Step 8.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
16	(Step 8) Check if NV S/I flow path is open as follows: 1NI-9A (NC Cold Leg Inj From NV) - OPEN OR 1NI-10B (NC Cold Leg Inj From NV) - OPEN	The operator observes the Green status light LIT for both valves, determines that neither valve is OPEN, and proceeds to the Step 8 RNO.		
17	(Step 8 RNO a-b) Perform the following: IF 1A AND 1B NV pumps OFF, THEN open 1NV-241 (Seal Inj Flow Control) GO TO step 10.	The operator observes that the 1B NV Pump Green status light is LIT, Red status lights are OFF. The operator adjusts the 1NV-241 controller output to 100% (Both Red and Black Needles to 100%). The operator proceeds to Step 10.		
18	(Step 10) ADJUST PD pump speed control output to 0%.	The operator observes the PD Pump Speed Controller in MANUAL and selects output on the SLIMs to be 0%.		
19	(Step 11) Open 1NV-1047A (U1 PD PUMP Recirc Isol)	The operator depresses the 1NV-1047A OPEN pushbutton and observes Red status light LIT, Green status light OFF.		
*20	(Step 12) Start the PD Pump.	The operator depresses the PD Pump START pushbutton and observes the Red status light LIT, Green status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
21	(Step 13) Ensure 1NV-1047A (U1 NV PD Pump Recirc Isol) closes after 2 minutes.	After two minutes, the operator observes that the 1NV-1047 Green status light is LIT, Red status light is OFF.		
*22	(Step 14) WHEN 1NV-1047A (U1 NV PD Pump Recirc Isol) is closed, THEN slowly raise PD Pump speed, taking at least 45 seconds to reach desired speed, to establish charging flow.	The operator uses the UP arrow on the PD Pump SLIMs, over at least a 45 second period, and observes Charging flow is increasing. **Cue:** **IF asked, indicate that desired Charging flow is 90 gpm.**		
23	(Note prior to Step 15) Cooling water for areas in next step was isolated by Step 6.	The operator reads Note and proceeds to Step 15.		
24	(Step 15) Notify station management to monitor temperature in both units 6900v switchgear room, turbine bldg, and service bldg areas.	The operator notifies the CRS. **Cue:** **Station Management has been notified.** The operator returns to EP/1/A/5000/FR-S.1, Step 5.b.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*25	(EP/1/A/5000/FR-S.1/Step 5.b/.b1) Align boration flowpath: OPEN 1NV-265B (U1 NV Boric Acid Sup Isol).	The operator depresses the 1NV-265B OPEN pushbutton and observes Red status light LIT, Green status light OFF.		
26	(Step 5.b.2) Start both boric acid transfer pumps.	The operator observes the 1A Boric Acid Transfer Red and Green status light OFF. The operator observes the 1B Boric Acid Transfer Pump Red status light LIT, Green status light OFF.		
27	(Step 5.b.3) Check emergency boration flow - GREATER THAN 30 GPM	The operator observes boration flow on 1NVP-5440 to be 70-80 gpm.		
28	(Step 5.c) Check if NV flowpath aligned to NC System 1NV-244A (Charging Line Cont Isol Outside Isol) - OPEN 1NV-245B (Charging Line Cont Outside Isol) - OPEN	The operator observes 1NV-244A Red status light LIT, Green status light OFF. The operator observes 1NV-245B Red status light LIT, Green status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*29	(Step 5.d) Ensure charging flow is greater than emergency boration flow.	The operator uses the UP arrow on the PD Pump SLIMs, as needed, and observes Charging flow is increasing. **Cue:** **IF asked, indicate that desired Charging flow is 90 gpm.**		
30	(Step 5.e) Check Pzr pressure - LESS THAN 2335 PSIG	The operator observes that Pzr Pressure is less than 2335 psig on 1NCP-5161 (or equivalent).		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM A

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

INITIAL CONDITIONS:

- Unit 1 was at 100% power with “A” NV pump and the “A” Boric Acid Transfer Pump tagged for maintenance.
- A lockout occurred on Zone “1B”. Due to a relaying failure, busses 1TB and 1TD failed to swap to their alternate power source. The “1B” Diesel Generator started and loaded 1ETB.
- The reactor coolant pumps tripped on under frequency.
- An automatic reactor trip FAILED to occur. EP/1/A/5000/FR-S.1 (Response To Nuclear Power Generator/ATWS) has been implemented and completed through Step 4.
- Normal Letdown has just automatically isolated.
- The reactor has just been tripped locally.

INITIATING CUE:

The CRS has directed you to emergency borate the NC System in accordance with Step 5 of EP/1/A/5000/FR-S.1, Response To Nuclear Generation/ATWS.

SIM JPM B

Facility: McGuire

Task No.:

Task Title: CA Suction Source Realignment

JPM No.: 2016 Systems - Control Room JPM B (Alternate Path)

K/A Reference: 061 A2.07 (3.4/3.5)

Examinee:

NRC Examiner:

Facility Evaluator:

Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom ______ Simulator X Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:	• Unit 1 has just tripped from 100% power, due to seismic activity. • The crew is now implementing EP/1/A/5000/ES-0.1 (Reactor Trip Response). • The CAST has developed a leak, and level has lowered to 1.5 feet.

Initiating Cue:	The CRS has directed you to perform EP/1/A/5000/G-1, Generic Enclosure 20 (CA Suction Source Realignment), while the crew continues with ES-0.1.

Task Standard: The operator will realign the suction of the CA Pumps from the non-safety related to the safety-related source (RN). During the course of this action, the operator will recognize that RN Supply to the 1B MDCA Pump cannot be established, and stop the pump.

Required Materials: None

General References: EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), Rev 34

	EP/1/A/5000/ES-0.1 (Reactor Trip Response), Rev 42 EP/1/A/5000/G-1 (Generic Enclosures), Rev 37 OMP 4-3 (Use of Abnormal and Emergency Procedures), Rev 42
Handouts:	Handout 1: Enclosure 20 (CA Suction Source realignment) of EP/1/A/5000/G-1 (Generic Enclosures).
Time Critical Task:	NO
Validation Time:	8 minutes

Critical Step Justification	
Step 4	This step is critical because pressing the 1RN-69A OPEN pushbutton is necessary to realign the suction of the CA Pumps from the non-safety related to the safety-related source.
Step 5	This step is critical because pressing the 1CA-15A OPEN pushbutton is necessary to realign the suction of the CA Pumps from the non-safety related to the safety-related source.
Step 6	This step is critical because pressing the 1CA-86A OPEN pushbutton is necessary to realign the suction of the CA Pumps from the non-safety related to the safety-related source.
Alternate Path Critical Step Justification	
Step 12	This step is critical because pressing the STOP pushbutton for the 1B MDCA Pump is necessary to stop the 1B MDCA pump.
Step 15	This step is critical because pressing the 1CA-11A CLOSE pushbutton is necessary to realign the suction of the CA Pumps from the non-safety related to the safety-related source.
Step 19	This step is critical because pressing the 1CA-7AC CLOSE is necessary to to realign the suction of the CA Pumps from the non-safety related to the safety-related source.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset simulator to IC-39 (100%).
2. Place Simulator in RUN.
3. Ensure that the B Train of RN is in operation.
4. Insert REM-CA0018B=0 to ensure that 1CA-18B (1B CA Pump Suction from 1B RN Isol) will not OPEN.
5. Adjust CACST to less than 30%, but greater than 0%.
6. Insert (CA) PLP-078 = 1.48 – (Simulates Leak in CAST).
7. Override ON OBE Exceeded Annunciator (1AD-13 E-7). (1AD13_E07 = ON)
8. Manually trip the reactor and perform the actions of EP/1/A/5000/E-0, and transition to EP/1/A/5000/ES-01.
9. Ensure both MDCA Pumps are running, acknowledge and silence all annunciators, and Freeze the Simulator.

<u>**OR**</u>

1. Reset to IC-243 (October, 2015)
2. Momentarily go to RUN to acknowledge Alarms then place Simulator in FREEZE.
3. Leave Simulator in FREEZE until operator is ready to begin.

NOTE: **The Booth/Floor Instructor will need to control BOP during the performance of this JPM and ENSURE that SI Actuation is NOT needed.**

(Denote Critical Steps with an asterisk)*

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
1	(Enclosure 20, Step 1/1.a) Check if RN assured CA suction should be immediately aligned as follows: Check if failure (causing leak) of CA Storage Tank (water tower) or associated CA suction piping - KNOWN TO EXIST.	The operator recognizes from the Initial Conditions that a CAST leak exists, and proceeds.		
2	(Step 1.b) GO TO Step 4.	The operator proceeds to Step 4.		
3	(Step 4) Align A train RN to CA suction as follows: (Step 4.a) Start 1A RN pump.	The operator observes the 1A RN Pump Red status light LIT, Green status light OFF; and motor amps at ≈ 88 amps, and determines the 1A RN Pump is running.		
*4	(Step 4.b) OPEN 1RN-69A (1A RN Assured Supply To U1 CA Isol).	The operator presses the 1RN-69A OPEN pushbutton and observes the Red status light LIT, Green status light OFF. The operator will acknowledge alarm on 1AD-5.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*5	(Step 4.c) OPEN 1CA-15A (1A CA Pump Suction From 1A RN Isol)	The operator presses the 1CA-15A OPEN pushbutton and observes the Red status light LIT, Green status light OFF. The operator will acknowledge alarm on 1AD-5.		
*6	(Step 4.d) OPEN 1CA-86A (U1 TD CA Pump Suction From 1A RN Isol).	The operator presses the 1CA-86A OPEN pushbutton and observes the Red status light LIT, Green status light OFF. The operator will acknowledge alarm on 1AD-5.		
7	(Step 5) Align B train RN to CA suction as follows: (Step 5.a) Start 1B RN pump.	 The operator observes the 1B RN Pump Red status light LIT, Green status light OFF; and motor amps at ≈ 88 amps, and determines the 1B RN Pump is running.		
8	(Step 5.b) OPEN 1RN-162B (1B RN Assured Supply To U1 CA Isol).	The operator presses the 1RN-162B OPEN pushbutton and observes the Red status light LIT, Green status light OFF. The operator will acknowledge alarm on 1AD-5.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	(Step 5.c) OPEN 1CA-18B (1B CA Pump Suction From 1B RN Isol).	The operator presses the 1CA-18B OPEN pushbutton and observes the Green status light remains LIT, Red status light OFF (**Alternate Path**). The operator proceeds to the RNO.		
10	(Step 5.c RNO) IF 1B CA pump is on, THEN stop 1B MD CA pump as follows: (Step 5.c RNO 1) Reset S/I.	The operator presses the RESET Pushbuttons and observes RESET status lights LIT for both Train A and B SI. (Already RESET)		
11	(Step 5.c RNO 2) Reset 1B Sequencer.	The operator presses the Sequencer RESET and observes RESET status lights LIT Pushbuttons for both Train A and B. (Already RESET)		
*12	(Step 5.c RNO 3) Stop 1B CA pump.	The operator presses the STOP pushbutton for the 1B MDCA Pump and observes the Green status light LIT, Red status light OFF; and that motor amps drop to 0.		
13	(Step 5.c RNO 4) IF 1B CA pump still on,….	The operator observes that the 1B MDCA Pump is OFF, and proceeds.		
14	(Step 5.d) OPEN 1CA-116B (U1 TD CA Pump Suction From 1B RN Isol).	The operator presses the 1CA-116B OPEN pushbutton and observes the Red status light LIT, Green status light OFF. The operator will acknowledge alarm on 1AD-5.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*15	(Step 6) Isolate non-safety CA suction sources from MD CA pumps as follows: (Step 6.a) CLOSE 1CA-11A (1A CA Pump Suction Isol).	The operator presses the 1CA-11A CLOSE pushbutton and observes the Green status light LIT, Red status light OFF.		
16	(Step 6.b) CLOSE 1CA-9B (1B CA Pump Suction Isol).	The operator presses the 1CA-9B CLOSE pushbutton and observes the Green status light LIT, Red status light OFF.		
17	(Step 7) Isolate non-safety CA suction sources from TD CA pump as follows: (Step 7.a) Check the following valves - OPEN: 1RN-69A (1A RN Assured Supply To U1 CA Isol) 1CA-86A (U1 TD CA Pump Suction From 1A RN Isol).	 The operator observes the 1RN-69A Red status light LIT, Green status light OFF. The operator observes the 1CA-86A Red status light LIT, Green status light OFF.		
18	(Step 7.b) GO TO Step 7.d.	The operator proceeds to Step 7.d.		
*19	(Step 7.d) CLOSE 1CA-7AC (U1 TD CA Pump Suction Isol).	The operator presses the 1CA-7AC CLOSE pushbutton and observes the Green status light LIT, Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	(Step 7) WHEN time allows, THEN….	**Cue:** **Another operator will complete the remaining steps.**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM B

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- Unit 1 has just tripped from 100% power, due to seismic activity.
- The crew is now implementing EP/1/A/5000/ES-0.1 (Reactor Trip Response).
- The CAST has developed a leak, and level has lowered to 1.5 feet.

INITIATING CUE:

The CRS has directed you to perform EP/1/A/5000/G-1, Generic Enclosure 20 (CA Suction Source Realignment), while the crew continues with ES-0.1.

SIM JPM C

Facility:	McGuire	Task No.:	
Task Title:	Establish Excess Letdown following a loss of Normal Letdown in Mode 4	JPM No.:	2016 Systems - Control Room JPM C (Alternate Path)
K/A Reference:	004 A4.06 (3.6/3.1)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom ______ Simulator X Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Ensure Handout 1 is placed on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM).

Initial Conditions:	• Unit 1 is performing a plant shutdown and cooldown to Mode 5. • The plant is currently at 345°F and 600 psig. • The crew has entered AP/1/A/5500/12, Loss of Letdown, Charging or Seal Injection, due to a loss of Normal Letdown. • It is not expected that the crew will be able to re-establish Normal Letdown without corrective maintenance.
Initiating Cue:	The CRS has directed you to establish Excess Letdown per AP/1/A/5500/12 starting with Step 52, and maintain Pressurizer level between 85-96%.
Task Standard:	The operator will attempt to place Excess Letdown in service in accordance with Step 52 of AP/1/A/55/12; and then after recognizing that Excess Letdown cannot be placed in service, establish letdown to the PRT using the Rx Head Vessel Vents in accordance with Step 53 of AP/1/A/5500/12 and maintain Pressurizer level between 85-96%.

Required Materials: None

General References: OP/1/A/6100/SD-4 (Cooldown to 240 Degrees F), Rev 68
OP/1/A/6100/SD-2 (Cooldown to 400 Degrees F), Rev 54
AP/1/A/5500/12 (Loss of Letdown, Charging or Seal Injection), Rev 24

Handouts: Handout 1: AP/1/A/5500/12 (Loss of Letdown, Charging or Seal Injection) marked up through Step 43 RNO, open on the CRS Desk.

Time Critical Task: NO

Validation Time: 8 minutes

<u>Critical Step Justification</u>	
Step 3	This step is critical because pressing the 1KC-315B and 305B OPEN pushbutton is necessary to attempt to place Excess Letdown in service in accordance with Step 52 of AP/1/A/55/12.
Step 10	This step is critical because pressing the 1NV-24B OPEN pushbutton is necessary to attempt to place Excess Letdown in service in accordance with Step 52 of AP/1/A/55/12.
<u>Alternate Path Critical Step Justification</u>	
Step 10	This step is critical because recalling that IF AT ANY TIME excess letdown cannot be established, THEN observing Note prior to Step 53 is necessary to establish letdown to the PRT using the Rx Head Vessel Vents in accordance with Step 53 of AP/1/A/5500/12.
Step 16	This step is critical because pressing the 1NC-272AC and 1NC-273AC, or the 1NC-274B and 1NC-275B OPEN pushbutton is necessary to establish letdown to the PRT using the Rx Head Vessel Vents in accordance with Step 53 of AP/1/A/5500/12.
Step 17	This step is critical because knowing that Pzr level must be lowered to 85% is necessary to establish letdown to the PRT using the Rx Head Vessel Vents in accordance with Step 53 of AP/1/A/5500/12 while minimizing the cycling of the Rx Head Vents.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset the Simulator to a Mode 4 IC (prior to placing ND in service)

2. Adjust plant parameters such that:

   NCS Temperature is 345±3°F
   NCS pressure is ≈ 500-700 psig
   Pzr Level is ≈ 85%

3. Allow plant conditions to stabilize as needed.

   4. Insert REM-NV0024B = 0 (1NV-24B (C NC LOOP TO EXS L/D HX ISOL) is stuck CLOSED).

5. Insert REM-NV0001A = 0 (1NV-1A (NC L/D ISOL TO REGEN HX) spuriously closes and cannot be opened).

6. Perform AP/1/A/5500/12 through Step 43 RNO (Handout 1).

7. Allow pressurizer level to rise to 95 %.

8. Stabilize plant conditions and Freeze the Simulator

OR

1. Reset Simulator to Temporary Snap IC-244 (October, 2015)
2. Momentarily place Simulator in Run to acknowledge alarms.
3. Leave Simulator in FREEZE until operator is ready to begin.

NOTE: **During the performance of this JPM, the Simulator Instructor will need to monitor unrelated alarms and silence as needed.**

(Denote Critical Steps with an asterisk*)

Ensure Handout 1 is placed on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM).

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
1	(Step 52) Establish excess letdown as follows: (Step 52.a) Adjust charging to minimum while maintaining the following: • NC pump seal injection flow greater than 6 GPM • Pzr level at program level.	The operator observes seal injection flow to be greater than 6 GPM. The operator observes that Pressurizer level is 95% and slowly rising. The operator observes that charging flow is adjusted to minimum.		
2	(Step 52.b) IF AT ANY TIME excess letdown cannot be established, THEN observe Note prior to Step 53 and GO TO Step 53 to establish letdown using Rx Vessel Head Vents.	The operator reads the conditional step, and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*3	(Step 52.c) OPEN the following valves: 1KC-315B (U1 Excess L/D Hx KC Ret Hdr Cont Otsd Isol). 1KC-305B (U1 KC To Excess L/D Hx Cont Outside Isol).	The operator presses the 1KC-315B OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF. The operator presses the 1KC-305B OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF.		
4	(Step 52.d) Ensure 1NV-27B (U1 Excess L/D Hx Outlet 3-Way Cntrl) selected to "VCT" position.	The operator observes the 1NV-27B White VCT status light is LIT, White NCDT status light is OFF.		
5	(Note prior to Step 52.e) Opening and then closing 1NV-26B (U1 Excess L/D Hx Outlet Cntrl) in the next steps will reduce the possibility of water hammer by ensuring that the excess letdown line is filled with water.	The operator reads the Note, and proceeds.		
6	(Step 52.e) OPEN 1NV-26B (U1 Excess L/D Hx Outlet Cntrl).	The operator rotates the Manual Loader control knob clockwise until both the Black and Red needles indicate 100%.		
7	(Step 52.f) Wait 2 minutes.	The operator takes no additional action for 2 minutes. **Cue:** **Two minutes have elapsed.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	(Step 52.g) CLOSE 1NV-26B (U1 Excess L/D Hx Outlet Cntrl).	The operator rotates the Manual Loader control knob counter-clockwise until both the Black and Red needles indicate 0%.		
9	(Step 52.h) Check the following valves - OPEN: • 1NV-94AC (U1 NC Pumps Seal Water Return Cont Inside Isol) • 1NV-95B (U1 NC Pumps Seal Water Return Cont Outside Isol).	The operator observes the 1NV-94AC Red status light is LIT, Green status light is OFF. The operator observes the 1NV-95B Red status light is LIT, Green status light is OFF.		
*10	(Step 52.i) OPEN 1NV-24B (1C NC Loop To Excess L/D Hx Isol).	The operator presses the 1NV-24B OPEN pushbutton, and observes the Green status light remains LIT, Red status light is OFF. **(Alternate Path)** The operator recalls that IF AT ANY TIME excess letdown cannot be established, THEN observe Note prior to Step 53 and GO TO Step 53 to establish letdown using Rx Vessel Head Vents. The operator proceeds to Step 53.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
11	(Note prior to Step 53) The following step is performed in conjunction with OP/1/A/6150/004 (Pressurizer Relief Tank), Enclosure 4.3 (PRT Cooling).	The operator reads the Note, and proceeds. **Cue:** **Another operator will perform Enclosure 4.3 of OP/1/A/6150/004.**		
12	(Step 53) Establish letdown to PRT using Rx Vessel Head Vents as follows: (Step 53.a) Check unit status - IN MODE 3, 4 OR 5.	The operator observes NCS temperature and the Rx Trip Breakers and determines that the plant is in Mode 4.		
13	(Step 53.b) IF AT ANY TIME normal letdown OR excess letdown available, THEN perform one of the following: Establish normal letdown PER Steps 43 through 49. OR Establish excess letdown PER Step 52.	The operator reads the conditional step, and proceeds.		
14	(Caution prior to Step 53.c) PRT rupture disk relieves at 100 psig.	The operator reads the Caution, and proceeds.		
15	(Note prior to Step 53.c) Cycling of head vents in the following step should be minimized due to water hammer concerns in vent line.	The operator reads the Note, and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*16	(Step 53.c) IF AT ANY TIME Pzr level approaches 96%, THEN perform the following: (Step 53.c.1) OPEN one train of head vent valves: Train A: • 1NC-272AC (U1 A Train Head Vent to PRT Isol) • 1NC-273AC (U1 A Train Head Vent to PRT Isol). OR Train B: • 1NC-274B (U1 B Train Head Vent to PRT Isol) • 1NC-275B (U1 B Train Head Vent to PRT Isol).	The operator reads the conditional step, and observes Pressurizer level to be ≥ 96%. The operator presses the 1NC-272AC OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF. The operator presses the 1NC-273AC OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF. OR The operator presses the 1NC-274B OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF. The operator presses the 1NC-275B OPEN pushbutton, and observes the Red status light is LIT, Green status light is OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*17	(Step 53.c.2) WHEN Pzr at desired level, THEN CLOSE head vent valves opened above.	The operator observes Pressurizer level to be lowering toward 96%, and then continues to lower Pressurizer level toward 85%. **Cue:** **Another operator will continue with this procedure.**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM C

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- Unit 1 is performing a plant shutdown and cooldown to Mode 5.
- The plant is currently at 345°F and 600 psig.
- The crew has entered AP/1/A/5500/12, Loss of Letdown, Charging or Seal Injection, due to a loss of Normal Letdown.
- It is not expected that the crew will be able to re-establish Normal Letdown without corrective maintenance.

INITIATING CUE:

The CRS has directed you to establish Excess Letdown per AP/1/A/5500/12 starting with Step 52, and maintain Pressurizer level between 85-96%.

SIM JPM D

Facility:	McGuire	Task No.:	
Task Title:	Remove Pressurizer Heaters from Service	JPM No.:	2016 Systems - Control Room JPM D (Alternate Path)
K/A Reference:	010 A4.02 (3.6/3.4)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: __X__

Classroom ______ Simulator __X__ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:	• Unit 1 has just increased reactor power to 100% per OP/1/A/6100/003 (Controlling Procedure for Unit Operation). • Chemistry has confirmed that the Boron Concentration difference between the Pzr and the NC System is 4 ppm.

Initiating Cue:	• The CRS has directed you to remove Pzr Heater Groups A, B and D from service per Enclosure 4.6 (Operation of Pzr Heaters) of OP/1/A/6100/003, and ensure that NC System pressure is being controlled normally at 2235 psig. • All outstanding R&Rs that may impact performance of Enclosure 4.6 have been evaluated.

Task Standard: The operator will remove the A, B and D Pzr Heater Groups from service in accordance with Step 3.4.4 of Enclosure 4.6, and then after responding to the failure of the C Pzr Heater Group, manually control pressure by re-energizing at least one heater group. The operator will place at least one Pzr Heater Group in service in accordance with Step 3.3.1 (or equivalent) of Enclosure 4.6, before MCB Annunciator 1AD-6, C6 alarms.

Required Materials:	None
General References:	OP/1/A/6100/003 (Controlling Procedure for Unit Operation), Rev. 197 OP/1/A/6100/010G (Annunciator Response for Panel 1AD-6), Rev. 68 AD-HU-ALL-0004 (Procedure and Work Instruction Use and Adherence), Rev. 3
Handouts:	Handout 1: Enclosure 4.6 (Operation of Pzr Heaters) of OP/1/A/6100/003 (Controlling Procedure for Unit Operation)
Time Critical Task:	NO
Validation Time:	12 minutes

Critical Step Justification	
Step 7	This step is critical because rotating either the A, B or D Pzr Htr Mode Select Switch counter - clockwise to AUTO is necessary to remove the 1st Pzr Heater group from service.
Step 10	This step is critical because rotating either the A, B or D Pzr Htr Mode Select Switch counter - clockwise to AUTO is necessary to remove the 2nd Pzr Heater group from service.
Step 16	This step is critical because rotating either the A, B or D Pzr Htr Mode Select Switch counter - clockwise to AUTO is necessary to remove the 3rd Pzr Heater group from service.
Step 18	This step is critical because selecting Pzr Pressure Master and selecting “M” is necessary to remove the A, B and D Pzr Heater Groups from service in accordance with Step 3.4.4 of Enclosure 4.6.
Step 19	This step is critical because adjusting the Master Pressure Controller the error signal is < 15 psig is necessary to remove the A, B and D Pzr Heater Groups from service in accordance with Step 3.4.4 of Enclosure 4.6.
Step 20	This step is critical because selecting Pzr Pressure Master and selects “A” is necessary to remove the A, B and D Pzr Heater Groups from service in accordance with Step 3.4.4 of Enclosure 4.6.
Alternate Path Critical Step Justification	
Step 21	This step is critical because observing MCB Annunciator 1AD6/D6 and addressing the ARP is necessary to recognize that all Pressurizer Heaters are OFF.
Step 23	This step is critical because re-energizing at least one set of Pressurizer heaters is necessary to place at least one Pzr Heater Group in service in accordance with Step 3.3.1 (or equivalent) of Enclosure 4.6, before MCB Annunciator 1AD-6, C6 alarms.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset simulator to IC-39 (100%)

2. Ensure Simulator reflects having been completed through Step 3.38.10.3 of OP/1/A/6100/003, Enclosure 4.1 (Power Increase).

3. Ensure that Pzr Heater groups A, B, and D are energized.

4. Acknowledge Alarms and Freeze Simulator

5. Create Lesson Plan NRC JPM D (Failure of Pzr Variable Heaters).
(ANN) 1AD6-D06 = ON
Insert X10_190_1 = False (0) (C heaters energize/de-energize Red Status light – OFF)

OR

1. Reset Simulator to Temporary Snap IC-245 (October, 2015).
2. Execute Lesson Plan NRC JPM C (Failure of Pzr Variable Heaters).
3. Momentarily place Simulator in Run to acknowledge alarms.
4. Leave Simulator in FREEZE until operator is ready to begin.

NOTE: **During the performance of this JPM, the simulator operator will need to execute failure at Step 20 of the JPM.**

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
1	(Enclosure 4.6, Step 3.1) Evaluate all outstanding R&Rs that may impact performance of this procedure.	The operator recognizes that this step has already been performed (Initial Conditions), and proceeds.		
2	(Note prior to Step 3.2) During steady state conditions, Pzr Htr Groups are normally OFF and in AUTO.	The operator reads the Note and proceeds.		
3	(Step 3.2) Perform the following sections as applicable: • Section 3.3, Placing A, B, D Pzr Heater Groups in Service. • Section 3.4, Removing A, B, D Pzr Heater Groups form Service. • Section 3.5, Placing C Pzr Heater Group in Service. • Section 3.6, Removing C Pzr Heater Group from Service. • Section 3.7, Manual Operation of A, B, D Pzr Heater Groups	The operator recognizes that Section 3.4 is the applicable section and proceeds to Section 3.4.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(Step 3.4) Removing A, B, D Pzr Heater Groups From Service (Caution prior to Step 3.4.1) Pzr Htr Groups and Pzr Spray Controls should be operated with extreme caution to prevent NC System pressure transients. (Step 3.4.1) Ensure Boron Concentration difference between Pzr and NC System less than 50 ppm.	The operator reads the Caution and proceeds. The operator recognizes that this condition is already met (Initial Conditions), and proceeds.		
5	(Step 3.4.2) IF three Pzr Htr Groups in service AND desire to operate with two Pzr Htr Groups in service…..	The operator recognizes that this step is NOT applicable and proceeds.		
6	(Step 3.4.3) IF three Pzr Htr Groups in service AND desire to operate with one Pzr Htr Group in service…..	The operator recognizes that this step is NOT applicable and proceeds.		
*7	(Step 3.4.4) IF three Pzr Htr Groups in service AND desire to remove all Pzr Htr Groups from service, perform the following: (Step 3.4.4.1) Place one of the following in AUTO: A Pzr Htr Mode Select B Pzr Htr Mode Select D Pzr Htr Mode Select	The operator rotates either the A, B or D Pzr Htr Mode Select Switch counter - clockwise to AUTO.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	(Step 3.4.4.2) Check associated Pzr Htr Group in OFF. A Pzr Htr Group B Pzr Htr Group D Pzr Htr Group	The operator observes the Green status light LIT and the Red status light OFF for the heater group, whose Mode Select Switch was moved to AUTO in the previous step.		
9	(Step 3.4.4.3) Monitor Pzr pressure for 2 minutes.	The operator observes actual Pressurizer Pressure and Spray Valve position (Or equivalent) for 2 minutes and determines that Pzr Pressure has stabilized. **Examiner Cue:** **If pressure is stabilized, Two minutes has elapsed.**		
*10	(Step 3.4.4.4) Place second Pzr Htr Mode Select Switch in AUTO: A Pzr Htr Mode Select B Pzr Htr Mode Select D Pzr Htr Mode Select	The operator rotates either the A, B or D Pzr Htr Mode Select Switch counter-clockwise to AUTO.		
11	(Step 3.4.4.5) Check associated Pzr Htr Group in OFF. A Pzr Htr Group B Pzr Htr Group D Pzr Htr Group	The operator observes the Green status light LIT and the Red status light OFF for the heater group, whose Mode Select Switch was moved to AUTO in the previous step.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	(Step 3.4.4.6) Monitor Pzr pressure for 2 minutes.	The operator observes actual Pressurizer Pressure and Spray Valve position (Or equivalent) for 2 minutes and determines that Pzr Pressure has stabilized. **Examiner Cue:** **If pressure is stabilized, Two minutes has elapsed.**		
13	(Note prior to Step 3.4.4.7) Placing Pzr Press Master in manual makes automatic operation of 1NC-34A (Pzr PORV) unavailable and should be evaluated using Electronic Risk Assessment Tool. This assessment should be performed prior to placing Pzr Press Master in manual.	The operator reads the Note and proceeds.		
14	(Step 3.4.4.7) IF time allows AND Unit 1 in Modes 1-4, evaluate unavailability of 1NC-34A (Pzr PORV) using Electronic Risk Assessment Tool.	The operator informs the CRS. **Examiner Cue:** **As the CRS, indicate that the ERAT has been used, and the Pzr Press Master may be placed in MAN.**		
15	(Note prior to Step 3.4.4.8) Steps 3.4.4.8 – 3.4.4.10 C should be performed without delay.	The operator reads the Note and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*16	(Step 3.4.4.8) Place third Pzr Htr Mode Select in AUTO: A Pzr Htr Mode Select B Pzr Htr Mode Select D Pzr Htr Mode Select	The operator rotates either the A, B or D Pzr Htr Mode Select Switch counter-clockwise to AUTO.		
17	(Step 3.4.4.9) Check associated Pzr Htr Group in OFF. A Pzr Htr Group B Pzr Htr Group D Pzr Htr Group	The operator observes the Green status light LIT and the Red status light OFF for the heater group, whose Mode Select Switch was moved to AUTO in the previous step.		
*18	(Step 3.4.4.10) On the DCS Work Station, Pressurizer and PRT graphic, perform the following: (Step 3.4.4.10 A) Place PZR PRESS MASTER in manual.	The operator observes the NC-Pressurizer and PRT DCS Screen and observes Pressurizer pressure. The operator selects Pzr Pressure Master and selects “M” (Turns RED).		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*19	(Step 3.4.4.10 B) Adjust PZR PRESS MASTER output until the following occurs: C Pzr Htr Group begins cycling 1NC-27C (A Loop Pzr Spray Control) Closes 1NC-29C (B Loop Pzr Spray Control) Closes	Using the NC-Pressurizer and PRT DCS Screen, the operator adjusts Pzr Press Master output (**DOWN**) until the error signal is < 15 psig. The operator observes C Pzr Heater Group Red Status light cycling ON and OFF, and determines that the C Pzr Htr Group is cycling. The operator observes the 1NC-27C SLIMs Limit Switch and determines that 1NC-27C is CLOSED. The operator observes the 1NC-29C SLIMs Limit Switch and determines that 1NC-29C is CLOSED.		
*20	(Step 3.4.4.10 C) Place PZR PRESS MASTER in auto.	Using the NC-Pressurizer and PRT DCS Screen, the operator selects Pzr Pressure Master and selects “A” (Turns GREEN).		

Simulator Instructor NOTE: Execute & Activate Lesson Plan (Failure of Pzr Variable Heaters) (Alternate Path)

It is expected that MCB Annunciator 1AD6/D6 (PZR HTR CONTROLLER TROUBLE) will alarm.

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*21	(Step 3.4.4.11) Monitor Pzr pressure for 2 minutes.	The operator observes actual Pressurizer Pressure and Spray valve Position (Or equivalent) and determines that Pzr Pressure is lowering. The operator observes MCB Annunciator 1AD6/D6 and addresses ARP.		
22	(OP/1/A/6100/010 G, Immediate Action 1) Remove Group C Heater Group from automatic control by opening supply breaker.	The operator observes the C Pzr Heater Group Green Status light is LIT, and determines that the Group C Heater supply breaker is OPEN.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*23	(OP/1/A/6100/010 G, Immediate Action 2) Manually control pressure using other heater groups.	The operator recognizes that no Pzr htrs are energized and proceeds to Enclosure 4.6, Step 3.3.1 (Or Equivalent) to place one Pzr Htr Group in service. **Examiner Note:** **The operator may use one or more Pzr Heater Groups to maintain NC System Pressure within the normal band.** **The operator MUST place at least one Pzr Htr Group in service to complete the Critical nature of this task.** **The operator should realize the need to get one set of htrs on for pressure control and MAY start one set of htrs based on ARP guidance to manually control pressure. If NOT, the required OP Steps of Section 3.3.1 are scripted.** **However, Section 3.7 of Enclosure 4.6 may be used as well.**		
		Examiner Note: **IF MCB Annunciator 1AD-6, C6, alarms before the operator energizes one set of Heaters, the Critical Step is Failed.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
24	(Enclosure 4.6, Step 3.3) Placing A, B, D Pzr Heater Groups in service. (Caution prior to Step 3.3.1) Pzr Htr Groups and Pzr Spray Controls should be operated with extreme caution to prevent NC System pressure transients. (Step 3.3.1) IF desired to operate with one Pzr Htr group in service, perform the following: (Step 3.3.1.1) Place of the following in MAN: A Pzr Htr Mode Select B Pzr Htr Mode Select D Pzr Htr Mode Select	The operator reads the Caution, and proceeds. The operator rotates either the A, B or D Pzr Htr Mode Select Switch clockwise to MAN.		
25	(Step 3.3.1.2) Place the associated Pzr Htr Group in ON: A Pzr Htr Group B Pzr Htr Group D Pzr Htr Group	The operator depresses the ON pushbutton for the heater group, whose Mode Select Switch was moved to MAN in the previous step, and observes the Red status light LIT and the Green status light OFF.		
26	(Step 3.3.1.3) Monitor Pzr pressure for 2 minutes.	The operator observes Pressurizer Pressure and Spray valve Position (Or equivalent) for 2 minutes and determines that Pzr Pressure has stabilized at 2235 ±15 psig.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM D

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ________________________ Date: ________________

INITIAL CONDITIONS:

- Unit 1 has just increased reactor power to 100% per OP/1/A/6100/003 (Controlling Procedure for Unit Operation).
- Chemistry has confirmed that the Boron Concentration difference between the Pzr and the NC System is 4 ppm.

INITIATING CUE:

- The CRS has directed you to remove Pzr Heater Groups A, B and D from service per Enclosure 4.6 (Operation of Pzr Heaters) of OP/1/A/6100/003, and ensure that NC System pressure is being controlled normally at 2235 psig.
- All outstanding R&Rs that may impact performance of Enclosure 4.6 have been evaluated.

SIM JPM E

Facility:	McGuire	Task No.:	
Task Title:	Depressurize NCS During Natural Circulation Cooldown	JPM No.:	2016 Systems - Control Room JPM E (Alternate Path)
K/A Reference:	EPE E09 EA1.1 (3.5/3.5)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: __X__

Classroom ______ Simulator __X__ Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Ensure Handout 1 is placed on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

Initial Conditions:	• Unit 1 has tripped from 100% power due to a Loss of Off-Site Power. • The crew is currently implementing EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown), and is currently at Step 15. • Normal Letdown is in service.
Initiating Cue:	The CRS has directed you to depressurize the NC system to 1905 PSIG using aux spray per Generic Enclosures, Enclosure 3 (Establishing NV Aux Spray).
Task Standard:	The operator will place Auxiliary Spray in service and lower Pzr Pressure to 2030 psig; and after diagnosing a loss of Normal Letdown immediately remove Aux Spray from service.
Required Materials:	None

General References: EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), Rev 34
EP/1/A/5000/ES-0.1 (Reactor Trip Response), Rev 42
EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown), Rev 12
EP/1/A/5000/G-1 (Generic Enclosures), Rev 38
OP/1/A/6200/001 A (Chemical and Volume Control System Letdown), Rev 53

Handouts: Handout 1: EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown) marked up for this JPM.
Handout 2: Generic Enclosure 3 (Establishing NV Aux Spray)
Handout 3: Enclosure 4.7 (Operator Action With NV Aux Spray In Service) of OP/1/A/6200/001 A (Chemical and Volume Control System Letdown)

Time Critical Task: NO

Validation Time: 12 minutes

Critical Step Justification	
Step 9	This step is critical because pressing the 1NV-21A OPEN pushbutton is necessary to place Auxiliary Spray in service and lower Pzr Pressure to 2030 psig.
Step 10	This step is critical because pressing the 1NV-16A CLOSE pushbutton is necessary to place Auxiliary Spray in service and lower Pzr Pressure to 2030 psig.
Step 11	This step is critical because adjusting the 1NV-238 controller and 1NV-241 manual loader to ensure that Regenerative Hx letdown temperature remains less than 380°F, and Pzr spray water delta T remains less than 320°F is necessary to place Auxiliary Spray in service and lower Pzr Pressure to 2030 psig.
Alternate Path Critical Step Justification	
Step 13	This step is critical because pressing the 1NV-13B OPEN pushbutton and the 1NV-21A CLOSE pushbutton is necessary to remove Aux Spray from service after diagnosing a loss of Normal Letdown.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset Simulator to IC-39 (100% power)
2. Insert MALF EP002A and EP002B (Loss of Off-site Power)
3. Implement E-0, ES-0.1 and ES-0.2 through Step 15.
4. Ensure NCS System parameters as follows:
   - Thots - < 550°F
   - Pzr Level – at Setpoint
   - Pzr Pressure ≈ 2335 psig
   - SG NR Levels ≈ 39%
5. Ensure Normal Letdown is in service.
6. Ensure that all available Pzr Heaters are ON.
7. Place REM-NV0007B=0 cd H_X10_125_1 LT 2030 and on TRIGGER #1 (1NV-7B inadvertently closed).
8. Freeze Simulator.

OR

1. Reset Simulator to Temporary Snap IC-246 (October, 2015).

NOTE: During the performance of the JPM, the Simulator Instructor will be required to:

- **Acknowledge spurious alarms unrelated to the task being performed.**
- **The Letdown isolation is triggered to occur at 2030 psig. If Letdown isolation does NOT occur as expected, Operate TRIGGER #1 at Step 12-13 of JPM when Pzr Pressure has lowered to 2030 psig.**

(Denote Critical Steps with an asterisk)*

Ensure Handout 1 is placed on CRS Desk.
Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
1	(Enclosure 3, Step 1) IF S/I has occurred, THEN….	The operator recognizes that SI has NOT occurred, and proceeds.		
2	(Step 2) REFER TO OP/1/A/6200/001 A (Chemical and Volume Control System Letdown), Enclosure 4.7 (Operator Actions with NV Aux Spray in Service).	The operator seeks a copy of Enclosure 4.7 of OP/1/A/6200/001 A. **Cue:** **Provide operator with Handout 3.** The operator reviews the Enclosure, and proceeds.		
3	(Caution prior to Step 3) Raising charging flow will raise NV aux spray water delta T and raise spray flowrate.	The operator reads the Caution, and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(Notes prior to Step 3) Pzr spray water delta T can be determined by subtracting "REGEN HX CHARGING TEMP" from "PZR VAPOR SPACE TEMP". Controlling flow through 1NV-241 (U1 Seal Water Inj Flow Control) also controls NV aux spray flow.	The operator reads the Notes, and proceeds.		
5	(Step 3) Control charging and letdown flow in subsequent steps as required to: Maintain Pzr spray water delta T less than 320°F. Maintain Regenerative Hx letdown temperature less than 380°F.	The operator reads the Step, and proceeds.		
6	(Step 4) IF AT ANY TIME normal letdown is lost, THEN immediately isolate NV aux spray.	The operator reads the conditional Step, and proceeds.		
7	(Step 5) CLOSE the following normal Pzr spray valves and leave closed while NV aux spray is used: 1NC-27C (1A NC Loop PZR Spray Control) 1NC-29C (1B NC Loop PZR Spray Control).	The operator observes the 1NC-27C SLIMS and observes the output to be 0%, and that the Red closed light is LIT. The operator observes the 1NC-29C SLIMS and observes the output to be 0%, and that the Red closed light is LIT.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	(Caution prior to Step 6) The number of times the following valves are cycled should be kept to minimum, to limit the number of thermal transients on charging nozzle.	The operator the Caution, and proceeds.		
*9	(Step 6) Establish NV aux spray as follows: (Step 6.a) OPEN 1NV-21A (U1 NV Supply to U1 Aux PZR Spray Isol).	The operator presses the 1NV-21A OPEN pushbutton and observes the Red status light is LIT, and the Green status light is OFF.		
10 *	(Step 6.b) CLOSE the following valves: 1NV-13B (U1 NV Supply To 1A NC Loop Isol) 1NV-16A (U1 NV Supply To 1D NC Loop Isol).	The operator observes the 1NV-13B Green status light is LIT, and the Red status light is OFF. The operator presses the 1NV-16A CLOSE pushbutton and observes the Green status light is LIT, and the Red status light is OFF.		
*11	(Step 7) Slowly control charging flow as desired to control depressurization rate.	The operator adjusts the 1NV-238 controller and 1NV-41 manual loader to ensure that Regenerative Hx letdown temperature remains less than 380°F, and Pzr spray water delta T remains less than 320°F. The operator observes Pzr Pressure is slowly lowering.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	(Caution prior to Step 8) If excessive depressurization occurs, the following step may need to be performed immediately.	The operator reads the Caution, and proceeds.		
Simulator Instructor NOTE: If NOT already done, when Pzr Pressure is 2030 psig Operate TRIGGER #1.				
*13	(Step 8) IF AT ANY TIME NV aux spray must be stopped, THEN perform the following:	The operator observes Letdown flow at 0 gpm or responds to Group 4 C5, 1NV-7B LETDOWN CONT ISOL OTSD CLOSED, annunciator on the ESF Monitor Status Panel **(Alternate Path)**.		
	(Step 8.a) OPEN 1NV-13B (U1 NV Supply To 1A NC Loop Isol).	The operator presses the 1NV-13B OPEN pushbutton and observes the Red status light is LIT, and the Green status light is OFF.		
	(Step 8.b) IF 1NV-13B will not open, THEN …..			
	(Step 8.c) CLOSE 1NV-21A (U1 NV Supply to U1 Aux PZR Spray Isol).	The operator presses the 1NV-21A CLOSE pushbutton and observes the Green status light is LIT, and the Red status light is OFF.		
	(Step 8.d) WHEN desired to restore NV aux spray, THEN RETURN TO Step 1.	**Cue:** **Another Operator will continue with this procedure.**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM E

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- Unit 1 has tripped from 100% power due to a Loss of Off-Site Power.
- The crew is currently implementing EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown), and is currently at Step 15.
- Normal Letdown is in service.

INITIATING CUE:

The CRS has directed you to depressurize the NC system to 1905 PSIG using aux spray per Generic Enclosures, Enclosure 3 (Establishing NV Aux Spray).

SIM JPM G

Facility:	McGuire	Task No.:	
Task Title:	Restore Power to 6900V Buses	JPM No.:	2016 Systems - Control Room JPM G
K/A Reference:	062 A2.05 (2.9/3.3)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom ______ Simulator X Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:	• A total loss of Offsite Power has occurred to the Unit 1 Switchyard. • Unit 1 tripped from 100% power. • The Electrical Grid has remained energized throughout this event. • Unit 1 has implemented AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB). • Power has been restored to the Unit 1 Switchyard. • The crew is preparing to restore power to the 6900VAC Buses, and is complete through Step 43.n.

Initiating Cue:	• The CRS has directed you to restore power to the 6900V buses starting with Step 43.o of AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB) using the Normal Supply breakers. • Toddville has indicated that all Unit 1 Switchyard PCBs are available, and has given permission to close them as needed.

Task Standard: The operator will re-energize all four 6900V Buses per AP/1/A/5500/07 Steps 43.o-r.3.

Required Materials: None

General References: AP/1/A/5500/07 (Loss of Electrical Power), Rev 36
EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), Rev 34
EP/1/A/5000/ES-0.1 (Reactor Trip Response), Rev 42

Handouts: Handout 1: Step 43 of Case I (Loss of Normal Power to Both 1ETA and 1ETB) of AP/1/A/5500/07 (Loss of Electrical Power) marked up for this JPM.

Time Critical Task: NO

Validation Time: 7 minutes

Critical Step Justification	
Step 3	This step is critical because pressing the CLOSE pushbutton for PCB8 AND pressing the CLOSE pushbutton for PCB12 are necessary to re-energize all four 6900V Buses per AP/1/A/5500/07 Steps 43.o-r.3.
Step 5	This step is critical because pressing the CLOSE pushbutton for 1TA, 1TB, 1TC and 1TD normal breakers are necessary to re-energize all four 6900V Buses per AP/1/A/5500/07 Steps 43.o-r.3.
Step 6	This step is critical because placing the 1TA, 1TB, 1TC, and 1TD Mode Select Switch to AUTO is necessary to re-energize all four 6900V Buses per AP/1/A/5500/07 Steps 43.o-r.3.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset to IC-39 (100% Steady-state)
2. Insert the following malfunctions:

   MALF-EP001 Station Blackout

3. Place Simulator in Run and acknowledge Annunciator Alarms.
4. Implement EP/1/A/5000/E-0, EP/1/A/5000/ES-0.1 and AP/1/A/5500/07, Case I through Step 43.n.
5. Stabilize plant.
6. Remove MALF-EP001
7. Insert LOA-EP172, 173 and 174 (Switchyard Lockout Reset).
8. Acknowledge alarms and Freeze the Simulator.

OR

1. Reset Simulator to Temporary Snap IC-248 (October, 2015).

NOTE: **During the performance of the JPM, the Simulator Instructor will be required to acknowledge spurious alarms unrelated to the task being performed.**

(Denote Critical Steps with an asterisk)*

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
1	(43.o) Check the following MODs – CLOSED: • MOD-8R	The operator observes the MOD-8R Red status light LIT, Green status light OFF.		
	• MOD-8Y	The operator observes the MOD-8Y Red status light LIT, Green status light OFF.		
	• MOD-9R	The operator observes the MOD-9R Red status light LIT, Green status light OFF.		
	• MOD-9Y	The operator observes the MOD-9Y Red status light LIT, Green status light OFF.		
	• MOD-11R	The operator observes the MOD-11R Red status light LIT, Green status light OFF.		
	• MOD-11Y	The operator observes the MOD-11Y Red status light LIT, Green status light OFF.		
	• MOD-12R	The operator observes the MOD-12R Red status light LIT, Green status light OFF.		
	• MOD-12Y	The operator observes the MOD-12Y Red status light LIT, Green status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	(Step 43.p) Check switch indications for the following 6900V switchgear breakers – LIT:			
	• "1TA NORMAL BREAKER"	The operator observes the 1TA normal bkr Green status light LIT, Red status light OFF.		
	• "1TA STDBY BREAKER"	The operator observes the 1TA standby bkr Green status light LIT, Red status light OFF.		
	• "1TB NORMAL BREAKER"	The operator observes the 1TB normal bkr Green status light LIT, Red status light OFF.		
	• "1TB STDBY BREAKER"	The operator observes the 1TB standby bkr Green status light LIT, Red status light OFF.		
	• "1TC NORMAL BREAKER"	The operator observes the 1TC normal bkr Green status light LIT, Red status light OFF.		
	• "1TC STDBY BREAKER"	The operator observes the 1TC standby bkr Green status light LIT, Red status light OFF.		
	• "1TD NORMAL BREAKER"	The operator observes the 1TD normal bkr Green status light LIT, Red status light OFF.		
	• "1TD STDBY BREAKER".	The operator observes the 1TD standby bkr Green status light LIT, Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	(Step 43.q) Close available PCBs as directed by Toddville TCC.			
*	• PCB8	The operator presses the CLOSE pushbutton for PCB8 and observes the Red status light LIT and Green status light OFF (The 1A Transformer voltage will rise to 24KV).		
	• PCB9	The operator presses the CLOSE pushbutton for PCB9 and observes the Red status light LIT and Green status light OFF.		
	• PCB11	The operator presses the CLOSE pushbutton for PCB11 and observes the Red status light LIT and Green status light OFF (The 1B Transformer voltage will rise to 24KV).		
*	• PCB12	The operator presses the CLOSE pushbutton for PCB12 and observes the Red status light LIT and Green status light OFF.		
4	(Step 43.r) WHEN busline energized, THEN energize 6900V busses as follows: (Step 43.r.1) Check electrical grid – HAS REMAINED ENERGIZED DURING THIS EVENT.	The operator observes that Electrical Grid has remained energized throughout this event (Initial Conditions), and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*5	(Step 43.r.2) Close the normal or standby breaker on de-energized busses: • 1TA	The operator presses the CLOSE pushbutton for 1TA normal breaker and observes the Red status light LIT, Green status light OFF.		
	• 1TB	The operator presses the CLOSE pushbutton for 1TB normal breaker and observes the Red status light LIT, Green status light OFF.		
	• 1TC	The operator presses the CLOSE pushbutton for 1TC normal breaker and observes the Red status light LIT, Green status light OFF.		
	• 1TD.	The operator presses the CLOSE pushbutton for 1TD normal breaker and observes the Red status light LIT, Green status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*6	(Step 43.r.3) Place the mode select switches for the following 6900V busses in auto: • 1TA • 1TB • 1TC • 1TD.	The operator places the 1TA Mode Select Switch to AUTO. The operator places the 1TB Mode Select Switch to AUTO. The operator places the 1TC Mode Select Switch to AUTO. The operator places the 1TD Mode Select Switch to AUTO.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM G

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- A total loss of Offsite Power has occurred to the Unit 1 Switchyard.
- Unit 1 tripped from 100% power.
- The Electrical Grid has remained energized throughout this event.
- Unit 1 has implemented AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB).
- Power has been restored to the Unit 1 Switchyard.
- The crew is preparing to restore power to the 6900VAC Buses, and is complete through Step 43.n.

INITIATING CUE:

- The CRS has directed you to restore power to the 6900V buses starting with Step 43.o of AP/1/A/5500/07 (Loss of Electrical Power), Case I (Loss of Normal Power to 1ETA and 1ETB) using the Normal Supply breakers.
- Toddville has indicated that all Unit 1 Switchyard PCBs are available, and has given permission to close them as needed.

SIM JPM H

Facility:	McGuire	Task No.:	
Task Title:	Isolate the Circulating Water System During Turbine Building Flooding	JPM No.:	2016 Systems - Control Room JPM H
K/A Reference:	075 A2.02 2.5/2.7		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom ______ Simulator X Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Ensure Handout 1 is placed on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

Initial Conditions:	• With Unit 1 at 100% power, massive RC System Flooding occurred in the Unit 1 Turbine Building. • The crew has implemented AP/0/A/5500/44 (Plant Flooding) Enclosure 1 (Unit 1 Turbine Bldg Flooding), and an operator has just been dispatched to check the flood doors closed. • The crew has just manually tripped the reactor. • An operator has been dispatched to close the breaker for 1RC-21. • The U-1 Turbine Building Rounds AO (Bob) is standing by via radio.

Initiating Cue:	The CRS has directed you to isolate the RC System by continuing with Enclosure 1 (Unit 1 Turbine Bldg Flooding) of AP/0/A/5500/44 (Plant Flooding), step 5.d, and completing all Step 5 sub-steps, while the crew continues with EP/1/A/5000/E-0 (Reactor Trip and/or Safety Injection). **This is a Time Critical JPM**

Task Standard:	The operator will take actions to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Required Materials:	None
General References:	AP/0/A/5500/44 (Plant Flooding), Rev 18 PT/0/A/4600/113 (Operator Time Critical Task Verification), Enclosure 13.15 (Isolating Internal Plant Flooding), Rev 20 EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), Rev 34 EP/1/A/5000/ES-0.1 (Reactor Trip Response), Rev 42
Handouts:	Handout 1: AP/0/A/5500/44 (Plant Flooding) marked up for place-keeping through Step 3. Handout 2: Enclosure 1 (Unit 1 Turbine Bldg Flooding) of AP/0/A/5500/44 (Plant Flooding) marked up for place-keeping through Step 5.c RNO c.3.
Time Critical Task:	YES – Enclosure 13.15 of PT/0/A/4600/113. **The operator will close 1RC-21 in 29 minutes and complete the task in 40 Minutes.** Operator isolates water leak in Turbine Building within 40 minutes of leak initiation (prior to exceeding level at 1.25 foot high curbs provided at most openings to the Auxiliary Building basement from turbine Building). This may require local closure of breakers to RC discharge crossover valves (1RC-21, 1RC-22). Breaker should be closed within 5 minutes of dispatch. 1RC-21 & 22 must be closed within 29 min of leak prior to flooding associated MCCs in turbine bldg basement. The flood evaluated in SER 10.4 is a RC pipe or expansion joint leak in the Turbine Building basement. Engineering has evaluated the time delay between Turbine Bldg flood initiation and receipt of Control Room alarms in calculation MCC-1139.01-00-0268, Turbine/Auxiliary Building Design Basis Flooding Analysis. 1RC-21 and 22 may have to be closed to isolate turbine bldg flooding. Because their power supplies (600V MCCs) are in the turbine bldg basement, the breakers for these valves have to be closed, and the valve(s) closed prior to water getting in MCC. 5 minutes allowed from dispatch to close breakers. Water in MCC can occur in 29 min (PIP M08-3367 CA4).
Validation Time:	12 minutes

Critical Step Justification	
Step 1	This step is critical because depressing the Vacuum Breaker OPEN pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 2	This step is critical because depressing the 1A, 1B, and 1C RC Pump STOP pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 5	This step is critical because depressing the 1RC-5 CLOSE pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 6	This step is critical because depressing the 1RC-21 CLOSE pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 7	This step is critical because depressing the 1RC-79, 80 and 81 CLOSE pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 9	This step is critical because depressing the 1RC-9, 10, 11, 12, 13 and 14 CLOSE pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.
Step 11	This step is critical because depressing the 1RC-15, 16, 17, 18, 19 and 20 CLOSE pushbutton is necessary to attempt to isolate the Unit 1 RC System in accordance with Enclosure 1 of AP/0/A/5500/44.

SIMULATOR OPERATIONAL GUIDELINES

1. Reset simulator to IC-39, 100% Power
2. Place in RUN and allow time to stabilize
3. Override MCB Annunciator 1AD8/C4, TURB ROOM SUMP UNIT 1 HI-HI LEVEL to ON.
4. Manually trip reactor.
5. Complete EP/1/A/5000/E-0 through Step 6, and EP/1/A/5000/ES-0.1 through Step 16.
6. Acknowledge all alarms.
7. Freeze the Simulator.

OR

1. Reset to Temp IC-249 (October, 2015).
2. Place Simulator in Run and acknowledge alarms/Reset SLIMS.

NOTE: Simulator Instructor will need to operate Trigger #1 at JPM Step 3.

(Denote Critical Steps with an asterisk*)

Ensure Handout 1 is placed on CRS Desk.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 2.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
Simulator Instructor NOTE: Leave Simulator in FREEZE until operator is ready to begin.				
*1	(Step 5.d) Open Main condenser "VACUUM BREAKER".	The operator depresses the Vacuum Breaker OPEN pushbutton and observes the Red status light LIT, and Green status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	(Step 5.e) Stop the following Unit 1 RC pumps:			
*	• 1A RC pump	The operator depresses the 1A RC Pump STOP pushbutton and observes the Green status light LIT, and Red status light OFF (Amps indicate 0).		
*	• 1B RC pump	The operator depresses the 1B RC Pump STOP pushbutton and observes the Green status light LIT, and Red status light OFF (Amps indicate 0).		
*	• 1C RC pump	The operator depresses the 1C RC Pump STOP pushbutton and observes the Green status light LIT, and Red status light OFF (Amps indicate 0).		
	• 1D RC pump	The operator observes the 1D RC Pump Green status light LIT, and Red status light OFF (Amps indicate 0).		
		Examiner Cue: **Alert Booth Operator to operate Trigger #1.** **Booth Operator:** **Operate Trigger #1.** **Afterwards, Call as AO, and report that the breaker for 1RC-21 has been closed.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	(Step 5.f) On Unit 1 OAC RC graphic, check 1RC-22 (U1 RC Crossover To U2 RC Disch Isol) - OPEN.	The operator calls up the RC graphic on the OAC. The operator observes that 1RC-22 is RED (open) on the RC Graphic.		
4	(Step 5.g) Check 1RC-7 (U1 RC Crossover To U2 RC Supply Isol) - OPEN.	The operator observes the 1RC-7 Red status light LIT, and Green status light OFF (Or uses the RC Graphic on the OAC).		
*5	(Step 5.h) Press CLOSE pushbutton for 1RC-5 (U1 RC Crossover Supply Isol).	The operator depresses the 1RC-5 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
*6	(Step 5.i) WHEN breaker for 1RC-21 is closed, THEN press CLOSE pushbutton for 1RC-21 (U1 RC Crossover Disch Isol)	The operator observes the 1RC-21 Red status light LIT, and Green status light OFF. The operator depresses the 1RC-21 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF. **Stop Time for Time Critical Task 1:** ____________________		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*7	(Step 5.j) Press CLOSE pushbutton on the following Unit 1 RC discharge gates:			
	• 1RC-79 (1A Main Condenser Discharge Gate)	The operator depresses the 1RC-79 CLOSE pushbutton.		
	• 1RC-80 (1B Main Condenser Discharge Gate)	The operator depresses the 1RC-80 CLOSE pushbutton.		
	• 1RC-81 (1C Main Condenser Discharge Gate)	The operator depresses the 1RC-81 CLOSE pushbutton.		
8	(Step 5.k) Record time.	The operator records the time in the space provided.		
*9	(Step 5.l) Press CLOSE pushbutton for the following waterbox inlet valves:	**Examiner Note:** **The operator may NOT wait for these valves to complete stroking, prior to proceeding (Bulleted Substeps), The procedure checks their position later.**		
	• 1RC-9 (1A1 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-9 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
	• 1RC-10 (1A2 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-10 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*9 (Cont'd)	• 1RC-11 (1B1 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-11 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
	• 1RC-12 (1B2 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-12 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
	• 1RC-13 (1C1 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-13 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
	• 1RC-14 (1C2 Main Condenser Waterbox Inlet Isol)	The operator depresses the 1RC-14 CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF.		
10	(Note prior to Step 5.m) Waterbox isolation valves take 1-2 minutes to close.	The operator reads the Note and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*11	(Step 5.m) CLOSE the following waterbox outlet valves: • WHEN 1RC-9 is closed, THEN close 1RC-15 (1A1 Main Condenser Waterbox Outlet Isol). • WHEN 1RC-10 is closed, THEN close 1RC-16 (1A2 Main Condenser Waterbox Outlet Isol). • WHEN 1RC-11 is closed, THEN close 1RC-17 (1B1 Main Condenser Waterbox Outlet Isol). • WHEN 1RC-12 is closed, THEN close 1RC-18 (1B2 Main Condenser Waterbox Outlet Isol). • WHEN 1RC-13 is closed, THEN close 1RC-19 (1C1 Main Condenser Waterbox Outlet Isol). • WHEN 1RC-14 is closed, THEN close 1RC-20 (1C2 Main Condenser Waterbox Outlet Isol).	The operator, after observing the associated Waterbox Inlet Valve Green status light LIT, depresses the associated Waterbox Outlet Valve CLOSE pushbutton and observes the Green status light LIT, and Red status light OFF, for each valve.		
12	(Step 5.n) Check 1RC-5 (U1 RC Crossover Supply Isol) - CLOSED.	The operator observes the 1RC-5 Green status light LIT, and Red status light OFF.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	(Step 5.o) Check 1RC-21 (U1 RC Crossover Disch Isol) - CLOSED.	The operator observes the 1RC-21 Green status light LIT, and Red status light OFF.		
14	(Step 5.p) Place 1RL-18 (Unit 1 LT Coolers Control) in manual and CLOSE.	The operator places the 1RL-18 Controller in MANUAL, and adjusts so that 1RL-18 is CLOSED (Output = 0).		
15	(Step 5.q) Dispatch operator to CLOSE the following valves: 1RL-13 (1A LT Cooler Inlet Isol) (Unit 1 turbine bldg, 760+10, 1GG-33 & 1F-33, north of MTOT room) 1RL-15 (1B LT Cooler Inlet Isol) (Unit 1 turbine bldg, 739+5 1G-33 & 1FF-33, bottom of stairway).	The operator contacts an AO to take both actions. **Booth CUE:** **As AO, acknowledge.**		
16	(Step 5.r) Check Unwatering pump - OUT OF SERVICE.	The operator contacts the AO (or WCC) in the Unit 1 Turbine Building. **Booth CUE:** **As AO (or WCCS) in U1 TB, the Unwatering Pump is NOT in service.**		
17	(Note prior to Step 5.s) RC pump discharge valve indications are on OAC “RCPMPS” graphic. These valves should automatically close when their respective RC pump is stopped.	The operator reads the Note and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
18	(Step 5.s) Check the following RC Inlet valves - CLOSED:			
	• 1RC-1 (1A RC Pump Disch Isol)	The operator observes OAC Graphic (RC PMPS) showing 1RC-1 as GREEN.		
	• 1RC-2 (1B RC Pump Disch Isol)	The operator observes OAC Graphic (RC PMPS) showing 1RC-2 as GREEN.		
	• 1RC-3 (1C RC Pump Disch Isol)	The operator observes OAC Graphic (RC PMPS) showing 1RC-3 as GREEN.		
	• 1RC-4 (1D RC Pump Disch Isol).	The operator observes OAC Graphic (RC PMPS) showing 1RC-4 as GREEN.		
19	(Note prior to Step 5.t) Discharge gates can take up to 11 minutes to close from time recorded in Step 5.k.	The operator reads the Note and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	(Step 5.t) Check the following RC discharge gates on Unit 1 - CLOSED:			
	• 1RC-79 (1A Main Condenser Discharge Gate)	The operator observes the 1RC-79 Green and Red status light LIT.		
	• 1RC-80 (1B Main Condenser Discharge Gate)	The operator observes the 1RC-80 Green and Red status light LIT.		
	• 1RC-81 (1C Main Condenser Discharge Gate).	The operator observes the 1RC-81 Green and Red status light LIT.		
		Examiner NOTE: **These Valves will most likely still be stroking closed (≈13 minutes closure time).**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________ **TIME CRITICAL STOP TIME 2:** ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems - Control Room JPM H

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- With Unit 1 at 100% power, massive RC System Flooding occurred in the Unit 1 Turbine Building.
- The crew has implemented AP/0/A/5500/44 (Plant Flooding) Enclosure 1 (Unit 1 Turbine Bldg Flooding), and an operator has just been dispatched to check the flood doors closed.
- The crew has just manually tripped the reactor.
- An operator has been dispatched to close the breaker for 1RC-21.
- The U-1 Turbine Building Rounds AO (Bob) is standing by via radio.

INITIATING CUE:

The CRS has directed you to isolate the RC System by continuing with Enclosure 1 (Unit 1 Turbine Bldg Flooding) of AP/0/A/5500/44 (Plant Flooding), step 5.d, and completing all Step 5 sub-steps, while the crew continues with EP/1/A/5000/E-0 (Reactor Trip and/or Safety Injection).

This is a Time Critical JPM

IN-PLANT JPM I

Facility:	McGuire	Task No.:	
Task Title:	Transfer of 1EMXA-4 To SSF During A Loss Of All AC on Unit 1	JPM No.:	2016 Systems – In-Plant JPM I
K/A Reference:	055 EA2.03 (3.9/4.7)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: X Actual Performance: ______

Classroom ______ Simulator ______ Plant X

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:	• A Station Blackout has occurred at Unit 1. • The crew is currently in EP/1/A/5000/ECA-0.0 (Loss of All AC Power). • The CRS has dispatched an operator to the SSF to complete Enclosure 2 (Unit 1 SSF ECA-0.0 Actions).
Initiating Cue:	The CRS has directed you to perform Enclosure 3 (Unit 1 ETA and ETB Rooms - ECA-0.0 Actions).
Task Standard:	The operator will transfer 1EXMA-4 to its alternate power supply within 4 minutes from dispatch (Start of the JPM), and identify that the 1ETA‑2 Lockout Relay has tripped.
Required Materials:	PPE (Hardhat, Safety Glasses, Hearing Protection, Safety Shoes etc.)
General References:	EP/1/A/5000/ECA-0.0 (Loss of All AC Power), Rev 37 PT/0/A/4600/113 (Operator Time Critical Task Verification), Rev 20

Handouts: Handout 1: Blank Copy of Enclosure 3 (Unit 1 ETA and ETB Rooms - ECA-0.0 Actions).

Time Critical Task: **Yes - 3 Minutes from time of dispatch (See Enclosure 13.10 of PT/0/A/4600/113)**

Seal injection from standby makeup pump can be initiated within 10 minutes of a loss of all AC power event or an App R fire event. This requires completion of actions at SSF to start SBMUP within 7 minutes of dispatch, and completion of actions in ETA room to swap EMXA-4 within 4 minutes of dispatch. To support the local actions, the following dispatches must be initiated: Operator dispatched to ETA room to swap EMXA-4 within 4 minutes of loss of all NCP seal cooling. (This ensures NV valve controls are swapped to SSF prior to operator at SSF aligning SBMUP. After dispatch, it takes 1 minute to get dosimetry and leave control room through side door, and 3 additional minutes from aux bldg door at MG set room to perform local action. Valve control will then be swapped to SSF 2 minutes before the operator at SSF must align and start SBMUP).

NOTE: Dispatch is from Aux Bldg side of CAD Door 509

Validation Time: 10 minutes

Critical Step Justification	
Step 2	This step is critical because rotating the 1EMXA4-1A Breaker counterclockwise is necessary to transfer 1EXMA-4 to its alternate power supply within 4 minutes from dispatch.
Step 3	This step is critical because removing the Kirk Key from the 1EMXA4-1A Breaker is necessary to transfer 1EXMA-4 to its alternate power supply within 4 minutes from dispatch.
Step 4	This step is critical because inserting the Kirk Key in Breaker 1EMXA4-3A and rotating the 1EMXA4-3A Breaker clockwise is necessary to transfer 1EXMA-4 to its alternate power supply within 4 minutes from dispatch.
Step 5	This step is critical because observing the 1ETA-2 Breaker and interpreting the meaning of the Breaker Handle is pointing towards 2 O'clock and an ORANGE target is visible at 12 O'clock is necessary to identify that the 1ETA-2 Lockout Relay has tripped.

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Notes prior to Step 1) The fastest pathway to 1ETA room from Control Room is: Exit Fire Door 926A (CAD 507) (Unit 1 Submarine Door to C/R Electrical Pen Rm; Elev. 767). Emergency egress Fire Door 925E (CAD 509) (C/R Electrical Pen Rm; Elev. 767; Door to Unit 1 aux bldg stairway). Enter cable room (from stairwell). Enter 1ETA room through swgr AHU room.	The operator reads the Notes and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	(Step 1) At 1EMXA4 (located north wall 1ETA room), swap 1EMXA4 to its alternate power supply (SMXG) as follows:			
	(Caution prior to Step 1.a) It may be necessary to apply pressure on the breaker rotary switch in the counterclockwise direction while opening the kirk key device(s).	The operator reads the Caution, and proceeds.		
*	(Step 1.a) Open breaker 1EMXA4-1A (1EMXA4 Incoming Bkr (Normal) From 1EMXA2 MCC).	The operator rotates the 1EMXA4-1A Breaker counterclockwise. **Cue:** **The Breaker is rotated counterclockwise.**		
*3	(Step 1.b) Remove kirk key from 1EMXA4-1A.	The operator removes the Kirk Key from the 1EMXA4-1A Breaker. **Cue:** **The Kirk Key is removed.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*4	(Step 1.c) Use kirk key and close breaker 1EMXA4-3A (1EMXA4 Incoming Bkr (Alternate) From SMXG MCC).	The operator inserts the Kirk Key in Breaker 1EMXA4-3A.		
		Cue: **The Kirk Key is inserted.**		
		The operator rotates the 1EMXA4-3A Breaker clockwise.		
		Cue: **The Breaker is rotated clockwise.**		
		Stop Time for Time Critical Step: ---------------------------		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*5	(Step 2) Check for tripped lock-out relays on the following cabinets in 1ETA Room:	The operator observes the 1ETA-1 Breaker.		
	• 1ETA-1 (Normal Incoming Bkr From 1ATC Xfmr (6900/4160v))	**Cue:** **There is NO Orange Target visible.**		
	• 1ETA-2 (Alternate Incoming Bkr From SATA Xfmr (6900/4160v))	The operator observes the 1ETA-2 Breaker.		
		Cue: **There is an Orange Target visible.**		
		The operator determines that the 1ETA-2 Lockout Relay is tripped. The operator observes the 1ETA-15 Breaker.		
	• 1ETA-15 (1A Diesel Generator Auxiliary Instrumentation for 1ETA-14)	**Cue:** **There is NO Orange Target visible.**		
		The operator observes the 1ERNCADGRC1A Breaker.		
	• 1ERNCADGRC1A (D/G Relay Cabinet 1A).	**Cue:** **There is NO Orange Target visible.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	(Step 3) Check for tripped lock-out relays on the following cabinets in 1ETB Room: • 1ETB-1 (Normal Incoming Bkr From 1ATD Xfmr (6900/4160v)) • 1ETB-2 (Alternate Incoming Bkr From SATB Xfmr (6900/4160v)) • 1ETB-15 (1B Diesel Generator Auxiliary Instrumentation for 1ETB-14) • 1ERNCADGRC1B (D/G Relay Cabinet 1B).	The operator proceeds to the 1ETB Room. **Cue:** **Another operator has checked the relays in 1ETB and reports to you that none are tripped.**		
7	(Step 4) Notify Control Room Supervisor status of relays checked above.	The operator uses radio or phone to inform CRS that ONLY the 1ETA-2 Lockout Relay (Alternate Incoming Bkr From SATA Xfmr (6900/4160v)) is tripped. **Cue:** **CRS acknowledges message and directs you to return to the control room.**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems – In-Plant JPM I

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

INITIAL CONDITIONS:

- A Station Blackout has occurred at Unit 1.
- The crew is currently in EP/1/A/5000/ECA-0.0 (Loss of All AC Power).
- The CRS has dispatched an operator to the SSF to complete Enclosure 2 (Unit 1 SSF ECA-0.0 Actions).

INITIATING CUE:

The CRS has directed you to perform Enclosure 3 (Unit 1 ETA and ETB Rooms - ECA-0.0 Actions).

A PORTION OF THIS JPM IS TIME CRITICAL

NOTE: No plant equipment should be operated during the performance of this JPM. All actions must be SIMULATED.

IN-PLANT JPM J

Facility:	McGuire	Task No.:	
Task Title:	Locally Trip Unit 2 Main Turbine and Both Unit 2 FWPT's	JPM No.:	2016 Systems – In-Plant JPM J
K/A Reference:	068 AA1.23 (4.3/4.4)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: X Actual Performance: ______

Classroom ______ Simulator ______ Plant X

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:

- A loss of control room has occurred. AP/2/A/5500/17 (Loss Of Control Room) has been implemented and is complete through step 10.b.
- You have been dispatched to standby at the Unit 2 Main Turbine.
- Communications have been established between you and the SRO at the Unit 2 Aux. Shutdown panel.

Initiating Cue: The SRO at the Unit 1 Aux. Shutdown panel will direct you to perform the local actions of Step 10.c.1-3 of AP/1/A/550/17 Loss of Control Room) at the appropriate time.

Task Standard: The operator will trip the Unit 2 Main Turbine locally, and trip any of the available "trip" mechanisms on both FWPT's such that 2SP-1 and 2SP-2 are closed.

Required Materials: PPE (Hardhat, Safety Glasses, Hearing Protection, Safety Shoes etc.)

General References: AP/2/A/5500/17 (Loss of Control Room), Rev 25

Handouts: Handout 1: Page 6 of 41 of AP/2/A/5500/17 (Loss of Control Room)

Time Critical Task: NO

Validation Time: 10 minutes

Note: During this JPM, task directions will be given sequentially by the evaluator (acting as the SRO at the Aux Shutdown panel). The operator is expected to perform this task via these directions (no procedure in hand). Either CF Pump can be tripped first. Verifications can be performed after each pump is tripped or after both CF Pumps are tripped.

Critical Step Justification	
Step 2	This step is critical because manipulating the trip lever at front end standard to trip turbine is necessary to trip the Unit 2 Main Turbine locally.
Step 3	This step is critical because depressing the manual trip pushbutton on the supervisory panel, opening 2LP-4 and/or 14 on each FWPT supervisory panel, OR depressing the mechanical Trip Knob located at each FWPT's Governor Pedestal is necessary to trip both Unit 2 both FWPT's.
Step 4	This step is critical because rotating the handwheel for 2SP-1 and 2SP-2 in the clockwise direction is necessary to trip both Unit 2 both FWPT's.

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
	Cue: **As the SRO at the ASP, direct the operator to Check all throttle valves - CLOSED.**			
1	(Step 10.c.1) Check all throttle valves - CLOSED.	The operator observes the four throttle valves. **Cue:** **Springs are contracted; yellow tape is NOT aligned on any of the Throttle Valves.** The operator determines the Turbine is NOT TRIPPED and informs SRO at Aux. Shutdown panel that turbine is not tripped.		
	Cue: **As the SRO at the ASP, direct the operator to trip the Main Turbine.**			

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*2.	(Step 10.c.1 RNO) Trip main turbine.	The operator manipulates trip lever at front end standard to trip turbine. **Cue:** **Throttle Valve springs are expanded, yellow tape is aligned on each Throttle Valve.** The operator informs the SRO at the ASP that the Main Turbine is tripped.		
	Cue: **As the SRO at the ASP, direct the operator to Trip both Unit 2 CF pumps.**			

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*3	(Step 10.c.2) Trip both Unit 2 CF pumps.	The operator proceeds to the FWPTs then manually trips both turbines by: Depressing the manual trip pushbutton on the supervisory panel. **OR** Opening 2LP-4 and/or 14 on each FWPT supervisory panel. **OR** Depressing the mechanical Trip Knob located at each FWPT's Governor Pedestal.		
		Cue: **Provide the appropriate cue:** **Pushbutton depressed, reset light is DARK, RPMs are decreasing.** **OR** **Handle lever rotated counterclockwise, reset light is DARK, RPMs are decreasing** **OR** **Mechanical Trip Knob at FWPTs Governor Pedestal depressed, reset light is DARK, RPMs are decreasing**		
		The operator informs the SRO at the ASP that both FWPTs are tripped.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
	Cue: **As the SRO at the ASP, direct the operator to close 2SP-1 and 2SP-2.**			
*4	(Step 10.c.3) CLOSE the following valves: 2SP-1 (Main Steam to 2A CF Pump Turb Isol) (Unit 2 turbine bldg, 760+14, 2H-26, east of CF pump 2A) 2SP-2 (Main Steam to 2B CF Pump Turb Isol) (Unit 2 turbine bldg, 760+14, 2H-26, east of CF pump 2A).	The operator locates both valves. NOTE: The valve locations are contained in the AP. If the operator cannot locate the valves and indicates that he/she would ask the SRO for further guidance then give the location as a cue. **Cue: <u>(Only if needed)</u>** **2SP-1 (Main Steam to 1A CF Pump Turb Isol) (Unit 2 turbine bldg, 760+14, 2H-26, east of CF pump 2A)** **Cue: <u>(Only if needed)</u>** **2SP-2 (Main Steam to 2B CF Pump Turb Isol) (Main Steam to 2B CF Pump Turb Isol) (Unit 2 turbine bldg, 760+14, 2H-26, east of CF pump 2A).**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*4 (Cont'd)		The operator rotates the handwheel for 2SP-1 in the clockwise direction.		
		Cue: **The handwheel stops moving and the stem is fully in.**		
		The operator rotates the handwheel for 2SP-2 in the clockwise direction.		
		Cue: **The handwheel stops moving and the stem is fully in.**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Systems – In-Plant JPM J

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________________ Date: ____________________

INITIAL CONDITIONS:

- A loss of control room has occurred. AP/2/A/5500/17 (Loss Of Control Room) has been implemented and is complete through step 10.b.
- You have been dispatched to standby at the Unit 2 Main Turbine.
- Communications have been established between you and the SRO at the Unit 2 Aux. Shutdown panel.

INITIATING CUE:

The SRO at the Unit 2 Aux. Shutdown panel will direct you to perform the local actions of Step 10.c.1-3 of AP/2/A/550/17 Loss of Control Room) at the appropriate time.

NOTE: No plant equipment should be operated during the performance of this JPM. All actions must be SIMULATED.

IN-PLANT JPM K

Facility:	McGuire	Task No.:	
Task Title:	Emergency Borate the Reactor Coolant System Locally Using 2NV-269	JPM No.:	2016 Systems – In-Plant JPM K
K/A Reference:	APE 024, AA1.04 (3.6/3.7)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: X Actual Performance: ______

Classroom ______ Simulator ______ Plant X

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout AP/2/A/5500/38 page 8 of 19 marked up for place-keeping.

Initial Conditions:

- Unit 2 was at 100% power when a Boron dilution event occurred.
- AP/2/A/5500/38 (Emergency Boration) was entered.
- While attempting to open 2NV-265B (Boric Acid To NV Pumps), the RO discovered that 2NV-265B was de-energized.

Initiating Cue: The CRS has directed you to emergency borate the NC System by performing Step 12.d RNO of AP/2/A/5500/38 (Emergency Boration and Response to Inadvertent Dilution).

A Portion of this JPM is TIME CRITICAL

Task Standard: 2NV-269 is located and manually opened within ten (10) minutes.

Required Materials: PPE (Hardhat, Safety Glasses, Hearing Protection, Safety Shoes etc.)
Dosimetry

General References: AP/2/A/5500/38 (Emergency Boration and Response to Inadvertent Dilution), Rev 11

PT/0/A/4600/113 (Operator Time Critical Task Verification), Enclosure 13.3 (Stop Dilution and Borate During a Dilution Event), Rev 20

Handouts: Handout 1: Step 12.d RNO (Page 8 of 19) of AP/2/A/5500/38 (Emergency Boration and Response to Inadvertent Dilution) marked up for place-keeping.

Time Critical Task: YES – Enclosure 13.3 of PT/0/A/4600/113

Modes 1 and 2: Operators will stop dilution and initiate boration within 15 minutes. This may involve time critical local actions to open NV-265 or NV-269 (10 minutes from dispatch) per AP-38. Time starts when rods reach insertion limit (automatic rod control), or when reactor trips (manual rod control). (If you stop the dilution prior to going below rod insertion limit or reactor trip, emergency boration is not required.)

Only securing dilution within times above is required by the safety analysis, but UFSAR 15.4.6 states that operators can also initiate boration in these stated times. Operators will therefore be required to meet times for both securing dilution and initiating boration. The stated times are long enough for operators to perform actions. Note that UFSAR Section 15.4.6 states that operators have "at least 15 minutes" (Modes 1 and 2). The actual limiting times per UFSAR Table 15-19 are 16.6 minutes when rods are in manual (after trip), and 25.9 minutes when rods are in auto (after reaching rod insertion limit).

Validation Time: 8 minutes

NOTE: Start this JPM from the hallway outside of the Ops kitchen area.

Record the Time Critical Completion Time (in JPM step number 2) when 2NV-269 is open.

Critical Step Justification	
Step 2	This step is critical because locating 2NV-269, removing the locking device, and rotating the handwheel in the counter-clockwise direction is necessary to manually open 2NV-269.

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout AP/2/A/5500/38 page 8 of 19 marked up for place-keeping.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Step 12.d RNO) Perform the following: (Step 12.d RNO 1) Dispatch operator to OPEN 2NV-265B (aux bldg, 733+3, JJ-57, near chemical addition tank).	The operator locates 2NV-265B, presses downward on the Motor handwheel clutch, and rotates the handwheel in the counter-clockwise direction. **Cue:** **Handwheel clutch engaged** **Force applied in the counter clockwise direction** **Handwheel is NOT moving** The operator recognizes that valve cannot be opened and continues.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2 *	(Step 12.d RNO 2) IF 2NV-265B cannot be opened, THEN: (Step 12.d RNO 2.a) Dispatch operator to unlock and open 2NV-269 (Unit 2 NV Pump Boric Acid Supply Isol) (aux bldg, 733+4, JJ-58, near chemical addition tank).	The operator locates 2NV-269, removes the locking device, and rotates the handwheel in the counter-clockwise direction within ten minutes of dispatch. **Cue:** **Lock removed, Handwheel rotated fully counter-clockwise.** **Stop Time for Time Critical Task:** ____________________		
3	(Step 12.d RNO 2.b) OPEN 2NV-267A (Boric Acid To Blender Control).	The operator calls the Control Room to report 2NV-269 Open and requests that the BOP Open 2NV-267A. **Cue:** **The Control Room operator acknowledges that 2NV-269 and 2NV-267A is open.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(Step 12.d RNO 3) Do not continue until 2NV-265B or 2NV-269 flowpath above is aligned.	The operator recognizes that 2NV-269 is OPEN, and indicates that the task is complete.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

Job Performance Measure No.: 2016 Systems – In-Plant JPM K

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

INITIAL CONDITIONS:

- Unit 2 was at 100% power when a Boron dilution event occurred.
- AP/2/A/5500/38 (Emergency Boration) was entered.
- While attempting to open 2NV-265B (Boric Acid To NV Pumps), the RO discovered that 2NV-265B was de-energized.

INITIATING CUE:

The CRS has directed you to emergency borate the NC System by performing Step 12.d RNO of AP/2/A/5500/38 (Emergency Boration and Response to Inadvertent Dilution).

A Portion of this JPM is TIME CRITICAL

NOTE: No plant equipment should be operated during the performance of this JPM. All actions must be SIMULATED.

JPM A1a RO

Facility:	McGuire	Task No.:	
Task Title:	Complete a Surveillance for Mode Change	JPM No.:	2016 Admin – JPM A1a RO
K/A Reference:	2.1.20 (4.6)		

Examinee:		NRC Examiner:	
Facility Evaluator:		Date:	

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom X Simulator ______ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-2.

Initial Conditions:

- Unit 1 is in Mode 4 during a plant startup.
- Current EFPD is 248.
- NC System pressure has stabilized at 1600 psig.
- Chemistry has reported that the CLA Boron Concentrations are as follows:
  - CLA 1A – 2485 ppm
  - CLA 1B – 2482 ppm
  - CLA 1C – 2491 ppm
  - CLA 1D – 2349 ppm
- It has become necessary to perform Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items, in order to continue with the plant startup.

Initiating Cue:

- The CRS has directed you to complete Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items.
- Identify any Flex Strategy Administrative Limits and/or Technical Specification LCO's that are not being complied with.

Task Standard:	The operator will complete Enclosure 13.4 of PT/1/A/4600/003D in accordance with the attached KEY, determine that all Flex Strategy Administrative Limits are met, and determine that LCO 3.5.1 is not currently met.
Required Materials:	Calculator
General References:	PT/1/A/4600/003D (Monthly Surveillance Items), Rev 89 MCEI-0400-304 (McGuire Unit 1 Cycle 24 Core Operating Limits Report), Rev 0 McGuire Technical Specification LCO 3.5.1 (Accumulators), Amendment 218/200
Handouts:	Handout 1: Blank copy of the body of PT/1/A/4600/003D, Monthly Surveillance Items and Enclosure 13.4, NC Boron Concentration Checklist. Handout 2: McGuire Cycle 24 Core Operating Limits Report.
Time Critical Task:	NO
Validation Time:	15 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-2.

START TIME: ___________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Step 1, Bullet 1) Perform the following: IF performing routine monthly surveillances, THEN……	The operator recognizes that the Surveillance is NOT being performed for the Monthly Surveillance and proceeds.		
2	(Note prior to Step 1, Bullet 2) IF performing this procedure in preparation for mode change, Enclosure 13.4 may be performed prior to Mode 3 however, this surveillance shall be met in Mode 3 prior to NC System pressure increasing to greater than 1000 psig.	The operator reads the Note and proceeds.		
*3	(Step 1, Bullet 2) IF performing this procedure prior to Mode 3 OR Unit in Mode 3 prior to NC System pressure increasing greater than 1000 psig, THEN record the following: Mode to be entered: _____ Date: _____	The operator records Mode **3** and **Today (or Equivalent)**, and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*4	(Step 2) Check Boron Concentration of Cold Leg Accumulators within limits specified in COLR (Step 2.1) Record the following: Cold Leg Accumulator 1A Cold Leg Accumulator 1B Cold Leg Accumulator 1C Cold Leg Accumulator 1D	The operator records **2485** in the 1A CLA space provided. The operator records **2482** in the 1B CLA space provided. The operator records **2491** in the 1C CLA space provided. The operator records **2349** in the 1D CLA space provided.		
*5	(Step 2.2) Record Cold Leg Accumulator limits as specified in COLR: (Min) _____________ ppmB (Max) _____________ ppmB	The operator reviews the procedure and Section 2.11.1 of the Unit 1 COLR and determines that based on a current EFPD of 248, the minimum required Accumulator Boron Concentration is **2475** ppm, and records this in the space provided. The operator recognizes that the 1D CLA is less than that required by Tech Spec LCO 3.5.1. The operator reviews the procedure and Section 2.11.1 of the Unit 1 COLR and determines that the maximum allowable Accumulator Boron Concentration is **2875** ppm, and records this in the space provided.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	(Notes prior to Step 3) The FLEX Strategy CLA minimum Boron Concentration limit is a Beyond Design Basis External Event administrative limit and does NOT affect Tech Spec operability. The FLEX Strategy Boron Concentration administrative limit for Cold Leg Accumulators is greater than 2400 ppmB.	The operator reads the Notes and proceeds.		
7	(Step 3) Check FLEX CLA Boron Concentration administrative limit met (Step 3.1) IF all Cold Leg Accumulators Boron Concentration greater than 2400 ppmB, THEN….	The operator recognizes that the 1D CLA Boron Concentration is NOT greater than 2400 ppm, and proceeds.		
*8	(Step 3.2) IF only one Cold Leg Accumulator below 2400 ppmB, THEN perform the following: (Step 3.2.1) Record affected CLA: ___________	The operator records **1D** in the space provided.		
*9	(Step 3.2.2) Record affected CLA Boron Concentration: ___________ ppmB	The operator records **2349** in the space provided.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*10	(Step 3.2.3) Determine average Boron Concentration of the other three CLAs: [(___________ ppmB [1st CLA]) + (___________ ppmB [2nd CLA]) + (___________ ppmB [3rd CLA])] ÷ 3 = _____ [Avg of other CLAs]	The operator records **2485** in one space provided. The operator records **2482** in a second space provided. The operator records **2491** in the third space provided. The operator performs the calculation and determines that the Average of the Other CLAs is **2486** ppm, and this value is recorded.		
*11	(Step 3.2.4) Determine average CLA Boron Concentration: (______________ ppmB [Affected CLA] + ______________ ppmB [Average of other CLAs]) ÷ 2 = ______________ ppmB [Average CLA Boron Conc]	The operator records **2349** in the space provided for the Affected CLA. The operator records **2486** in the space provided for the Average of the Other CLAs. The operator performs the calculation and determines that the Average CLA Boron Concentration is **2417.5** ppm, and this value is recorded.		
*12	(Step 3.2.5) IF Average CLA Boron Concentration is greater than 2400 ppmB, THEN this surveillance is met.	The operator recognizes that the Average CLA Boron Concentration is greater than 2400 ppm, and concludes that the Surveillance (i.e. All Flex Strategy Administrative Limits) is met, and proceeds.		
13	(Step 3.2.5) IF above calculation is less than 2400 ppmB, THEN….	The operator recognizes that this step is NOT applicable, and proceeds.		
14	(Note prior to Step 3.3) Steps 3.3.1 and 3.3.2 may be performed concurrently.	The operator reads the Note and proceeds.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
15	(Step 3.3) IF more than one CLA is less than 2400 ppmB, THEN….	The operator recognizes that CLA 1A, 1B and 1C are all greater than 2400 ppm, that this step is NOT applicable, and proceeds.		
*16	(Step 4) Initial one of the following: • No Discrepancy • Discrepancy Sheet Attached (IF any Acceptance Criteria NOT met, THEN it is identified as a discrepancy, evaluated per Tech Spec/SLC and appropriate corrective action taken.) (Directed Action) Identify any Flex Strategy Administrative Limits and/or Technical Specification LCO that have been exceeded.	The operator leaves both bullets unsigned and hands off the Enclosure to the CRS. The operator recognizes that the 1D CLA is less than that required by Tech Spec LCO 3.5.1. The operator recognizes that all Flex Strategy Administrative Limits are met.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A1a RO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________________ Date: ____________________

INITIAL CONDITIONS:

- Unit 1 is in Mode 4 during a plant startup.
- Current EFPD is 248.
- NC System pressure has stabilized at 1600 psig.
- Chemistry has reported that the CLA Boron Concentrations are as follows:
  - CLA 1A – 2485 ppm
  - CLA 1B – 2482 ppm
  - CLA 1C – 2491 ppm
  - CLA 1D – 2349 ppm
- It has become necessary to perform Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items, in order to continue with the plant startup.

INITIATING CUE:

- The CRS has directed you to complete Enclosure 13.4, NC Boron Concentration Checklist, of PT/1/A/4600/003D, Monthly Surveillance Items.
- Identify any Flex Strategy Administrative Limits and/or Technical Specification LCO's that are not being complied with.

JPM A1a SRO

Facility:	McGuire	Task No.:	
Task Title:	Review a Completed Procedure	JPM No.:	2016 Admin – JPM A1a SRO
K/A Reference:	2.1.20 (4.6)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: __X__

Classroom __X__ Simulator ______ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handout 1.

Initial Conditions:

- Unit 1 is in Mode 4 during a plant startup.
- Current EFPD is 248.
- NC System pressure has stabilized at 1600 psig.
- PT/1/A/4600/003D, Monthly Surveillance Items, Enclosure 13.4, NC Boron Concentration Checklist, has been performed.
- The completed Enclosure 13.4 is now ready for review.

Initiating Cue: Review the completed procedure to identify:

- Whether the startup may continue to Mode 1.
- ALL administrative procedural/paperwork requirements.

Task Standard:	The operator will review completed Enclosure 13.4 of PT/1/A/4600/003D and identify that the Surveillance performer has entered an incorrect value for the minimum value of the Cold Leg Accumulator Boron Concentration; and correct this entry. Then when the correction is made, the operator will determine that the 1A through 1C CLA are within the allowable Boron concentration range, but that the 1D CLA is outside of the allowable range. The operator will identify that Mode 3 cannot be entered until 1D CLA boron concentration is raised, and complete Attachment 6 of AD-HU-ALL-0004 (Procedure and Work Instruction Use and Adherence) in accordance with a provided KEY.
Required Materials:	Unit 1 COLR and Technical Specifications must be available to the operator for reference during the JPM.
General References:	PT/1/A/4600/003D (Monthly Surveillance Items), Rev 89 AD-HU-ALL-0004 (Procedure and Work Instruction Use and Adherence) Rev 3 MCEI-0400-304 (McGuire Unit 1 Cycle 24 Core Operating Limits Report), Rev 0 McGuire Technical Specification LCO 3.5.1 (Accumulators), Amendment 218/200 McGuire Technical Specification LCO 3.0 (Applicability), Amendment 238/220

Handouts:

Handout 1: PT/1/A/4600/003D (Monthly Surveillance Items) marked up as follows:

- Procedure Cover Comments Block: This procedure used for Enclosure 13.4 ONLY.
- Checkmarks adjacent to Limits and Precautions 6.1 through 6.4.
- Step 7.1 initialed (with Kevin Cole printed aside).
- Note prior to Step 12.3 checked.
- Step 12.3 initialed.

Enclosure 13.4, “Boron Concentration Checklist,” marked up as follows:

- Step 1 Bullet 1 is NA and initialed.
- Note prior to Step 1 Bullet 2 is checked.
- Step 1 Bullet 2 is initialed, MODE **3** is recorded and **TODAY** is entered as the date.
- Step 2.1 – ALL four checkboxes are checked. Boron concentration for each CLA is recorded as follows:
  - CLA 1A - 2485
  - CLA 1B - 2482
  - CLA 1C - 2491
  - CLA 1D - 2349 **(Does NOT Meet Acceptance Criteria)**
- Step 2.2 Checkbox is checked. COLR values are recorded as follows:
- (MIN) – 2329 **(Recorded in ERROR from U1 COLR for 300 - 350 EFPD, should be 2475)**
- (MAX) – 2875
- Notes prior to Step 3.1are checked.
- Step 3.1 is NA and initialed.
- Step 3.2 is initialed.
- Step 3.2.1 Checkbox is checked and “1D” is recorded.
- Step 3.2.2 Checkbox is checked and “2349” is recorded.
- Step 3.2.3 is completed as follows: 1st CLA:2485, 2nd CLA:2482, 3rd CLA:2491, Avg of Other CLAs:2486
- Step 3.2.4 is completed as follows: Affected CLA:2349, Avg of Other CLAs:2486, Avg CLA Boron Conc:2417.5
- Step 3.2.5 is initialed.
- Step 3.2.6 is NA and initialed.
- Note prior to Step 3.3 is checked.
- Step 3.3 is NA and initialed.
- Step 4 Bullet 1 - Left Blank
- Step 4 Bullet 2 - Left Blank (This will be signed off by SRO performing JPM)

Handout 2: Blank copy of Attachment 6, “Equipment Problem Evaluation Form" of AD-HU-ALL-0004, "Procedure and Work Instruction Use and Adherence." (Handed out during JPM Step 3)

Time Critical Task:	NO
Validation Time:	18 minutes
Note:	A Key is provided as a separate document to this JPM.

(Denote Critical Steps with an asterisk)*

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1 *	(PT/1/A/4600/003D, Step 12.3) IF in Modes 1, 2, 3, OR prior to entering Mode 3, perform Enclosure 13.4 (Boron Concentration Checklist).	The operator reviews the procedure and Section 2.11.1 of the Unit 1 COLR and discovers the following errors: • The Minimum Cold Leg Accumulator limit has been incorrectly recorded as 2329, when it should be 2475. • The operator may draw a line through 2329, record 2475, initial and date the entry. **Cue:** **If the operator wants Chemistry to check individual CLA Boron Concentration values, report that the values listed on Enclosure 13.4 are correct.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*2	(PT/1/A/4600/003D, Enclosure 13.4, Step 4) Initial one of the following: • No Discrepancy	The operator refers to Step 11.3 of PT/1/A/4600/003D and determines that each Cold Leg Accumulator shall contain a boron concentration within the LCO limits specified in the COLR.		
*		The operator compares the 1A CLA Cb of 2485 to the corrected minimum Cb, and determines that the Acceptance Criteria is MET.		
*		The operator compares the 1B CLA Cb of 2482 to the corrected minimum Cb, and determines that the Acceptance Criteria is MET.		
*		The operator compares the 1C CLA Cb of 2491 to the corrected minimum Cb, and determines that the Acceptance Criteria is MET.		
*		The operator compares the 1D CLA Cb of 2349 to the corrected minimum Cb, and determines that the Acceptance Criteria is NOT MET.		
		The operator indicates that the procedure would be returned to the RO to correct.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*3	(PT/1/A/4600/003D, Enclosure 13.4, Step 3) Initial one of the following: • Discrepancy Sheet Attached (IF any Acceptance Criteria NOT met, it is identified as a discrepancy, evaluated per Tech Spec/SLC and appropriate corrective action taken.)	**Cue:** **When the operator indicates that the RO will complete a Discrepancy Sheet, provide Handout 2, and ask the operator to complete the sheet as they would expect the RO to do.** The operator completes AD-HU-ALL-0004 Attachment 6 per the provided KEY. The operator reviews Technical Specification LCO 3.5.1 and determines that the Specification is NOT applicable in Mode 4, but that entry into Mode 3 cannot be made under the current conditions.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A1a SRO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

INITIAL CONDITIONS:

- Unit 1 is in Mode 4 during a plant startup.
- Current EFPD is 248.
- NC System pressure has stabilized at 1600 psig.
- PT/1/A/4600/003D, Monthly Surveillance Items, Enclosure 13.4, NC Boron Concentration Checklist, has been performed.
- The completed Enclosure 13.4 is now ready for review.

INITIATING CUE:

Review the completed procedure to identify:

- Whether the startup may continue to Mode 1.
- ALL administrative procedural/paperwork requirements.

<u>JPM A1b RO</u>

Facility:	McGuire	Task No.:	
Task Title:	Calculate the Boric Acid Addition for a specified Rod Change	JPM No.:	2016 Admin – JPM A1b RO
K/A Reference:	2.1.25 (3.9)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: __X__

Classroom __X__ Simulator ______ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

Initial Conditions:

- Unit #1 Reactor Power is at 50%, Steady State.
- Core burnup is 125 EFPD.
- NC Boron Concentration = 950 PPM.
- Present Control Rods Bank “D” at 165 steps.
- Desired Rod Height is Control Rods Bank “D” at 210 steps.

Initiating Cue: The CRS has directed you to determine the amount of boric acid needed to obtain the desired Control Rod Height using the McGuire Unit 1 Data Book.

Task Standard: Boric Acid Addition of approximately 253.2 gallons is calculated within + 4 gallons.

Required Materials: Calculator

General References:	OP/0/A/6100/006 (Reactivity Balance Calculation), Rev 77 OP/1/A/6100/022 (Unit 1 Data Book), Rev 481 MCEI-0400-304 (Unit 1 Cycle 24 Core Operating Limits Report), Rev 0
Handouts:	Handout 1: OP/1/A/6100/022 (Unit 1 Data Book) Cycle 24, Enclosure 4.3 – Section 5.1 Boration and Dilution Tables Handout 2: OP/1/A/6100/022 (Unit 1 Data Book) Cycle 24, Enclosure 4.3 – Table 6.3.3 Integral Rod Worth in Overlap HFP, Equilibrium Xenon Handout 3: OP/1/A/6100/022 (Unit 1 Data Book) Cycle 24, Enclosure 4.3 – Graph 6.11 Differential Boron Worth (HFP, ARO, Eq Xe, Eq Sm)
Time Critical Task:	NO
Validation Time:	15 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*1	Operator determines **165 steps** integral rod worth using the 51-150 EFPD column of OP/1/A/6100/22, Enclosure 4.3, Table 6.3.3, IRW in Overlap, HFP, Equilibrium Xe.	Initial inserted reactivity worth = **153 pcm**		
*2	Operator determines **210 steps** integral rod worth using the 51-150 EFPD column of OP/1/A/6100/22, Enclosure 4.3, Table 6.3.3, IRW in Overlap, HFP, Equilibrium Xe.	Desired Rod height inserted reactivity worth = **15 pcm**		
*3	Operator determines the change in reactivity required for the rod insertion	Change in reactivity to be compensated due to rod insertion = **15 pcm** **-153 pcm** **-138 pcm**		
*4	Using OP/1/A/6100/22, Enclosure 4.3, Graph 6.11 Differential Boron Worth (HFP, ARO, Eq Xe, Eq Sm, Unit 1 Cycle 21) determines the Differential Boron Worth for present conditions (125 EFPD)	Operator determines the Differential Boron Worth from the graph to be = **-6.02 pcm/ppm**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5	Using the Differential Boron Worth and the Change in reactivity, determines the change in Boron Concentration	Operator determines the change in Boron Concentration to be = **-138 /-6.02 pcm/ppm** = **22.9 ppm**		
6	Operator determines Boron Concentration required	Change in Boron = **950 + 22.9 ppm** **= 972.9 ppm**		
*7	Using OP/1/A/6100/22, Enclosure 4.3 Section 5.1 Boron and Dilution Tables, determines the Boric Acid addition	Using Present Boron Concentration 950 ppm and the Desired Boron Concentration of 972.9 ppm, determines from Table that change from 950-972.9 ppm will require the addition of **253.2 gallons** of Boric Acid. OR Calculation: 67388 x Ln(6050/6027.3) = **255.6 gallons**. Total Boric Acid to add = **253.2 ± 4 gallons (249.2-257.2 gallons).**		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

Job Performance Measure No.: 2016 Admin – JPM A1b RO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

KEY:

Tables:

Page 12 of 20
Intersect Present Cb of 950 ppm with Desired Cb 970 ppm and determine 223 gallons.
Intersect Present Cb of 950 ppm with Desired Cb 980 ppm and determine 335 gallons.

335 gallons - 223 gallons = 112 gallons/10ppm = 11.2 gallons/ppm

223 gallons (at 970) + [11.2 gallons/ppm x 2.7 ppm] = 253.24

Calculation:

G = V x Ln [(C-Bi)/(C-Bf)]

Where:

G	Volume of boric acid required for boration
V	Equivalent System Volume = 67388 Gallons (Constant)
C	Concentration of Boric Acid being added = 7000 ppm (Constant)
Bi	Present NCS Boron Concentration (ppm B)
Bf	Desired NCS Boron Concentration (ppm B)

G = 67388 gallons x Ln [(7000 ppmB – 950 ppmB)/(7000-972.9 ppmB)]

G = 67388 gallons x Ln [(6050 ppmB)/(6027.1 ppmB)]

G = 67388 gallons x Ln [1.003766] = **255.55** gallons

INITIAL CONDITIONS:

- Unit #1 Reactor Power is at 50%, Steady State.
- Core burnup is 125 EFPD.
- NC Boron Concentration = 950 PPM.
- Present Control Rods Bank “D” at 165 steps.
- Desired Rod Height is Control Rods Bank “D” at 210 steps.

INITIATING CUE:

The CRS has directed you to determine the amount of boric acid needed to obtain the desired Control Rod Height using the McGuire Unit 1 Data Book.

JPM A1b SRO

Facility:	McGuire	Task No.:	
Task Title:	Calculate QPTR	JPM No.:	2016 Admin – JPM A1b SRO
K/A Reference:	2.1.7 (4.7)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom X Simulator ______ Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue and Current Power Range Detector Currents (Last Two Pages of this JPM), and Handouts 1-2.

Initial Conditions:

- The Unit 1 OAC failed and is not operating.
- The vendor is being consulted concerning repairs.
- It is estimated it will take approximately 15 hours to complete repairs.
- The crew has implemented PT/1/A/4600/021A (Loss of Operator Aid Computer while in Mode 1) and completed through step 12.15.
- Unit 1 is at 99% power and all Power Range Instruments are OPERABLE.

Initiating Cue: The CRS has directed you to calculate QPTR in accordance with Step 12.16 of PT/1/A/4600/21A (Loss of Operator Aid Computer while in Mode 1), and identify any applicable Technical Specification required ACTION.

Task Standard: The operator will calculate the QPTR (See Attached Key) and determine that the QPTR Technical Specification has been exceeded; Then identify the required TS ACTION (i.e. Power must be reduced to at least 94% within two hours, and ACTIONS A.2 through A.7 must be taken).

Required Materials:	Calculator
General References:	PT/1/A/4600/021A (Loss of Operator Aid Computer while in Mode 1), Rev 41 OP/1/A/6100/022 (Unit 1 Data Book – Cycle 24), Rev 481 McGuire Technical Specifications LCO 3.2.4 (Quadrant Power Tilt Ratio), Amendment 261/241
Handouts:	Handout 1: PT/1/A/4600/021A (Loss of Operator Aid Computer while in Mode 1) marked up through step 12.15. Handout 2: OP/1/A/6100/022 (MNS Unit #1 Data Book), Enclosure 4.3, Table 2.2 (Excore Currents and Voltages Correlated to 100% Full Power at Various Axial Offsets) Handout 3: McGuire Technical Specifications Book
Time Critical Task:	NO
Validation Time:	25 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue and Current Power Range Detector Currents (Last Two Pages of this JPM), and Handouts 1-2.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Step 12.16) IF QPTR Alarm inoperable AND greater than 50% RTP, perform the following: (Step 12.16.1) IF all Power Range (PR) channel inputs to QPTR operable, calculate QPTR on Enclosure13.5 (Calculation Sheet for Quadrant Power Tilt) Part A within 12 hours and every 12 hours thereafter until QPTR Alarm operable.	The operator determines from initial conditions QPTR Alarm is inoperable, Unit 1 is at 100% power and all PR channels are operable. Operator proceeds to Enclosure 13.5 (Calculation Sheet for Quadrant Power Tilt) Part A.		
2	(Enclosure 13.5 Part A) Complete the Form	The operator enters the current Date and Time at the top of the form.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*3	(Enclosure 13.5 Part A) Measured Current - From NI cabinet's current meter (located on respective PRB Drawers). Ensure Detector Milliamp Range Switches are in "0.5" position and read 0-500 microamp scale.	The operator records the correct amperage reading for each detector (From the Handout provided) in the **Measured Current** row for each of the eight (8) detectors as follows: PR-41A = **295** PR-41B = **304** PR-42A = **299** PR-42B = **327** PR-43A = **299** PR-43B = **315** PR-44A = **285** PR-44B = **304**		
*4	(Enclosure 13.5 Part A) Calibration Current - From most recent calibration data using "0" Incore Axial Offset Current in Data Book, Table 2.2 ("IT" for detector "A", "IB" for detector "B").	The operator locates OP/1/A/6100/022, Enclosure 4.3, Table 2.2, Excore Currents and Voltages Correlated to 100% Full Power at Various Axial Offsets. The operator records the correct amperage reading for each detector (Table 2.2) in the **Calibration Current** row for each of the eight (8) detectors as follows: PR-41A = **133.0** PR-41B = **145.5** PR-42A = **125.2** PR-42B = **135.0** PR-43A = **131.3** PR-43B = **147.3** PR-44A = **129.8** PR-44B = **147.7**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*5	(Enclosure 13.5 Part A) Relative Flux (RF) – Divide line 1 by line 2 to calculate Relative Flux (RF) for each upper (A) and lower (B) detector.	The operator correctly calculates the average RF and records the in the **Relative Flux (RF)** row for each of the eight (8) detectors as follows: PR-41A = 295/133.0 = **2.22** PR-41B = 304/145.5 = **2.09** PR-42A = 299/125.2 = **2.39** PR-42B = 327/135.0 = **2.42** PR-43A = 299/131.3 = **2.28** PR-43B = 315/147.3 = **2.14** PR-44A = 285/129.8 = **2.20** PR-44B = 304/147.7 = **2.06**		
*6	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. Avg RF of A Detectors	The operator records the RF of each of the four (4) A detectors and calculates the Avg RF of A Detectors as follows: **(2.22+2.39+2.28+2.20)/4 = 2.27**		
*7	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. Avg RF of B Detectors	The operator records the RF of each of the four (4) B detectors and calculates the Avg RF of B Detectors as follows: **(2.09+2.42+2.14+2.06)/4 = 2.18**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*8	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-41A Tilt	The operator calculates the PR-41A Tilt as follows: **2.22/2.27 = 0.98 ± .01** And records this value.		
*9	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-41B Tilt	The operator calculates the PR-41B Tilt as follows: **2.09/2.18 = 0.96 ± .01** And records this value.		
*10	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-42A Tilt	The operator calculates the PR-42A Tilt as follows: **2.39/2.27 = 1.05 ± .01** And records this value.		
*11	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-42B Tilt	The operator calculates the PR-42B Tilt as follows: **2.42/2.18 = 1.11 ± .01** And records this value.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*12	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-43A Tilt	The operator calculates the PR-43A Tilt as follows: **2.28/2.27 = 1.00 ± .01** And records this value.		
*13	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-43B Tilt	The operator calculates the PR-43B Tilt as follows: **2.14/2.18 = 0.98 ± .01** And records this value.		
*14	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-44A Tilt	The operator calculates the PR-44A Tilt as follows: **2.20/2.27 = 0.97 ± .01** And records this value.		
*15	(Enclosure 13.5 Part A) Quadrant Power Tilts: Calculate by dividing each upper relative flux by the average upper relative flux and dividing each lower relative flux by the average lower relative flux. PR-44B Tilt	The operator calculates the PR-44B Tilt as follows: **2.06/2.18 = 0.94 ± .01** And records this value.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*16	(Technical Specification 3.2.4) The QPTR shall be ≤ 1.02.	The operator determines that quadrants are >1.02 and refers to LCO 3.2.4. The operator determines that power must be reduced (ACTION A.1) to at least 73% (Highest QPTR is 1.11 on PR-42B; Reduce ≥ 3% from RTP (100%) for each 1% of QPTR > 1.02 (1.11-1.02 = 0.09 x 3% RTP x100% QPTR/RTP)) within 2 hours. The operator determines that ACTION A.2, A.3, A.4, A.5, A.6 and A.7 must be completed within the required COMPLETION TIME.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

Job Performance Measure No.: 2016 Admin – JPM A1b SRO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

KEY:

Part A Page 1 of 4

	PR-41		PR-42		PR-43		PR-44	
	A	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Measured Current	295	304	299	327	299	315	285	304
Calibration Current	133.0	145.5	125.2	135.0	131.3	147.3	129.8	147.7
Relative Flux (RF)	2.22	2.09	2.39	2.42	2.28	2.14	2.20	2.06

Part A Page 2 of 4

Avg RF of A Detectors = $\boxed{2.22}$ + $\boxed{2.39}$ + $\boxed{2.28}$ + $\boxed{2.20}$ = 2.27

Avg RF of B Detectors = $\boxed{2.09}$ + $\boxed{2.42}$ + $\boxed{2.14}$ + $\boxed{2.06}$ = 2.18

PR-41A Tilt RFA = $\frac{\text{RF of PR-41A}}{}$ = $\frac{2.22}{2.27}$ 0.98*

PR-41B Tilt RFB = $\frac{\text{RF of PR-41B}}{}$ = $\frac{2.09}{2.18}$ 0.96*

PR-42A Tilt RFA = $\frac{\text{RF of PR-42A}}{}$ = $\frac{2.39}{2.27}$ 1.05*

PR-42B Tilt RFB = $\frac{\text{RF of PR-42B}}{}$ = $\frac{2.42}{2.18}$ 1.11*

PR-43A Tilt RFA = $\frac{\text{RF of PR-43A}}{}$ = $\frac{2.28}{2.27}$ 1.00*

PR-43B Tilt RFB = $\frac{\text{RF of PR-43B}}{}$ = $\frac{2.14}{2.18}$ 0.98*

PR-44A Tilt RFA = $\frac{\text{RF of PR-44A}}{}$ = $\frac{2.20}{2.27}$ 0.97*

PR-44B Tilt RFB = $\frac{\text{RF of PR-44B}}{}$ = $\frac{2.06}{2.18}$ 0.94*

* $\pm$ .01

The following Detector Currents are observed on the NI cabinet current meters:

NI-41 detector:

A (left) 295 microamps

B (right) 304 microamps

NI-42 detector:

A (left) 299 microamps

B (right) 327 microamps

NI-43 detector:

A (left) 299 microamps

B (right) 315 microamps

NI-44 detector:

A (left) 285 microamps

B (right) 304 microamps

INITIAL CONDITIONS:

- The Unit 1 OAC failed and is not operating.
- The vendor is being consulted concerning repairs.
- It is estimated it will take approximately 15 hours to complete repairs.
- The crew has implemented PT/1/A/4600/021A (Loss of Operator Aid Computer while in Mode 1) and completed through step 12.15.
- Unit 1 is at 99% power and all Power Range Instruments are OPERABLE.

INITIATING CUE:

The CRS has directed you to calculate QPTR in accordance with Step 12.16 of PT/1/A/4600/21A (Loss of Operator Aid Computer while in Mode 1), and identify any applicable Technical Specification required ACTION.

<u>JPM A2 RO</u>

Facility:	McGuire	Task No.:	
Task Title:	Determine Leak Isolation Boundaries	JPM No.:	2016 Admin – JPM A2 RO
K/A Reference:	2.2.41 (3.5)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom X Simulator ______ Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-2.

Initial Conditions:	• Unit 1 is operating at 100% power. • Suspecting a leak in the Aux Building the crew entered Case II of AP/1/A/5500/10, NC System Leakage Within the Capacity of Both NV Pumps. • An AO has just reported that there is a large packing leak on 1NV-151A (NV Pumps Recirculation Valve).

Initiating Cue:	The CRS has directed you to: • Identify the closest leak isolation boundary valves for this leak. • Identify which, if any, of these valves need to be re-positioned from their current position. • Identify the Breaker location for any electrically operated leak isolation boundary valve that may need to be operated.

Task Standard: The operator will review the Flow Diagram of Chemical and Volume Control System (NV) and determine the closest leak isolation boundary valves for this leak, review OP/1/A/6200/001E and determine the boundary valves that need to be re-positioned, and review OP/1/A/6200/001E and determine the Breaker location for 1NV-150A in accordance with the Attached KEY.

Required Materials: None

General References: AP/1/A/5500/10 (NC System Leakage Within the Capacity of Both NV Pumps), Rev 23

OP/1/A/6200/001 B (Chemical and Volume Control System Charging), Rev 63

OP/1/A/6200/001 E (Chemical and Volume Control System Valve Checklists), Rev 34

MNS Drawing MCFD-1554-01.00 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 11

MNS Drawing MCFD-1554-01.01 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 11

MNS Drawing MCFD-1554-01.02 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 13

MNS Drawing MCFD-1554-01.03 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 4

MNS Drawing MCFD-1554-02.00 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 18

MNS Drawing MCFD-1554-02.01 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 6

MNS Drawing MCFD-1554-03.00 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 20

MNS Drawing MCFD-1554-03.01 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 24

MNS Drawing MCFD-1554-04.00 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 12

MNS Drawing MCFD-1554-05.00 (Flow Diagram of Chemical and Volume Control System (NV)), Rev 22

Handouts: Handout 1: Series of MNS Drawings - Flow Diagram of Chemical and Volume Control System (NV)

Handout 2: OP/1/A/6200/001 E (Chemical and Volume Control System Valve Checklists)

Time Critical Task: NO

Validation Time: 30 minutes

(Denote Critical Steps with an asterisk)*

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-2.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*1	(Directed Action) Identify the closest leak isolation boundary valves for this leak.	The operator will review the Flow Diagram of Chemical and Volume Control System (NV) and determine the closest leak isolation boundary valves for this leak are: • 1NV-150B, NV Pumps Recirculation • 1NV-148, Seal Wtr Filt #1 Outlet Isol • 1NV-152, SW Hx #1 Tube Inlet Isol • 1NV-149, Seal Wtr Filter Byp • 1NV-154, SW Hx #1 Byp See attached KEY		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*2	(Directed Action) Identify which, if any, of these valves need to be re-positioned from their current position.	The operator will review the Flow Diagram of Chemical and Volume Control System (NV) and/or OP/1/A/6200/001 E and determine that of these leak isolation boundary valves only the following valves must be re-positioned: • 1NV-150B, NV Pumps Recirculation • 1NV-148, Seal Wtr Filt #1 Outlet Isol • 1NV-152, SW Hx #1 Tube Inlet Isol See attached KEY		
*3	(Directed Action) Identify the Breaker location for any electrically operated leak isolation boundary valve that may need to be operated.	The operator will review OP/1/A/6200/001 E and determine that the Breaker for 1NV-150B, NV Pumps Recirculation, is located at 1EMXB2-F2C. See attached KEY		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A2 RO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

KEY:

Closest leak isolation boundary valves for this leak.	• **1NV-150B, NV Pumps Recirculation** • **1NV-148, Seal Wtr Filt #1 Outlet Isol** • **1NV-152, SW Hx #1 Tube Inlet Isol** • **1NV-149, Seal Wtr Filter Byp** • **1NV-154, SW Hx #1 Byp**
Which, if any, leak isolation boundary valves need to be re-positioned from their current position.	• **1NV-150B, NV Pumps Recirculation** • **1NV-148, Seal Wtr Filt #1 Outlet Isol** • **1NV-152, SW Hx #1 Tube Inlet Isol**
Breaker location for any electrically operated leak isolation boundary valve that may need to be operated.	**The Breaker for 1NV-150B, NV Pumps Recirculation, is located at 1EMXB2-F2C.**

INITIAL CONDITIONS:

- Unit 1 is operating at 100% power.
- Suspecting a leak in the Aux Building the crew entered Case II of AP/1/A/5500/10, NC System Leakage Within the Capacity of Both NV Pumps.
- An AO has just reported that there is a large packing leak on 1NV-151A (NV Pumps Recirculation Valve).

INITIATING CUE:

The CRS has directed you to:

- Identify the closest leak isolation boundary valves for this leak.
- Identify which, if any, of these valves need to be re-positioned from their current position.
- Identify the Breaker location for any electrically operated leak isolation boundary valve that may need to be operated.

Closest leak isolation boundary valves for this leak.	
Which, if any, leak isolation boundary valves need to be re-positioned from their current position.	
Breaker location for any electrically operated leak isolation boundary valve that may need to be operated.	

JPM A2 SRO

Facility:	McGuire	Task No.:	
Task Title:	Respond to a Fire Detection System Trouble Alarm	JPM No.:	2016 Admin – JPM A2 SRO
K/A Reference:	2.2.40 (4.7)		

Examinee:		NRC Examiner:	
Facility Evaluator:		Date:	

Method of testing:

Simulated Performance:	______			Actual Performance:	X
Classroom	X	Simulator	______	Plant	________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

Initial Conditions:

- Units 1 and 2 are operating at 100% power.
- Annunciator 1AD-13 E3, FIRE DET SYS ALERT, has alarmed.
- The crew has entered OP/0/A/6400/002F (Fireworks Fire Detection System), and is performing Enclosure 4.1 (Fire Detection System Alarm/Trouble).
- The Fireworks Computer is Out of Service and cannot be immediately restarted.
- The Electronic Fire Impairment Log (eFIL) is unavailable.
- A check of Fire Alarm Control Panel (FACP) 1 shows that Zone 153A has a TROUBLE condition.
- The Fire Protection Engineer has reported that no evaluations have been made allowing any Fire Detection System equipment to be Non-Functional.

Initiating Cue:

- Complete Steps 3.12.1.2 through 3.12.1.5 of Enclosure 4.1 of OP/0/A/6400/002F.
- Identify any Technical Specification LCO/SLC required actions and specific monitoring requirements that must be made in Autolog in the space provided below.

Task Standard:	The operator will identify that SLC 16.9.6 ACTION is required, that Remedial Action Condition C is met, that the required ACTION must be performed, and entries made in AUTOLOG in accordance with the attached KEY.
Required Materials:	None
General References:	OP/1/A/6100/010 N (Annunciator Response for Panel 1AD-13), Rev. 78 OP/0/A/6400/002F (Fireworks Fire Detection System), Rev. 23 MNS SLC 16.9.6 (Fire Detection Instrumentation), Rev. 138 MNS Technical Specification LCO 3.6.5 (Containment Air Temperature), Amendment 184/166 NSD 316 (Fire Protection Impairment and Surveillance), Rev. 17 OMP 5-16 (Electronic Fire Impairment Log), Rev. 7
Handouts:	Handout 1: Full copy of OP/0/A/6400/002F with Enclosure 4.1 marked up through Step 3.12.1.1 Handout 2: McGuire Technical Specification Book. Handout 3: McGuire Selected License Commitment Book.
Time Critical Task:	YES. The SLC Action must be identified within 60 minutes.
Validation Time:	14 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Step 3.12.1.2) Check status of all zones in alarm or trouble once per hour from either FACP-1, FACP-9, or locally.	The operator recognizes that FACP-1 must be checked again within 1 hour, and proceeds.		
*2	(Step 3.12.1.3) Determine if any zone in alarm or trouble is SLC related. (Refer to Encl. 4.2, Fire Detection System - Fire Zone Data.)	The operator proceeds to Enclosure 4.2, Page 6 of 9, and determines that Zone 153A is SLC related.		
*3	(Step 3.12.1.4) IF any zone in alarm is SLC related, notify CRS to evaluate SLC as appropriate.	The operator addresses SLC 16.9.6, Fire Detection Instrumentation. The operator recognizes that the SLC is currently applicable (Initial Conditions). The operator evaluates SLC Table 16.9.6-1 and determines that Zone 153A has a restorable, cable-type sensor which is Non-Functional. The operator recognizes that one or more annulus fire detectors are Non-Functional, and that Remedial Action Condition C is met. The operator recognizes that Required Action C.1 (Establish a fire watch patrol of the annulus) must be accomplished within 1 hour AND C.2.1 (Verify at least one adjacent annulus fire detector zone is		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*3 (Cont'd)		FUNCTIONAL.) once per hour thereafter OR C.2.2 (Perform a fire watch patrol of the annulus if no adjacent zone is FUNCTIONAL.) once per 8 hours thereafter. **See attached KEY on Page 7 of 8.**		
*4	(Step 3.12.1.5) Document monitoring in Autolog as appropriate.	The operator identifies that the status of Zone 153A must be checked on FACP-1, FACP-9 or locally within 1 hour, and recorded. The operator identifies that the results of the above SLC Action must be recorded.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A2 SRO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

KEY:

Technical Specification LCO/SLC required actions (If Any):

Any of the possible combinations are appropriate:

C.1	**Perform a fire watch patrol of the annulus within 1 hour.**
C.2.1	**Verify at least one adjacent annulus fire detector zone is FUNCTIONAL.**

C.1	**Perform a fire watch patrol of the annulus within 1 hour.**
C.2.2	**Perform a fire watch patrol of the annulus if no adjacent zone is FUNCTIONAL once per 8 hours thereafter.**

Specific monitoring requirements that must be made in Autolog:

The operator identifies that the status of Zone 153A must be checked on FACP-1, FACP-9 or locally within 1 hour, and recorded (Requirement of Step 3.12.1.2). (Or Equivalent)

The operator identifies that the results of the above SLC Action must be recorded. (Or Equivalent)

INITIAL CONDITIONS:

- Units 1 and 2 are operating at 100% power.
- Annunciator 1AD-13 E3, FIRE DET SYS ALERT, has alarmed.
- The crew has entered OP/0/A/6400/002F (Fireworks Fire Detection System), and is performing Enclosure 4.1 (Fire Detection System Alarm/Trouble).
- The Fireworks Computer is Out of Service and cannot be immediately restarted.
- The Electronic Fire Impairment Log (eFIL) is unavailable.
- A check of Fire Alarm Control Panel (FACP) 1 shows that Zone 153A has a TROUBLE condition.
- The Fire Protection Engineer has reported that no evaluations have been made allowing any Fire Detection System equipment to be Non-Functional.

INITIATING CUE:

- Complete Steps 3.12.1.2 through 3.12.1.5 of Enclosure 4.1 of OP/0/A/6400/002F.
- Identify any Technical Specification LCO/SLC required actions and specific monitoring requirements that must be made in Autolog in the space provided below.

Technical Specification LCO/SLC required actions (If Any): ______________________________

Specific monitoring requirements that must be made in Autolog: ______________________________

JPM A3 RO

Facility:	McGuire	Task No.:	
Task Title:	Perform a Unit Vent Flow Calculation of a Containment Air Release	JPM No.:	2016 Admin – JPM A3 RO
K/A Reference:	2.3.11 (3.8)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom X Simulator ______ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

Initial Conditions:

- GWR Package # 2016013 for Unit 1 Containment Air Release is currently in use to conduct a series of Containment air releases.
- Three releases have been made.
- During the first release, conducted using Enclosure 4.2 (Air Release Mode With VQ Flow Monitor Operable) of OP/1/A/6450/017 (Containment Air Addition and Release), the Unit 1 VQ Monitor became inoperable.
- The crew stopped the release and continued the air release using Enclosure 4.3 (Air Release Mode with VQ Flow Monitor Inoperable) of OP/1/A/6450/017 (Containment Air Addition and Release), and recorded the release volume on the GWR paperwork.
- At 1743 on 4/4/16, containment pressure was 0.18 PSIG and another (4th) VQ release was initiated to reduce pressure to 0.12 PSIG per Step 3.9 of Enclosure 4.3.
- This release was secured at 1839 on 4/4/16 and the procedure was completed through step 3.9.1 for this 4th release.

Initiating Cue:	• You have been directed to calculate the volume released for the 4th release and complete all required paperwork starting with Step 3.9.2, **AND**, since this is the last release for GWR package 2016013, perform Steps 3.11.4 through 3.11.9 of Enclosure 4.3 to determine the total volume released from the Containment. • The CRS notified RP (Mike Cline) at 1840 on 4/4/16 that the release has been terminated.

Task Standard: The operator will calculate the volume of air released from the Containment during the final release, and determine the total volume of air released in the series of four releases in accordance with the provided KEY.

Required Materials: Calculator

General References: OP/1/A/6450/017 (Containment Air Release and Addition System), Rev 42

Handouts: Handout 1: Enclosure 4.2 (Air Release Mode With VQ Flow Monitor Operable) of OP/1/A/6450/017 (Containment Air Addition and Release) marked up as follows:

Step 2.1 – Initialed.
Step 2.2 – Initialed.
Step 2.3 – Initialed.
Step 2.4 – Initialed, GWR# 2016013 recorded.
Step 3.1 – Checkbox is checked.
Step 3.2 – Initialed.
Step 3.2.1 – Initialed and CV initialed.
Step 3.2.2 – Initialed and CV initialed.
Step 3.2.3-- Checkbox is checked
Step 3.2.4 – Initialed and **Mike Cline**/Date/Time Recorded consistent with first release Date/Time (4/4/16 0903).
Step 3.3 – N/A and Initialed.
Step 3.4 –Initialed.
Step 3.5 – Initialed and CV initialed.
Step 3.6 – Initialed.
Step 3.7 – Initialed.
Step 3.8 – Initialed.
Step 3.8.1 – Checkbox is checked.
Step 3.8.2 – Checkbox is checked.
Step 3.8.3 – Initialed and CV initialed, VQ Monitor flow is recorded as 1236, and Actual Volume Released is recorded as 12,360.
Step 3.8.4 – All three Checkbox' are checked.
Step 3.8.5 – Initialed.
Step 3.8.6 – Checkbox is checked.
Step 3.9.1 – Checkbox is checked.
Step 3.9.2 – Checkbox is checked.
Step 3.9.3 – Checkbox is checked.
Step 3.9.4 – Checkbox is checked.
Step 3.9.5 – Both Checkbox' are checked.
Step 3.9.6 – Checkbox is checked.
Step 3.9.7-- Initialed.
Step 3.10 – Initialed.

Page 5 of 5 (Attachment 1) is marked up as follows: Sheet 1 of 1

1VQ-2B Open					1VQ-2B Closed		
Doer	CV	VQ Flow Monitor Counting (√)	VQ Flow Less Than 300 cfm (√)	Date/Time	Doer	CV	Date/Time
Initial	Initial	√	√	4/4/16 0903	Initial	Initial	4/4/16 1016

Handout 2: Enclosure 4.3 (Air Release Mode With VQ Flow Monitor Inoperable) of OP/1/A/6450/017 (Containment Air Addition and Release) marked up as follows:

Step 2.1 – Initialed.
Step 2.2 – Initialed.
Step 2.3 – Initialed.
Step 2.4 – Initialed, GWR# 2016013 recorded.
Step 3.1 – Checkbox is checked.
Step 3.2 – Initialed.
Step 3.2.1 – Initialed and CV initialed.
Step 3.2.2 – Initialed and CV initialed.
Step 3.2.3 -- Checkbox is checked.
Step 3.2.4 – Initialed and Person Notified/Date/Time Recorded consistent with **first** release Date/Time on Page 6 of 6.
Step 3.3 – NA and Initialed.
Step 3.4 – Initialed.
Step 3.5 – Initialed.
Step 3.6 – Initialed and CV initialed.
Step 3.7.1 – Checkbox is checked.
Step 3.7.2 – Checkbox is checked.
Step 3.7.3 – Checkbox is checked.
Step 3.7.4 – Both Checkbox' are checked.
Step 3.7.5 – Initialed.
Step 3.7.6 – Initialed.
Step 3.8 – NA and Initialed.
Step 3.9 – Initialed.
Step 3.9.1 - Checkbox is triple-checked.
Step 3.9.2 - Checkbox is double-checked.
Step 3.9.3 - Double Initialed, and double CV initialed.
Step 3.10 – Initialed.

Page 6 of 6 (Attachment 1) is marked as follows: Sheet **1** of **1**

1VQ-2B Open				1VQ-2B Closed					
Doer	CV	Date/Time	Start Pressure (psig)	Doer	CV	Date/Time	Stop Pressure (psig)	Ft^3 Released	Total Ft^3 Released
Initial	Initial	4/4/16 1117	0.22	Initial	Initial	4/4/16 1258	0.12	21,740.17	21,740.17
Initial	Initial	4/4/16 1432	0.20	Initial	Initial	4/4/16 1547	0.12	15,747.32	37,487.49
Initial	Initial	4/4/16 1743	0.18	Initial	Initial		0.12		

Handout 3: GWR Paperwork with 12360ft^3 release volume from Enclosure 4.2 recorded.

Time Critical Task: NO

Validation Time: 24 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-3.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(Enclosure 4.3, Step 3.9.2) Record stop date/time on Attachment 1	The operator records **4/4/16 1839** in the 1VQ-2B Closed Date/Time Block of Attachment 1.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2 *	(Step 3.9.3) Calculate volume released using the following and record on Attachment 1. (Documentation of calculation NOT required) Cu. Ft. Released = X + (YxZ) Where: X and Y are from Table 4.3-1 Z is actual release duration in minutes from Attachment 1.	The operator uses Table 4.3-1 of Enclosure 4.3 and determines X to be **17.31** (Start Pressure of 0.18). The operator uses Table 4.3-1 of Enclosure 4.3 and determines Y to be **203.99** (Start Pressure of 0.18). The operator uses Attachment 1 of Enclosure 4.3 and determines Z to be **56** (Stop Time of 1839 - Start Time of 1743). The operator calculates volume released as follows: 17.31 + (203.99 x 56) = **11,440.75±0.5% (See KEY),** and records this value in the 1VQ-2B Closed Cubic Ft Released Block of Attachment 1. **Examiner Cue:** **If the operator is concerned about the completion of Steps 3.11.1-3, indicate that valves 1VQ-1A, 1VQ-2B and 1VQ-4 are CLOSED.**		
3	(Step 3.11.4) Ensure release stop date/time recorded on Attachment 1.	The operator ensures **4/4/16 1839** recorded in the 1VQ-2B Closed Date/Time Block of Attachment 1.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(Step 3.11.5) Notify RP that release has been terminated ……	The operator recognizes from the initial conditions that RP has been notified.		
5 *	(Step 3.11.6) Determine Total Cu. Ft Released on Attachment 1.	The operator adds the volume of this most recent release (**11,440.75**) to the total previously released on Attachment 1 (**37,487.49**) and determines that the total volume released is **48,928.24 ft^3 (See KEY)**. The operator records this value in the 1VQ-2B Closed Total Cubic Ft Released Block of Attachment 1.		
6	(Step 3.11.7) Record Total Cu. Ft Released from Attachment 1:________ft^3	The operator records **48,928.24 (See KEY)** in the 1VQ-2B Closed Cubic Ft Released Block of Attachment 1.		
*7	(Step 3.11.8) IF any VQ Totalizer readings recorded on GWR paperwork, perform the following: (Step 3.11.8.1) Determine Total Volume Released as recorded on GWR paperwork. (Step 3.11.8.2) Record Total Volume Released from GWR: _____________ ft^3.	The operator observes GWR paperwork and determines that **12,360** ft^3 had been released when the VQ Monitor was operable, and records this value on Enclosure 4.3, Step 3.11.8.2.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*8	(Step 3.11.9) Calculate Total Volume Released for GWR as follows: ____ ft^3 + ____ ft^3 = ____ ft^3 Step 3.11.7 Step 3.11.8.2 Total Vol Rel	The operator adds the total volume released recorded in Step 3.11.7 (**48,928.24**) and the total volume released recorded in Step 3.11.8.1 (**12,360**), and determines the Total Volume Released for this series of Containment Air Releases is **61,288.24 ft^3 (See KEY)**.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A3 RO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

KEY:

Enclosure 4.3, Attachment 1:

RED = filled in at start of JPM.
GREEN = filled in during JPM performance

1VQ-2B Open				1VQ-2B Closed					
Doer	**CV**	**Date/Time**	**Start Pressure (psig)**	**Doer**	**CV**	**Date/Time**	**Stop Pressure (psig)**	**Ft^3 Released**	**Total Ft^3 Released**
Initial	Initial	4/4/16 1117	0.22	Initial	Initial	4/4/16 1258	0.12	21,740.17	21,740.17
Initial	Initial	4/4/16 1432	0.20	Initial	Initial	4/4/16 1547	0.12	15,747.32	37,487.49
Initial	Initial	4/4/16 1743	0.18	Initial	Initial	4/4/16 1839	0.12	11,440.75	48,928.24

Enclosure 4.3, Step 3.9.3 (JPM Step 2): Volume released, current release:
17.31 ft^3 + (203.99 ft^3/min x 56 min) = 11,440.75 ft^3 (11,383.55 - 11,497.95)

Enclosure 4.3, Step 3.11.6 (JPM Step 5): Total Volume released, during performance of Enclosure 4.3:
11,440.75 ft^3 + 37,487.49 ft^3 = 48,928.24 ft^3 (48,871.04 – 48985.44)

Enclosure 4.3, Step 3.11.9 (JPM Step 8): Total Volume released, during performance of GW Permit:
48,928.24 ft^3 + 12360 ft^3 = 61,288.24 ft^3 (61,231.04 – 61,345.44)

INITIAL CONDITIONS:

- GWR Package # 2016013 for Unit 1 Containment Air Release is currently in use to conduct a series of Containment air releases.
- Three releases have been made.
- During the first release, conducted using Enclosure 4.2 (Air Release Mode With VQ Flow Monitor Operable) of OP/1/A/6450/017 (Containment Air Addition and Release), the Unit 1 VQ Monitor became inoperable.
- The crew stopped the release and continued the air release using Enclosure 4.3 (Air Release Mode with VQ Flow Monitor Inoperable) of OP/1/A/6450/017 (Containment Air Addition and Release), and recorded the release volume on the GWR paperwork.
- At 1743 on 4/4/16, containment pressure was 0.18 PSIG and another (4th) VQ release was initiated to reduce pressure to 0.12 PSIG per Step 3.9 of Enclosure 4.3.
- This release was secured at 1839 on 4/4/16 and the procedure was completed through step 3.9.1 for this 4th release.

INITIATING CUE:

- You have been directed to calculate the volume released for the 4th release and complete all required paperwork starting with Step 3.9.2, **AND**, since this is the last release for GWR package 2016013, perform Steps 3.11.4 through 3.11.9 of Enclosure 4.3 to determine the total volume released from the Containment.
- The CRS notified RP (Mike Cline) at 1840 on 4/4/16 that the release has been terminated.

JPM A3 SRO

Facility:	McGuire	Task No.:	
Task Title:	Take On-Site Protective Actions During a General Emergency	JPM No.:	2016 Admin – JPM A3 SRO
K/A Reference:	2.3.4 (3.7)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

Method of testing:

Simulated Performance: ______ Actual Performance: X

Classroom X Simulator ______ Plant ______

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue and the List of Available Rescuers (Last two (2) Pages of this JPM), and Handout 1.

Initial Conditions:

- With Unit 1 shutting down due to failed fuel causing high NC System Activity, a LOCA Outside of Containment occurred.
- A Site Assembly is in progress in accordance with Enclosure 4.3 of RP/0/A/5700/011 (Conducting a Site Assembly, Site Evacuation or Containment Evacuation), and all personnel have NOT been accounted for.
- An RP Technician reports that an operator working with him in the 695 pipe chase has fallen and is severely injured. He has moved the injured person to an area that is somewhat shielded. Due to rapidly increasing dose rates, the RP Technician leaves to get help. He believes the injuries are life threatening. He also stated that the individual could be retrieved but it would take two people to do so.
- The SM has initiated and completed the immediate and subsequent actions of Enclosure 4.1 of RP/0/A/5700/004 (General Emergency).
- RP has been contacted and estimates it will take at least ten minutes to retrieve the victim. Auxiliary Building Area Radiation Monitors indicate extremely high radiation levels.
- Dose rates at the area needing access are greater than 500 Rem/Hr.

Initiating Cue:	As the SM, evaluate, and take on-site Protective Actions in accordance with Step 3.8.2 and 3.8.3 of RP/0/A/5700/004 (General Emergency).
Task Standard:	Select and dispatch two rescuers (Smith and Shelly) by completing Enclosure 4.4 of RP/0/A/5700/004 (General Emergency).
Required Materials:	Calculator
General References:	RP/0/A/5700/004 (General Emergency), Rev 31 RP/0/A/5700/011 (Conducting a Site Assembly, Site Evacuation or Containment Evacuation), Rev 20 RP/0/A/5700/29, RP/0/A/5700/29 (Notification of Off-Site Agencies From the Control Room), Rev 17 AD-OP-ALL-1000 (Conduct of Operations), Rev 4
Handouts:	Handout 1: Full copy of RP/0/A/5700/004, General Emergency, marked up as follows: • Section 2 immediate actions are complete. • Enclosure 4.1 and 4.2 actions are complete. • Section 3 subsequent actions complete through Step 3.8.1.
Time Critical Task:	NO
Validation Time:	15 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue and the List of Available Rescuers (Last two (2) Pages of this JPM), and Handout 1.

START TIME: ___________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(RP/0/A/5700/004/Step 3.8.2) IF a situation is immediately hazardous to life or valuable property exists, evaluate potential dose rates by one of the following methods: (Step 3.8.2.a) Contact RP Shift at Ext. 4282.	The operator recognizes from initial conditions that Dose rates at the area needing access is greater than 500 Rem/Hr.		
2	(Step 3.8.2.b) Assess area monitors.	The operator recognizes from initial conditions that Dose rates at the area needing access is greater than 500 Rem/Hr. The operator determines that rescuers will need to be authorized to receive Emergency Exposure Dose Limits.		
3	(Step 3.8.3) Complete Enclosure 4.4 (Request for Emergency Exposure), prior to dispatch of emergency workers if emergency situation precludes documentation.	The operator reviews List of Available Rescuers in Control Room and determines qualification of potential rescuers.		
*4	(Enclosure 4.4.a) Request for Emergency Exposure	The operator determines that **Casey** cannot be dispatched as a rescuer (Declared pregnancy)		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*5	(Enclosure 4.4.c) Only on a volunteer basis to persons fully aware of the risks involved. All factors being equal, select volunteers above the age of 45 and those who normally receive little exposure.	Operator determines that **Blade** cannot be dispatched as a rescuer (Does NOT Volunteer). Operator determines that **Mack** cannot be dispatched as a rescuer (Has too much Lifetime Exposure). Operator determines that **Leavy** cannot be dispatched as a rescuer (Only STA – AD-OP-ALL-1000 Section 4.5.3 requires her in Control Room). Operator determines that **Baylor** cannot be dispatched as a rescuer (< 45 years Old).		
6 *	(Enclosure 4.4) Request for Emergency Exposure	The operator selects **Smith** and **Shelly** as rescuers, and completes Enclosure 4.4. The operator enters the following information on Enclosure 4.4 for **Smith**: • RP Badge # - 12579 • Name – Smith • Age – 52 • Employer – Duke The operator enters the following information on Enclosure 4.4 for **Shelly**: • RP Badge # - 12456 • Name – Shelly • Age – 48 • Employer – Duke		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6 (Cont'd)		The operator has **Smith** and **Shelly** Read and Sign Enclosure 4.4.		
		Cue: **After having selected rescuers sign Enclosure 4.4, indicate that each has signed.**		
		Cue: **If Operator seeks concurrence from RPM for authorization of Emergency Exposure Limits, indicate RPM Bob Smith has concurred.**		
		The operator signs Enclosure 4.4 indicating that they approve the Emergency Exposure Authorization.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: ______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A3 SRO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT ______

Examiner's Signature: ______________________ Date: ______________

List of Available Rescuers in Control Room:

RP Badge #	Name	Gender/ Age	Job Assignment	Employer	Current Exposure (yr)	Lifetime Exposure	Special Status
12345	Blade	Male/ 49	Maintenance	Duke	1800 mR	5.2 R	Would prefer not to go/ Reports good physical health
12456	Shelly	Female/ 48	Engineer	Duke	45 mR	400 mR	Volunteers/ Reports good physical health
12567	Mack	Male /45	AO	Duke	125 mR	35.4 R	Volunteers/ Reports good physical health
12579	Smith	Male/ 52	Training Supervisor	Duke	6 mR	1.4R	Volunteers/Reports good physical health
12110	Casey	Female/ 32	Security Supervisor	Duke	10 mR	65 mR	Declared Pregnant/Volunteers/ Reports good physical health
12238	Leavy	Female/ 46	STA (Only Qualified STA on Site)	Duke	4 mR	120 mR	Volunteers/Reports good physical health.
12198	Baylor	Male/ 34	U2 BOP	Duke	78 mR	1.7 R	Volunteers/ Reports good physical health

INITIAL CONDITIONS:

- With Unit 1 shutting down due to failed fuel causing high NC System Activity, a LOCA Outside of Containment occurred.
- A Site Assembly is in progress in accordance with Enclosure 4.3 of RP/0/A/5700/011 (Conducting a Site Assembly, Site Evacuation or Containment Evacuation), and all personnel have NOT been accounted for.
- An RP Technician reports that an operator working with him in the 695 pipe chase has fallen and is severely injured. He has moved the injured person to an area that is somewhat shielded. Due to rapidly increasing dose rates, the RP Technician leaves to get help. He believes the injuries are life threatening. He also stated that the individual could be retrieved but it would take two people to do so.
- The SM has initiated and completed the immediate and subsequent actions of Enclosure 4.1 of RP/0/A/5700/004 (General Emergency).
- RP has been contacted and estimates it will take at least ten minutes to retrieve the victim. Auxiliary Building Area Radiation Monitors indicate extremely high radiation levels.
- Dose rates at the area needing access are greater than 500 Rem/Hr.

INITIATING CUE:

As the SM, evaluate, and take on-site Protective Actions in accordance with Step 3.8.2 and 3.8.3 of RP/0/A/5700/004 (General Emergency).

JPM A4 SRO

Facility:	McGuire	Task No.:	
Task Title:	<u>Classify an Emergency Event</u>	JPM No.:	<u>2016 Admin – JPM A4 SRO</u>
K/A Reference:	2.4.41 (4.6)		

Examinee: NRC Examiner:

Facility Evaluator: Date:

<u>Method of testing:</u>

Simulated Performance: ______ Actual Performance: __X__

Classroom __X__ Simulator ______ Plant ________

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-4.

Initial Conditions:

- Both Units were operating at 100% power.
- Due to severe weather several of the Unit 1 Control Room Annunciator Panels failed 10 minutes ago.
- The crew entered PT/1/A4600/033 (Loss of Control Room Annunciators), and has completed Enclosure 13.2 (Partial Loss of Annunciator Panels) through Step 3.5.
- Two additional off-shift operators have been assigned to observe annunciators associated with Time Critical Actions.
- The OAC became unavailable at the time of the Annunciator Panel loss.
- IAE has reported that it will take at least an hour to determine the extent of the damage.
- Computer Services has not responded yet.
- 10 minutes into the event, Unit 1 trips for reasons unknown.
- The crew entered EP/1/A/5000/E-0, Reactor Trip and/or Safety Injection, and verified that the immediate actions were completed as expected.
- The crew transitioned to EP/1/A/5000/ES-0.1, Reactor Trip Response, after verifying that all Critical Safety Functions were either GREEN or YELLOW.

Initiating Cue:	• Classify the Event in accordance with RP/0/A/5700/000 (Classification of Emergency). • If more than one Emergency Action Level (EAL) has been exceeded, identify the EAL resulting in the Highest Emergency Classification. • Then, prepare a Nuclear Power Plant Emergency Notification Form for the event, and present to the Emergency Coordinator for approval.
Task Standard:	The operator will declare an ALERT based on 4.2.A.1, Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable; and complete the pre-printed ENF 4.2.A.1 in accordance with the attached KEY.
Required Materials:	Calculator
General References:	PT/1/A4600/033 (Loss of Control Room Annunciators), Rev 7 RP/0/A/5700/000 (Classification of Emergency), Rev 23 RP/0/B/5700/029 (Notifications to Offsite Agencies From the Control Room), Rev 17 OMP 4-3 (Use of Emergency And Abnormal Procedures and FLEX Support Guidelines), Rev 42 RP/0/A/5700/001 (Notification of Unusual Event), Rev 32 RP/0/A/5700/002 (Alert), Rev 32 RP/0/A/5700/003 (Site Area Emergency), Rev 33 RP/0/A/5700/004 (General Emergency), Rev 31
Handouts:	Handout 1: PT/1/A4600/033 (Loss of Control Room Annunciators) marked up for this JPM. Handout 2: RP/0/A/5700/000 (Classification of Emergency) Handout 3: RP/0/B/5700/029 (Notifications to Offsite Agencies From the Control Room) Handout 4: Blank copies of preprinted Nuclear Power Plant Emergency Notification Forms
Time Critical Task:	YES – 15 minute to make classification, and THEN 15 minutes to complete ENF.
Validation Time:	18 minutes

(Denote Critical Steps with an asterisk*)

Provide Candidate with Initial Conditions/Cue (Last Page of this JPM), and Handouts 1-4.

START TIME: ____________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	(OMP 4-3, Steps 7.21.1/7.21.1.1) OSM Responsibilities Assume role of Emergency Coordinator upon activation of the Emergency Plan until properly relieved by the Station Manager.	The operator enters RP/0/A/5700/000, Step 2.1.		
2	(RP/0/A/5700/000, Note prior to Step 2.1) Assessment, classification and declaration of any applicable emergency condition should be completed within 15 minutes after the availability to indications or information to cognizant facility staff that an EAL threshold has been exceeded. (Refer to enclosure 4.9, Emergency Declaration Guidelines, as needed.)	The operator reads the Note and proceeds. The operator refers to Enclosure 4.9 as needed.		
3	(RP/0/A/5700/000, Step 2.1) Determine operating mode that existed at the time the event occurred prior to any protection system or operator action initiated in response of the event.	The operator enters determines that the plant was in Mode 1 at the start of the event.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	(RP/0/A/5700/000, Step 2.2) IF valid Security Event,…..	The operator recognizes that this is NOT a valid Security Event, that this Step is Not Applicable, and proceeds.		
5	(RP/0/A/5700/000, Step 2.3) IF the plant was in Mode 1-4 and a valid condition affects fission product barriers, THEN …...	The operator reviews Enclosure 4.1, and determines that no Loss or Potential Loss of a Fission Product Barrier exists per Enclosure 1, and proceeds.		
6	(RP/0/A/5700/000, Step 2.4) IF a General Emergency is NOT declared in Step 2.3, OR the condition does not affect fission product barriers, THEN review the listing of enclosures to determine if the event is applicable to one of the categories shown.	The operator reviews Enclosure 4.2 through 4.7, and determines the following: The operator reviews Enclosure 4.2 and determines that an **ALERT** exists, based on **4.2.A.1**, Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable. [4.2.A.1-1 The following conditions exist: Unplanned loss of most (>50%) annunciators associated with safety systems for greater than 15 minutes. AND In the opinion of the Operations Shift Manager/Emergency		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6 (Cont'd)		Coordinator/EOF Director, the loss of the annunciators or indicators requires additional personnel (beyond normal shift compliment) to safely operate the unit. AND EITHER of the following: A significant plant transient is in progress. OR Loss of the OAC.].		
*7	(RP/0/A/5700/000, Step 2.5) IF Emergency Action Level threshold has been exceeded, THEN declare the appropriate Emergency Classification.	The operator determines that an **ALERT** exists, based on **4.2.A.1**, Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable. The operator records the event declaration time in Step 2.6.1.		

Examiner Note: Record Time Critical Stop Time __________

NOTE that this time is also the Start Time for the 2nd Time Critical action of completing the pre-printed ENF 4.2.A.1.

Provide the operator with Handout 4 (Pre-printed ENF for EAL). NOTE: that a pre-printed form for a different EAL must be provided if requested.

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	(RP/0/A/5700/000, Step 2.6) Implement the applicable Emergency Response Procedure (RP) for that classification and continue with subsequent steps of this procedure. • Notification of Unusual Event RP/0/A/5700/001 • Alert RP/0/A/5700/002 • Site Area Emergency RP/0/A/5700/003 • General Emergency RP/0/A/5700/004.	The operator proceeds to RP/0/A/5700/002, Immediate Actions.		
9	(RP/0/A/5700/002, Note and IA Steps 2.1-2.2) The Immediate Actions and part of the Subsequent Actions have been separated into position specific enclosures to enhance timely completion and consistent execution. The following Enclosures should be given to the appropriate personnel: The OSM should execute Enclosure 4.1 (OSM Immediate and Subsequent Actions) in a timely manner. The STA should execute Enclosure 4.2 (STA Immediate and Subsequent Actions) in a timely manner. Have an SRO make offsite notifications PER RP/0/B/5700/029 (Notifications to Offsite Agencies from the Control Room).	The operator proceeds to RP/0/A/5700/029, Immediate Actions.		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*10	(RP/0/A/5700/029, IA Step 2.1) For Initial Notifications, perform Enclosure 4.1 (Completion and Transmission of an Initial Notification Message).	The operator proceeds to Enclosure 4.1 Step 1. The operator completes the ALERT ENF by performing Steps 1-2.13 of Enclosure 4.1 in accordance with the attached KEY (See Page 10 of this JPM). The operator presents the completed ENF Form to the Emergency Coordinator. **NOTE:** The critical nature of this action is that the form is completed within 15 minutes.		

Terminating Cue: **Evaluation on this JPM is complete.**

STOP TIME: _______________

Critical TIME 1: _______________

Critical TIME 2: _______________

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2016 Admin – JPM A4 SRO

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Result: SAT ______ UNSAT _______

Examiner's Signature: ________________________________ Date: ____________________

KEY:

Enclosure 4.1 Step #	Block	How Completed
2.1.1	**Drill/Actual Event**	**Operator checks A (Drill) is already shaded in.**
2.1.2	**Message #**	**The operator enters 01 (or equivalent)**
Note prior to Step 2.2	**Notification Time**	**The operator leaves Blank**
Note prior to Step 2.2	**Notification Date**	**The operator leaves Blank**
Note prior to Step 2.2	**Authentication #**	**The operator leaves Blank**
2.2	**Initial/Follow-Up**	**The operator checks A (Initial).**
2.3.1	**Site**	**McGuire Nuclear Site is pre-recorded**
2.3.2	**Confirmation Phone #**	**(704) 875-6044 is pre-recorded**
2.4.1	**Emergency Classification**	**Operator checks B (ALERT) is already shaded in.**
2.4.2	**EAL #**	**Operator checks 4.2.A.1 is already written in.**
2.4.3	**EAL Description**	**Operator checks that the following statement is written in: Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable.**
2.5.1	**Protective Action Recommendations**	**Operator checks None is shaded in.**
2.6.1	**Emergency Release**	**The operator checks A (None)**
2.7.3	**Release Significance**	**The operator checks A (Not Applicable).**
2.8	**Event Prognosis**	**The operator checks A (Improving) or B (Stable).**
2.9.1	**Wind Direction**	**The operator leaves Blank**
2.9.2	**Wind Speed**	**The operator leaves Blank**
2.9.3	**Precipitation**	**The operator leaves Blank**
2.9.4	**Stability Class**	**The operator leaves Blank**
2.10.1	**Declaration/Termination**	**Operator checks A (Declaration) is shaded in.**
2.10.2	**Time/Date**	**The operator records the Time recorded in JPM Step 7, and today's date.**
2.11	**Affected Unit(s)**	**The operator checks U1 ONLY.**
2.12	**Unit Status**	**The operator records that Unit 1 is at 0% power, and shutdown within last 15 minutes, Today. The operator records that Unit 2 is at 100% power.**
2.13	**Remarks**	**Left Blank or "None" recorded**

Critical Steps are identified in RED

INITIAL CONDITIONS:

- Both Units were operating at 100% power.
- Due to severe weather several of the Unit 1 Control Room Annunciator Panels failed 10 minutes ago.
- The crew entered PT/1/A4600/033 (Loss of Control Room Annunciators), and has completed Enclosure 13.2 (Partial Loss of Annunciator Panels) through Step 3.5.
- Two additional off-shift operators have been assigned to observe annunciators associated with Time Critical Actions.
- The OAC became unavailable at the time of the Annunciator Panel loss.
- IAE has reported that it will take at least an hour to determine the extent of the damage.
- Computer Services has not responded yet.
- 10 minutes into the event, Unit 1 trips for reasons unknown.
- The crew entered EP/1/A/5000/E-0, Reactor Trip and/or Safety Injection, and verified that the immediate actions were completed as expected.
- The crew transitioned to EP/1/A/5000/ES-0.1, Reactor Trip Response, after verifying that all Critical Safety Functions were either GREEN or YELLOW.

INITIATING CUE:

- Classify the Event in accordance with RP/0/A/5700/000 (Classification of Emergency).
- If more than one Emergency Action Level (EAL) has been exceeded, identify the EAL resulting in the Highest Emergency Classification.
- Then, prepare a Nuclear Power Plant Emergency Notification Form for the event, and present to the Emergency Coordinator for approval.