FACILITY NAME: McGuire Section 2

REPORT NUMBER: 05000369,370/2009302

DRAFT RO WRITTEN EXAM

CONTENTS:

☐ **Draft RO Written Exam (75Q with ES-401-5 Information)**

Location of Electronic Files:

Document title:

RO As Submitted to NRC (Attached)

Submitted By: ______________ Verified By ______________

QuestionBank #	KA_system	KA_number
1801	SYS003	A1.02

KA_desc
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RCPS controls including: (CFR: 41.5 / 45.5)□RCP pump and motor bearing temperatures ....

Given the following plant conditions:

- Unit 2 is at 20% RTP.
- NC Pump 2A Lower Bearing Temperature is currently 190°F and has been increasing for the last six hours (at a rate of approximately 5°F/hr).

Which ONE (1) of the following is the minimum NCP Lower Bearing Temperature requiring NCP TRIP AND where this indication can be monitored?

A. 235°F
OAC AND Main Control Board

B. 225°F
OAC AND Main Control Board

C. 235°F
OAC ONLY

D. 225°F
OAC ONLY

General Discussion

Maximum NCP lower bearing temperature is 225 deg. NCP lower bearing temperature can be monitoring from both the OAC and via gages located in the control room on MC-5

KA is matched because in order to answer the question the candidate must know where the parameter (RCP pump bearing temp) can be monitored (ability to monitor), and recall the design maximum temperature and recognize at what point this limit will be exceeded and at which the pump controls would have to be operated to trip the pump.(to prevent exceeded the design maximum temperature)

Answer A Discussion

Incorrect: First part is incorrect but plausible because 235°F is the limit for #1 Seal Outlet temperature. Second part is correct, NCP lower bearing temperature can be monitoring from both the OAC and via gages located in the control room on MC-5

Answer B Discussion

CORRECT: 225 deg is the maximum design NCP lower bearing temperature and should this temperature be reached, a pump trip is required. This parameter can be monitoring on both the OAC and on MCB MC-5

Answer C Discussion

Incorrect. First part is incorrect but plausible because 235°F is the limit for #1 Seal Outlet temperature. Second part is plausible if the applicant does not recall that temperatures can be monitored on gages on MC-5.

Answer D Discussion

Incorrect: First part of the distracter is correct. Second part is plausible if the applicant does not recall that temperatures can be monitored on gages on MC-5.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-PS-NCP Reactor Coolant Pump and Motor Rev. 25, Pg 43 Learning Objective: OP-MC-PS-NCP Obj. 15	

QuestionBank #	KA_system	KA_number
1801	SYS003	A1.02

KA_desc
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RCPS controls including: (CFR: 41.5 / 45.5)□RCP pump and motor bearing temperatures ....

401-9 Comments:

401-9 Comments RESPONSE

Question 1 References:

OBJECTIVES

	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
8	Describe the controls and any interlocks associated with the Reactor Coolant Pump and Motor.	X	X	X	X	X
9	Given a parameter associated with the Reactor Coolant Pumps or Motors describe the indications for that parameter.			X	X	X
10	Given a limit and/or precaution associated with an operating procedure, discuss its basis and applicability.			X	X	X
11	Explain the reason for closing the NC Pump Seal Return valves when NCS pressure is below 100 psi.		X	X	X	X
12	Concerning the NC Pump seals: • Describe the general design of the NC Pump Seals. • Discuss the purpose of seal injection. • Discuss the flowpaths, flowrates and differential pressures associated with each seal. • Discuss the purpose of the seal injection throttle valves. • Discuss the purpose of the standpipes and the operation of the standpipe (draining and filling).	X	X	X	X	X
13	Describe the operation for adjusting NC Pump seal controlled leakage.		X	X	X	X
14	Concerning NC Pump Vibration Monitoring System: • State the purpose of the system. • Discuss the operation of the system.			 X X	 X X	 X
15	State the parameters and setpoints which would require an NC Pump to be stopped.			X	X	X

__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.

Objective #15

NC Pump trip criteria are:

* *Any motor bearing temperature exceeds 195 °F.*
* *Any motor winding temperature exceeds 311 °F.*
* *The lower pump bearing temperature exceeds 225 °F.*
* *The motor frame vibration exceeds 5 mils.*
* *The pump shaft vibration exceeds 20 mils.*
* *The motor shaft vibration exceeds 20 mils.*
* *The flywheel vibration exceeds 20 mils.*
* *The flywheel axial vibration exceeds 20 mils.*
* *High or Low oil level alarm with an adverse trend in either the upper or lower motor oil reservoirs.*
* *No. 1 seal outlet temperature exceeds 235 °F.*
* *ICCM indicates NC System is nearing saturation conditions (loss of subcooling).*
* *The No. 1 Seal ΔP is less than 200 PSI.*

BASIS: Stopping a pump when any of these parameters is exceeded should reduce the possibility of any further degradation of the pump or motor.

AP/1/A/5500/008 (Reactor Coolant Pump Malfunctions) provides guidance for No. 1 seal leakoff concerns.

BASIS: The AP provides the operator with guidance for responding to NCP malfunctions.

Starting an NC Pump supplied from the same Auxiliary Transformer through which a D/G is paralleled to the system may result in tripping the D/G breaker. The D/G should be shutdown or the NC Pump transferred to the alternate Auxiliary Transformer before starting.

BASIS: Due to large power drawn by the NCP, the D/G breaker may trip upon NCP start if the pump is started on the Auxiliary Transformer where the D/G is paralleled to that related 4160V bus.

QuestionBank #	KA_system	KA_number
1802	SYS003	A3.01

KA_desc
Ability to monitor automatic operation of the RCPS, including: (CFR: 41.7 / 45.5)□Seal injection flow ....

Given the following INITIAL conditions on Unit 1:

- Unit is operating at 100% RTP with all control systems in AUTO
- Charging Header Flow - 100 GPM
- Total Seal flow to NCPs - 30 GPM

The following occurs:

- 1NV-241 (U1 Seal Water Inj Flow Control) fails CLOSED
- Operators have performed the immediate actions of AP-12 (Loss of Letdown, Charging Or Seal Injection).

Assuming NO FURTHER OPERATOR ACTIONS, TOTAL seal injection flow 15 minutes after the failure will be _____.

A. 0 GPM

B. 30 GPM

C. 35 GPM

D. 50 GPM

C

General Discussion

The failure of 1NV-241 would isolate the normal charging flowpath resulting in all of the charging flow being diverted to the NCP seals. Immediate actions of AP-12 would have the operators isolate letdown. If no further actions are taken by the crew, PZR level would then begin to increase due to the loss of letdown and the PZR level master would reduce charging attempting to bring PZR level back to program. The level master would continue to reduce total charging flow until a flow rate of 35 GPM is reached at which point the minimum setting of level master would be reached The PZR level master is set via a potentiometer, for a min charging flow of 35 GPM. This is the minimum flow regardless of the level master demand. Due to the closure of 1NV-241, all of the flow would be directed to the seals and the total charging flow is sensed upstream of 1NV-241so regardless of the seal injection individual flow control valve positions, charging flow would end up at 35 GPM.

KA is matched because the candidate is required to understand the expected charging flow (seal injection) automatic response to a given transient and indicate what he would be seeing on the control board indications. (Monitor)

This is a higher cog question because the candidate given an initiating transient must predict the plant response and the resulting effect on the PZR level control system.

Answer A Discussion

Plausible: If the candidate correctly realizes that charging flow will go to minimum but does not understand that charging flow is limited to a minimum flow of 35 GPM.

Answer B Discussion

Plausible: because if the candidate does not recall that letdown would be isolated in AP-12 this would be correct.

Answer C Discussion

CORRECT: See explanation above

Answer D Discussion

Having flow go up is plausible if the applicant fails to realize that Letdown would be isolated per the immediate actions of AP-12.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

☑ Developed

☑ OPT Approved

☑ OPS Approved

☐ NRC Approved

Development References

Technical Reference(s): OP-MC-PS-ILE, Rev. 18 page 17

Learning Objective: OP-MC-PS-ILE, Obj. 7

Student References Provided

QuestionBank #	KA_system	KA_number
1802	SYS003	A3.01

KA_desc
Ability to monitor automatic operation of the RCPS, including: (CFR: 41.7 / 45.5)□Seal injection flow ....

401-9 Comments:

Oo3A301

Swap B with C so values are increasing

D: Why would flow go up given this failure and these conditions?

RFA 10/08/09

401-9 Comments RESPONSE

Having flow go up is plausible if the applicant fails to realize that Letdown would be isolated per the immediate actions of AP-12. This statement added to the distracter 'D' discussion.

Question 2 References:

From Lesson Plan OP-MC-PS-ILE page 17:

Objective #6

Integral means that the longer the input error signal exists, the larger the demand for control response. If actual level deviates from program level for a substantial amount of time, a significant demand for control response will develop. Once level has returned to program, this demand will slowly decrease causing level to overshoot or undershoot program setpoint depending on the direction of the initial level deviation.

To clear this integral signal, the controller must be placed in manual, positioned to the desired output for actual conditions and then placed back in auto.

0.0.1. PZR Level Master MAN-AUTO Station

This station allows the input error signal to vary the controller output in the automatic mode, or allows manual control of controller output. The output is sent to the NV-238 and Positive Displacement (PD) Pump MAN-AUTO stations.

Objective #7

A potentiometer is provided on the controller to set a minimum limit on charging flow to ensure seal injection flow is maintained. The setting of 0 -10 turns corresponds to 0 - 200 gpm. **The normal setting is 1.75 turns or 35 gpm. This function is bypassed when either the PZR Level Master OR the controller for NV-238 is placed in manual.** This pot is set up per OP/1(2)/A/6200/001A (Chemical and Volume Control System Letdown) Enc. 4.1.

Objective #8

When in MANUAL, the output of the controller sets a fixed position for NV-238 or a fixed speed for the PD Pump. Increasing the output causes NV-238 to open or PD Pump speed to increase. Decreasing the output causes NV-238 to close or PD Pump speed to decrease. (NV238 and/or PD Pump speed in Auto)

Objective #4

0.0.2. NV-238 MAN-AUTO Station

This station is used to control the position of NV-238. In AUTO, it compares the output of the Level Master to actual charging flow to position valve for needed charging flow. In MAN, open/close push-buttons are used to position the valve.

QuestionBank #	KA_system	KA_number
1803	SYS004	K5.49

KA_desc
Knowledge of the operational implications of the following concepts as they apply to the CVCS: (CFR: 41.5/45.7)□Purpose and method of hydrogen removal from RCS before opening system: explosion hazard, nitrogen purge ....

Given the following conditions on Unit 1:

- Unit is in Mode 5
- Preparations for refueling are in progress
- The crew is preparing to perform a Nitrogen purge of the VCT

Nitrogen is aligned to the VCT from __(1)__.
The purpose for performing this evolution is to __(2)__.

A. (1) Bulk Nitrogen
(2) Remove air and non- condensable gases from the NC System in preparation for taking the plant solid.

B. (1) Bulk Nitrogen
(2) Remove Dissolved Hydrogen from the NC System to prevent formation of an explosive Hydrogen / Oxygen mixture.

C. (1) Shutdown Waste Gas Decay Tank B
(2) Remove air and non- condensable gases from the NC System in preparation for taking the plant solid.

D. (1) Shutdown Waste Gas Decay Tank B
(2) Remove Dissolved Hydrogen from the NC System to prevent formation of an explosive Hydrogen / Oxygen mixture.

General Discussion

The VCT is normally aligned to bulk H2 in order to maintain a minimal concentration for 02 scavenging in the NC system. In order to perform a degas of the RCS, Radwaste will align the 'B' Shutdown Waste Gas Decay Tank to the VCT in order to provide a Nitrogen overpressure. The PZR Stm space sample is then aligned to the WG compressor which is also aligned to the 'B' SWGDT. The alignment is maintained until the Hydrogen concentration in the VCT is less than 4 % and the NCS hydrogen is less than 5cc/kg.

KA is matched because must understand the method of H2 removal from the RCS during degas. The operational implication would be alternate alignment required to be performed associated with the WG system, SWGDT B alignment to the VCT (CVCS). The candidate must also understand the operational implication of performing this alignment (To prevent an explosive mixture from being created in the NC system).

Answer A Discussion

Plausible: (1)During degas, the NCDT and the PRT are aligned to bulk Nitrogen, it would be reasonable to believe that the VCT would be aligned there as well. (2)) This is also part of the degas evolution but is not accomplished by Nitrogen alignment.

Answer B Discussion

Plausible: (1) As explained above, Answer (2) is correct.

Answer C Discussion

Plausible: Answer (1) is correct.
(2) Is plausible as this is also part of the degas evolution but not accomplished by Nitrogen alignment.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

☐ Developed
☑ OPT Approved
☑ OPS Approved
☐ NRC Approved

Development References

Technical Reference(s): OP-MC-WE-WG Rev 11 Pg. 27

Learning Objective: OP-MC-WE-WG Obj. 2

Student References Provided

QuestionBank #	KA_system	KA_number
1803	SYS004	K5.49

KA_desc

Knowledge of the operational implications of the following concepts as they apply to the CVCS: (CFR: 41.5/45.7)□Purpose and method of hydrogen removal from RCS before opening system: explosion hazard, nitrogen purge ....

401-9 Comments:

401-9 Comments RESPONSE

Question 3 References:

From Lesson Plan OP-MC-WE-WG page 27:

Shutdown Operation

Objective #2

(See Drawing 7.5)

Shutdown operation of WG may vary from outage to outage. Operations should follow the shutdown script to ensure proper operation and adherence to the outage schedule. The following is a generic description of WG alignment during a unit shutdown.

Prior to reactor shutdown, we isolate the continuous purge from the VCT of both units, then place Shutdown Tank "B" in service (i.e. WG header to compressor, to S/D tank, to recombiner). Closer to the shutdown we isolate H_2 overpressure to the VCT and align Shutdown Tank "B" to provide a N_2 overpressure. When directed by the outage script, we start VCT N_2 purge (this removes H_2 in the VCT and begins dropping H_2 in the NC system). When the reactor is subcritical, we start the more rapid phase of degas.

The gas flow from Shutdown Tank "B" splits – some flows to the VCT, and the rest is routed to the recombiner, then back to the compressor suction. This continues until the hydrogen concentration in the VCT is lowered to specifications (< 4%).

System flowpaths are similar to that for normal operation except that flow is through Shutdown Tank B.

Prior to reactor startup, the nitrogen is removed and hydrogen is added through similar flowpaths. The nitrogen removed from the system is stored in Shutdown Tank "B" and may be reused once or twice before recharging with fresh nitrogen.

Waste Gas Discharge

Objective #2

Releases of radioactive gases to the environment is covered in more detail in Lesson Plan WE-RGR, Radiological Gaseous Releases.

Waste gas tanks are in two banks. One bank can be isolated for discharge while one bank remains in service. **Discharge gas flows through 1WG160, Waste Gas Discharge Flow Controller, then through 0EMF50 to the Unit Vent.** (See Drawing 7.4)

Due to system arrangement we are unable to release a tank to the environment while the system is in recirc on the shutdown tank. (See Drawing 7.5)

From OP/1/A/6100/SD-10 Enclosure 4.1:

1. Limits and Precautions

1.1 The VCT, NCDT and PRT Gas Space Hydrogen concentrations must be less than 4% for degas to be complete.

1.2 The NC System Dissolved Hydrogen concentration must be less than 5 cc/kg for degas to be complete.

1.3 Due to the Unit 1 piping arrangement, the NC Pump seal leakoff drain line serves as a surge volume for the NCDT. A change in NCDT pressure will cause a change in NCDT level. During high level, high pressure operation (degas), dropping pressure without adjusting level could result in exceeding 100% level and introducing water into the suction of the Waste Gas Compressors.

2. Initial Conditions

_____ 2.1 RMWST is inservice with sufficient water level to supply Auxiliary Building components.

_____ 2.2 Nitrogen (N_2) is available to 100 psig header per OP/0/B/6450/008 (Nitrogen System).

_____ 2.3 Two backup bottles of nitrogen are available to support NCDT degas activities.

_____ 2.4 Component Cooling System (KC) is available per OP/1/A/6400/005 (Component Cooling Water System).

_____ 2.5 Chemistry has requested that Degas activities commence.

3. Procedure

☐ 3.1 Evaluate all outstanding R&Rs that may impact performance of this procedure.

☐ 3.2 Monitor for abnormal indications on EMF-41 (Trip 1 or 2) throughout Degas evolutions.

_____ 3.3 <u>IF</u> any abnormal indications on EMF-41, notify Radwaste Chemistry and RP Shift.

_____________________ _____/_____
Person Notified (Radwaste) Date Time

_____________________ _____/_____
Person Notified (RP Shift) Date Time

Unit 1

QuestionBank #	KA_system	KA_number
1804	SYS005	2.4.50

KA_desc
SYS005 GENERIC□Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)

Given the following INITIAL conditions on Unit 1:

- LTOP is in service
- T_{ave} = 175°F
- Train B ND is in service

The following occurs:

- Annunciator 1AD-6 D12 (PORV NC-32B Actuated) is in alarm
- 1NC-32B (PZR PORV) indicates OPEN
- Loop "C" NARROW Range Pressure is reading 370 PSIG
- Loop "D" WIDE Range Pressure is reading 380 PSIG

The controlling channel for 1NC-32B is __(1)__, and based on the conditions above, the operator would be required to __(2)__.

A. (1) Loop "C" Narrow Range Pressure
(2) Ensure 1NC- 32B closes when NC pressure is reduced below setpoint

B. (1) Loop "D" Wide Range Pressure
(2) Ensure 1NC- 32B closes when NC pressure is reduced below setpoint

C. (1) Loop "C" Narrow Range Pressure
(2) Close or isolate 1NC-32B

D. (1) Loop "D" Wide Range Pressure
(2) Close or isolate 1NC-32B

General Discussion

Per procedure, RHR cannot be placed in service until RCS temperature is 250 Deg or less. Cold overpressure protection is required at this reduced temperature and is provided by PZR PORV NC-32B and NC-34A which are placed in LTOP mode at less than 320 Deg RCS temperature. The pressure channels which provide input to actuate these PORV's are 0-600 psig NR pressure instruments which are placed in service with RCS pressure below 1000 psig. The lift setpoint for these valves in LTOP mode is 385 PSIG and the input to NC-32B is from Loop 'C' NR pressure transmitter (NCPT5142). The WR pressure transmitters are in service providing indication but provide no control actions.

KA is matched because of the low temperature requirement in order to place ND in service LTOP operation is an integral part of RHR operation in providing low temperature overpressure protection. In the given situation the candidate is presented with a situation where a relief valve has actuated (alarm generated) and then failed to reclose below setpoint. The candidate much then understand how to verify alarm setpoint (correct channel) and operate controls to isolate the PORV which should now be closed.

This is a high cog question because evaluate a given set of plant conditions, determine a miss operation of a component and then decide on a action to mitigate the consequences.

Answer A Discussion

Plausible: Answer 1 is correct, answer 2 is plausible because the given WR pressure is within the range where a LTOP PORV actuation would be expected to occur but is not an input to the controlling circuit.

Answer B Discussion

Plausible: If the candidate believes the WR pressure inputs LTOP. Setpoint is plausible as described above.

Answer C Discussion

CORRECT

Answer D Discussion

Plausible: Answer one is plausible as described above and answer 2 is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s):Lesson Plan OP-MC-PS-NC, Reactor Coolant System, Rev. 32, page 35 Lesson Plan OP-MC-PS-IPE, Pressurizer Pressure Control page 27 and 29	

QuestionBank #	KA_system	KA_number
1804	SYS005	2.4.50

KA_desc

SYS005 GENERIC□Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)

401-9 Comments:

401-9 Comments RESPONSE

Question 4 References:

From Lesson Plan OP-MC-PS-NC page 35:

There are four **Pzr pressure channels** which have meter indication on 1(2)MC10. These channels provide 2 out of 4 logic for the high pressure (2385 psig) and low pressure (1945 psig) reactor trips. These channels provide the 2 out of 4 logic for the low pressure Safety Injection (1845 psig). Channels 1,2 and 3 provide the 2 out of 3 logic for P11 (1955 psig). One of the channels can be selected for recording. Channels 1 or 3 can be selected for Pzr Pressure Control.

The Pressurizer Pressure Control and Level Control are covered in more detail in lesson plans OP-MC-PS-IPE and OP-MC-PS-ILE.

2.7 Pressurizer Power Operated Relief Valves

Objective # 13

Each unit has three **pressurizer power operated relief valves** (PORVs): NC32B, 34A and 36B. The purpose of these valves is to limit pressure for large power mismatches, prevent high pressure reactor trip and minimize undesirable opening of code safety valves. Each PORV has its own block valve which can be operated from the main control board section 1(2)MC10. Each PORV block valve is equipped with a 3-position control switch: "Override - CLSD - OPEN". The block valves switches are interlocked such that only the first valve placed in the "CLSD" position will close. In order to close the other block valves, their switches must be place in the "Override'" position.

Objective # 14

In automatic, the pressurizer PORVs are controlled by the pressure master. The pressure master has compensating circuitry which can compensate for rapid pressure increases or longer intervals where pressure remains above or below setpoint for longer periods of time. This compensating ability can modify the PORV lift setpoint however, 2335 psig is the generally accepted lift setpoint for the PORVs. 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 NI431B and NC34A is supplied from CLA "A" via NI430A. Annunciator alarms on 1(2)AD6 alert the operator that the N_2 from the CLA to NC32B and 34A has been enabled. 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.

From Lesson Plan OP-MC-PS-IPE pages 27 and 29:

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.

Operation (opening) of the Spray Valves can be overridden from the SSF by selecting "CLOSE" on the SSF Control Panel. This capability is in effect when 1EMXA-4 is swapped to its alternate supply (SMXG).

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-32 & 36 get N_2 from CLA 'B' via NI-431, and NC-34 from CLA 'A' via NI-430. 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-430 &431 will automatically open provided NC temperature < 320°F. NI-430 & 431 can be manually opened anytime with control board switch.

2.7.2 PORV Control

Objective #5

Refer to Drawing 7.8, P.O. Relief Valve Control. The three PORVs each have two 'OPEN-AUTO-CLOSE' control switches, 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 the interlock pressure is above 2185 psig and the control pressure is above 2335 psig (81.2% Press. Master output for NC34) and will reclose when control pressure is 2315 psig.

Objective #6

Annunciators alert the Operator whenever pressure is less than the interlock setpoint of 2185 psig. 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. Two of the PORVs have low temperature-overpressure protection, NC34 (TR "A") and NC32 (TR "B"). Both have control circuitry like the one shown for NC32 on Drawing 7.8, 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").

One is it annunciates to alert the Operator to select the low pressure mode of operation on the MCB keylock switch. The other is 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), and "Low Pressure" mode selected, and temperature less than 320°F, then the PORV will open (along with a PORV XXX Actuated annun.) when NC pressure increases above 380 + 2 - 2 psig. This pressure is sensed off NC Narrow Range (0-600 psig) loop "D" pressure transmitter NCPT5122 (TR "A") and loop "C" NCPT5142 (TR "B"), and can be read on the OAC. When cooling down and depressurizing the plant, the operating procedure waits until pressure is 325 psig before directing the Operator to select to "LOW PRESS" control. This is to ensure the high pressure opening 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.

A loss of KXA or KXB will prevent automatic operation of the PORVs. Manual operation is still possible. The PORVs are still considered operable per Technical Specifications and no action is required.

3.0 SYSTEM OPERATION

3.1 Normal Operation

3.1.1 Limits and Precautions

In "LOW PRESSURE MODE" the Pzr PORVs will open on NC NR Pressure between 378-382 psig. (OAC Point M1(2)A1365 monitors pressure for 1(2)NC-34A and M1(2)A1359 monitors pressure for 1(2)NC-32B).

While there is a bubble in the Pzr and Pzr Liquid Space/NCS Hot Leg ΔT exceeds 150°F, avoid inventory changes in the NCS that could cause a Pzr insurge. This could result in thermal shock of the surge line and Pzr lower hemisphere. If Pzr insurge cannot be prevented, attempt to minimize the rate of insurge by careful manipulation of plant controls.

IF an inadvertent Pzr insurge WHEN a Pzr bubble exists, results in Pzr Liquid Space/Steam Space ΔT of greater than 10°F, hold abnormal high level until temperatures equalize, then return Pzr level to normal.

IF the temperature difference between the Pzr and the spray fluid is greater than 320°F [do NOT initiate spray flow to minimize temperature transients to the Pzr]. Aux spray should not be used if letdown is lost to avoid thermal shocking spray nozzle.

QuestionBank #	KA_system	KA_number
1805	SYS006	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□ECCS pumps ....

Given the following on Unit 2:

- A Reactor Trip and Safety Injection have occurred due to a Small Break LOCA
- The 2A Safety Injection (NI) pump failed to automatically start
- Attempts to manually start the pump have been unsuccessful

To which ONE (1) of the following locations should the NEO be dispatched to check the 2A NI pump breaker?

A. 2ETA

B. 2EMXA

C. 2ELXA

D. 2TA

General Discussion

The 2B NI Pump is powered from Emergency Bus 2ETB. It is not powered from a Safety Related Load Center (i.e. EMXB).

The KA is matched because the applicant is required to know the power supplies to the Safety Injections pumps.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Correct unit. However, wrong bus.

Answer C Discussion

Incorrect. Correct unit. However, wrong bus.

Answer D Discussion

Incorrect. Correct unit. However, wrong bus.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

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

Development References	Student References Provided
Lesson Plan OP-MC-ECC-NI Objective 5 Section 2.2	

QuestionBank #	KA_system	KA_number
1805	SYS006	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□ECCS pumps ....

401-9 Comments: **401-9 Comments RESPONSE**

Question 5 References:

From Lesson Plan OP-MC-ECC-NI page 13:

2.0 COMPONENT DESCRIPTION

2.1 Suction Supplies

2.1.1 Refueling Water Storage Tank (FWST)

The FWST provides a large volume of borated water to be used during refueling, ECCS actuation, fill of the Cold Leg Accumulators and makeup to the spent fuel pool. The normal volume is 395,000 gallons with a minimum Technical Specification volume of 372,100 gallons (operating). The range of operating temperatures is from 70°F minimum to 100°F maximum. The tank is at atmospheric pressure. A typical Boron concentration is approximately 2700 - 2800 ppm (the actual COLR required value varies each cycle). Check valve NI-101 prevents backflow into the FWST when the ND pumps supply the NI pumps. NI-100B (common), NI-103A (Pump A) and NI-135B (Pump B) are normally Open suction line valves for the NI system.

2.1.2 Containment Sump

In the event of a major LOCA, the containment sump will receive water from the NC system break, ECCS injection flow through the break, and the ice condenser during ice melt. During the recirculation phase, water is taken from the containment sumps by the ND pumps and supplied to the Emergency Core Cooling System pumps including the NI pumps. NI-136B, ND-58A, NI-332A, and NI-333B are normally closed during power operation and Injection Phase, but are opened by operator action for cold leg recirculation and remain open for hot leg recirculation. NI-334B is normally open in this flow path. Annunciators inform the operator when containment sump level has reached greater than 2.5 and greater than 3 feet. This lets the operator know that adequate volume is contained in the sump for the recirculation phase.

2.2 Safety Injection Pumps

Objective # 4

The safety injection pumps are designed to inject water into the NC system when the system pressure remains high, above the pressure at which the accumulator tanks can operate, for a relatively long period of time. **Each pump has a shutoff head of 1520 psig and a design capacity of 400 gpm** at 2600 feet of head (1125 psid). The pumps start on receipt of a safety injection signal. Each pump is a multi-stage, centrifugal pump.

Objective # 5

The pumps are train related and are powered from ETA and ETB, Essential 4160 VAC.

2.2.1 Valve Leak-Off

By original design, valve stem leakoffs inside containment were routed to the NCDT. Since these leakoffs interfered with accurate NC System leakage determination, these

QuestionBank #	KA_system	KA_number
1806	SYS006	K2.04

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□ESFAS-operated valves ....

Which ONE (1) of the following ESF operated valves will lose power if 1EVDD is de-energized?

A. 1NI-10B, NC Cold Leg Inj from NV

B. 1NV-24B, NC Loop to Excess LD Hx Isol

C. 1KC-228B, Trn B Rx Bldg Non Ess Sup Isol

D. 1NV-142B, VCT Outlet Isolation

General Discussion

1NV-24B is powered from 1EVDD. All other loads listed in the distractors are powered from 1EMXB.

This KA is matched because all valves listed operate automatically on ESFAS signals and the applicant must know the power supply to all valves listed to determine the correct answer.

Answer A Discussion

Incorrect. Power supply is 1EMXB.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Power supply is 1EMXB.

Answer D Discussion

Incorrect. Power supply is 1EMXB.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

AP/1/A/5500/15, Loss of Vital or Aux Control Power page 107

Student References Provided

QuestionBank #	KA_system	KA_number
1806	SYS006	K2.04

KA_desc

Knowledge of bus power supplies to the following: (CFR: 41.7)□ESFAS-operated valves ....

401-9 Comments:

401-9 Comments RESPONSE

Question 6 References:

10. **NV System:**

- The following valves fail closed:
  - __ • 1NV-24B (C NC Loop To Exs L/D Hx Isol)
  - __ • 1NV-25B (C NC Loop To Exs L/D Hx Isol)
  - __ • 1NV-55B (B NC Pump Standpipe Fill)
  - __ • 1NV-87B (D NC Pump Standpipe Fill).
- The following valves fail open:
  - __ • 1NV-13B (NV Supply To A NC Loop Isol)
  - __ • 1NV-50B (B NC Pump Seal Return Isol)
  - __ • 1NV-82B (D NC Pump Seal Return Isol).

__ • 1NV-26B (U1 Excess L/D Hx Outlet Cntrl) loses Aux Shutdown Panel control only.

__ • 1NV-27B (Excess L/D Hx Otlt 3-Way Cntrl) fails to "VCT" position.

1EMXB Load List:

	1EMXB LOADS	Ref MC-1703-07.01
1EMXB 01A	ANNULUS VENT SYS DAMPER 1AVS-D-7	Damper Fails As Is, Can not cycle for Annulus pressure control
1EMXB 01B	ANNULUS VENT SYS DAMPER 1AVS-D-8	Damper Fails As Is, Can not cycle for Annulus pressure control, NOTE: Damper Not Closed enables Low press trip of VE Fan 1B
1EMXB 01C	ANNULUS VENT SYS DAMPER 1AVS-D-9	Damper Fails As Is, Can not cycle for Annulus pressure control
1EMXB 01D	$ NCP MTR BRG OIL FILL ISOL VLV 1NC195B	Valve 1NC-195 Fails As Is, OAC pt D3368 oos
1EMXB 02A	AUX FDWP 1B SUCTION ISOL VLV 1CA9B	Valve 1CA-9 Fails As Is, OAC pt D1582 oos
1EMXB 02B	$ AUX FDWP 1B SUCTION FROM RN HDR 1A VLV 1CA18B	Valve 1CA-18 Fails As Is, OAC pt D1609 oos
1EMXB 02C	$ T/D AUX FDWP SUCTION FROM RN HDR 1A VLV 1CA116B	Valve 1CA-116 Fails As Is, OAC pt D1579 oos
1EMXB 02D	SPARE SIZE 1 CFVR STR.	
1EMXB 03A	NUCLEAR SERVICE WATER STRAINER BACKFLUSH DRUM 1B	Strainer Backwash Motor OOS, vlvs 1RN-25B & 26B fail closed; NOTE: Annun & OAC alarms on assoc Hi d/p also OOS
1EMXB 03B	H2 MITIGATION SYSTEM PWR PNLBD 1B (GLOW PLUGS)	B Train Glow Plugs OOS
1EMXB 03C	SPARE SIZE 1 CFVNR CONTR	
1EMXB 03D	$ T/D AUX FDWP DISCH TO S/G 1D CTRL OTL ISOL VLV 1CA38B	Valve 1CA-38 Fails As Is, OAC pt D2945 oos
1EMXB 03E	AUX FDWP 1B DISCH TO SG 1D CNTRL OTL ISOL VLV 1CA42B	Valve 1CA-42 Fails As Is, OAC pt D2946 oos
1EMXB 04A	FUTURE	
1EMXB 04B	SPARE SIZE 1 CFVNR STR.	
1EMXB 04C	$ FUEL POOL COOLING PUMP 1B ESS AIR HDLG UNIT FP-AHU-1B	Fan OOS, 1RN-126 Closes IF in Auto only
1EMXB 04D	SPARE SIZE 1 CFVNR STR.	
1EMXB 04E	BORIC ACID TRANSFER PUMP NO. 1B	Pump OOS, OAC pts D0526, D1590 oos
1EMXB 04F	REFUELING WATER LOOP ISOLATION VLV 1FW32B	Valve 1FW-32 Fails As Is, OAC pt D2933 oos
1EMXB 05A	$ INCOMING FEEDER FROM 1ELXB-05C	1ELXB-05C is hard wired to feed buses 1EMXB & 1EMXB4
1EMXB 05B	$ FDR TO MCC 1EMXB1 & MCC 1EMXB2	1EMXB-05B is hard wired to 1EMXB bus to feed Inc Bkrs at 1EMXB1 & 1EMXB2 (ref MC-1703-07.01)
1EMXB 05C	FDR TO MCC 1EMXB3-R04A	1EMXB-05C is hard wired to 1EMXB bus to feed Inc Bkr at 1EMXB3-R04A (ref MC-1703-07.01)
1EMXB 05D	SPARE SIZE 1 CFVNR STR	
1EMXB 05E	$ CONT SPRAY PUMP 1B ESS AIR HDLG UNIT CS-AHU-1B	Fan OOS - NS 1B inop per interpret, 1RN-227 Closes IF in Auto only
1EMXB 05F	$ VITAL AC-DC SYSTEM BATTERY CHARGER EVCB NORM FDR	Loss of charger UNLESS aligned to Unit 2 pwr (2EMXB)
1EMXB 06A	SPARE SIZE 1 CFVNR STR	
1EMXB 06B	SPARE SIZE 1 CFVNR CONTR	
1EMXB 06C	$ A/C SYSTEM 4KV SWGR ROOM FAN SGR-AHU-1B	Fan OOS - 30 day Tech Spec per interpretation, 1YC-204 and Damper SGR-D-2 Fail Open; Monitor 1ETA Rm temp
1EMXB 06D	$ RHR PUMP 1B ESS AIR HDLG UNIT RHR-AHU-1B	Fan OOS - ND 1B inop per interpret, 1RN-231 Closes IF in Auto only

1EMXB 06E	$ VITAL AC-DC SYSTEM BATT CHARGER EVCD ALT FDR	Loss of charger UNLESS aligned to Unit 2 pwr (2EMXB)
1EMXB 07A	SPARE 150A FDBKR	
1EMXB 07B	UNIT 1 NI SYSTEM NORM TRACE HEATING PNLBD 1EHTB	
1EMXB 07C	$ ND / NS ROOMS SUMP PUMP 1B	Sump Pump OOS, (Sump Pump 1A pwr from 1EMXA), OAC pts D2896 (U1) & D1651 (U2) oos
1EMXB 07D	SPARE SIZE 2 CFVNR STR	
1EMXB 07E	AUX BLDG NON ESS RETURN AUTO ISOL VLV 1KC2B	Valve 1KC-2 Fails As Is, OAC pt D1368 oos
1EMXB 07F	REAC BLDG NON ESS RETURN AUTO ISOL VLV 1KC18B	Valve 1KC-18 Fails As Is, OAC pt D1344 oos
1EMXB 08A	TRAIN 1B TO A BLDG NON ESS SUP HDR ISOL VLV 1KC53B	Valve 1KC-53 Fails As Is, OAC pt D0210 oos
1EMXB 08B	$ KC TRAIN 1B RECIRC LINE ISOLATION VLV 1KC54B	Valve 1KC-54 Fails As Is, OAC pt D0211 oos
1EMXB 08C	ND HX 1B AUTO SUPPLY VLV 1KC81B	Valve 1KC-81 Fails As Is, OAC pt D0212 oos
1EMXB 08D	$ KC TRAIN 1B TO RB NON ESS SUP HDR ISOL VLV 1KC228B	Valve 1KC-228 Fails As Is, OAC pt D0213 oos
	1EMXB1 LOADS	Ref MC-1703-07.05
1EMXB1 01A	NC PUMP SUPPLY HDR PENT ISOL VLV 1KC338B	Valve 1KC-338 Fails As Is, OAC pt D1166 OOS
1EMXB1 01B	REACTOR MAKEUP SUPPLY HDR CONT ISOL VLV 1NB260B	Valve 1NB-260 Fails As Is, OAC pt D1576 OOS
1EMXB1 01C	$ N2 TO PRT CONT ISOL VLV 1NC53B	Valve 1NC-53 Fails As Is, OAC pt D1190 OOS
1EMXB1 01D	$ PRESS RELIEF TANK SPRAY CONT ISOL VLV 1NC56B	Valve 1NC-56 Fails As Is, OAC pt D1189 OOS
1EMXB1 02A	NC LOOP 1C TO ND PUMP 1B CONT ISOL VLV 1ND4B	Valve 1ND-4 Fails As Is, Loss of CB indication only
1EMXB1 02B	ND HX 1B OUTLET CROSSOVER BLOCK VLV 1ND15B	Valve 1ND-15 Fails As Is, Loss of CB indication only
1EMXB1 02C	ND PUMP 1B AND HX 1B MINIFLOW STOP VLV. 1ND67B	Valve 1ND-67 Fails As Is, Loss of CB indication only
1EMXB1 02D	PALS PNL SMPLE RET TO CONT ISOL VLV (OUTSIDE) 1WL1301B	Valve 1WL-1301 Fails As Is, OAC pt D1194 OOS
1EMXB1 03A	BIT DISCHARGE ISOL. VLV. 1NI10B	Valve 1NI-10 Fails As Is, Loss of CB indication only
1EMXB1 03B	TEST HDR OUTSIDE CONTAINMENT ISOL VLV 1NI96B	Valve 1NI-96 Fails As Is, Loss of CB indication only
1EMXB1 03C	$ FWST TO SAFETY INJECTION PUMPS VLV 1NI100B	Valve 1NI-100 Fails As Is, Loss of CB indication only
1EMXB1 03D	$ SAFETY INJ PUMP SUCT CROSSOVER FROM NV VLV 1NI333B	Valve 1NI-333 Fails As Is, Loss of CB indication only
1EMXB1 04A	$SAFETY INJ PUMP SUCT CROSSOVER TO NV ISOL VLV 1NI334B	Valve 1NI-334 Fails As Is, Loss of CB indication only
1EMXB1 04B	SAFETY INJ PUMP 1A MINIFLOW LINE ISOL.VLV.1NI115B	Valve 1NI-115 Fails As Is, Loss of CB indication only
1EMXB1 04C	SAFETY INJ PUMP TO ACCU. FILL LINE ISOL.VLV.1NI120B	Valve 1NI-120 Fails As Is, Loss of CB indication only
1EMXB1 04D	SAFETY INJECTION PUMP 1B SUCTION VLV 1NI135B	Valve 1NI-135 Fails As Is, Loss of CB indication only
1EMXB1 05A	FUTURE	
1EMXB1 05B	$ AC SYSTEM 4KV SWGR ROOM FAN SGR-AHU-1D	Fan OOS - 30 day Tech Spec per interpretation, 1YC-218 and Damper SGR-D-6 Fail Open; Monitor 1ETB Rm temp

1EMXB1 05C	ND HX 1B TO SAFETY INJ. PUMP 1B VLV 1NI136B	Valve 1NI-136 Fails As Is, Loss of CB indication only
1EMXB1 05D	SAFETY INJ PUMP 1B MINIFLOW LINE ISOL VLV. 1NI144B	Valve 1NI-144 Fails As Is, Loss of CB indication only
1EMXB1 05E	SAFETY INJ PUMP 1B COLD LEG INJ LINES ISOL VLV 1NI150B	Valve 1NI-150 Fails As Is, Loss of CB indication only
1EMXB1 06A	SAFETY INJ PUMP 1B HOT LEG INJ HDR ISOL VLV 1NI152B	Valve 1NI-152 Fails As Is, Loss of CB indication only
1EMXB1 06B	ND HDR TO NC COLD LEGS 1CD VLV. 1NI178B	Valve 1NI-178 Fails As Is, Loss of CB indication only
1EMXB1 06C	ND HDR TO NC HOT LEGS. ISOL. VLV. 1NI183B	Valve 1NI-183 Fails As Is, Loss of CB indication only
1EMXB1 06D	CONTAINMENT SUMP LINE 1B ISOL. VLV. 1NI184B	Valve 1NI-184 Fails As Is, Loss of CB indication only
1EMXB1 07A	NORMAL INCOMING FDR FROM MCC 1EMXB	
1EMXB1 07B	PZR STEAM SAMPLE HDR OUTSIDE CONT ISOL. VLV. 1NM7B	Valve 1NM-7 Fails As Is, OAC pt D1107 OOS
1EMXB1 07C	NC HOT LEGS SAMPLE HDR OUTSIDE CONT. ISOL. VLV. 1NM26B	Valve 1NM-E29326 Fails As Is, OAC pt D1106 OOS
1EMXB1 08A	SG 1A SAMPLE HDR CONTAINMENT ISOL VLV 1NM191B	Valve 1NM-191 Fails As Is, OAC pt D1105 OOS
1EMXB1 08B	SG 1C SAMPLE HDR CONTAINMENT ISOL VLV 1NM211B	Valve 1NM-211 Fails As Is, OAC pt D1104 OOS
1EMXB1 08C	NS PUMP 1B SUCT FROM CONT SUMP BLOCK VLV 1NS1B	Valve 1NS-1 Fails As Is, OAC pt D1192 OOS
1EMXB1 08D	NS PUMP 1B SUCT FROM FWST BLOCK VLV 1NS3B	Valve 1NS-3 Fails As Is, OAC pt D1191 OOS
	1EMXB2 LOADS	
1EMXB2 F01A	NS PUMP 1B DISCH CONTAINMENT ISOL VLV 1NS12B	Valve 1NS-12 Fails As Is, OAC pt D2242 OOS
1EMXB2 F01B	NS PUMP 1B DISCH CONT ISOL VLV 1NS15B	Valve 1NS-15 Fails As Is, OAC pt D2241 OOS
1EMXB2 F01C	ND PUMP 1B DISCH TO NS NOZZLES CONT ISOL VLV 1NS38B	Valve 1NS-38 Fails As Is, OAC pt D2244 OOS
1EMXB2 F01D	NV LETDOWN CONTAINMENT ISOL VLV 1NV7B	Valve 1NV-7 Fails As Is, OAC pt D3632 OOS
1EMXB2 F02A	NC PUMPS SEAL RETURN CONTAINMENT ISOL VLV 1NV95B	Valve 1NV-95 Fails As Is, OAC pt D3634 OOS
1EMXB2 F02B	$ VOLUME CONTROL TANK OUTLET ISOL VLV 1NV142B	Valve 1NV-142 Fails As Is, OAC pt D3636 OOS
1EMXB2 F02C	$ NV PUMPS MINI FLOW BLOCK VLV 1NV150B	Valve 1NV-150 Fails As Is, OAC pt D3637 OOS
1EMXB2 F02D	SPARE SIZE 1 CFVR STR	
1EMXB2 F03A	$ NV PUMPS SUCTION FROM FWST SUPPLY VLV 1NV222B	Valve 1NV-222 Fails As Is, OAC pt D3640 OOS
1EMXB2 F03B	CHARGING LINE CONTAINMENT ISOL VLV 1NV245B	Valve 1NV-245 Fails As Is, OAC pt D3642 OOS
1EMXB2 F03C	BORIC ACID TO CHARGING PUMPS BLOCK VLV 1NV265B	Valve 1NV-265 Fails As Is, OAC pt D3643 OOS
1EMXB2 F03D	SPARE SIZE 1 CFVR STR	
1EMXB2 F04A	AUX FDWP 1B DISCH TO S/G 1C CTRL OTL ISOL VLV 1CA46B	Valve 1CA-46 Fails As Is, OAC pt D2941 OOS
1EMXB2 F04B	$$ T/D AUX FDWP DISCH TO S/G 1C CTRL OTL ISOL VLV 1CA50B	Valve 1CA-50 Fails As Is, OAC pt D2943 OOS

1EMXB2 F04C	$ 1A S/G CF TO CA NOZZLE PREHEATER BYPASS VLV 1CF126B	Valve 1CF-126 Fails As Is, OAC pt D3448 OOS
1EMXB2 F04D	$ 1B S/G CF TO CA NOZZLE PREHEATER BYPASS VLV 1CF127B	Valve 1CF-127 Fails As Is, OAC pt D3449 OOS
1EMXB2 R01A	NS HX 1B CONTROL VLV 1RN238B	Valve 1RN-238 Fails As Is, NOTE: If 1RN-238 is not closed then 1RN-1005 (1EMF-45B) supply Opens
1EMXB2 R01B	$ C S/G TEMPERING ISOLATION VLV 1CF155B	Valve 1CF-155 Fails As Is, OAC pt D3366 OOS
1EMXB2 R01C	$ D S/G TEMPERING ISOLATION VLV 1CF157B	Valve 1CF-157 Fails As Is, OAC pt D3367 OOS
1EMXB2 R01D	SPARE SIZE 1 CFVR STR	
1EMXB2 R02A	$ RN TRAIN 1B SUPPLY ISOLATION VLV 1RN18B	Valve 1RN-18 Fails As Is, 1.47 Byp Pnl indication OOS
1EMXB2 R02B	$ RN TRAIN B ASSURED SUP TO AUX FDWPS ISOL VLV 1RN162B	Valve 1RN-162 Fails As Is
1EMXB2 R02C	COMPONENT COOLING HX 1B SUPPLY ISOL VLV 1RN187B	Valve 1RN-187 Fails As Is
1EMXB2 R02D	NS HX 1B SUPPLY ISOL VLV 1RN235B	Valve 1RN-235 Fails As Is
1EMXB2 R03A	AB NON ESS RETURN ISOLATION VLV 1RN63B	Valve 1RN-63 Fails As Is
1EMXB2 R03B	$ 1C S/G CF TO CA NOZZLE PREHEATER BYPASS VLV 1CF128B	Valve 1CF-128 Fails As Is, OAC pt D3450 OOS
1EMXB2 R03C	SPARE SIZE 1 CFVR STR	
1EMXB2 R03D	REFUELING WTR STRG TANK RECIRC LOOP ISOL VLV 1FW49B	Valve 1FW-49 Fails As Is, OAC pt D2935 OOS
1EMXB2 R04A	NORMAL INCOMING BKR FED FROM MCC 1EMXB	
1EMXB2 R04B	$ RN TRAIN 1B NON ESS HDR SUPPLY VLV 1RN41B	Valve 1RN-41 Fails As Is, (Vlv receives Unit 1 & Unit 2 Signals, Reference TAC sheet for U2 guidance as needed)
1EMXB2 R04C	$ 1D S/G CF TO CA NOZZLE PREHEATER BYPASS VLV 1CF129B	Valve 1CF-129 Fails As Is, OAC pt D3451 OOS
	1EMXB3 LOADS	
1EMXB3 F01A	UNIT 1 AUX BLDG VENT SYSTEM ISOL VLV 1RN279B	Valve 1RN-279 Fails As Is
1EMXB3 F01B	SPARE SIZE 1 CFVR STR	
1EMXB3 F01C	$ RN TRAIN 1B ESSENTIAL HDR RETURN ISOL VLV 1RN297B	Valve 1RN-297 Fails As Is
1EMXB3 F01D	RV CONTAINMENT OUTSIDE ISOL VLV 1RV77B	Valve 1RV-77 Fails As Is, (1RV-76 can isol pen)
1EMXB3 F02A	$ EXCESS LETDOWN HX SUPPLY CONT ISOL VLV 1KC305B	Valve 1KC-305 Fails As Is, Mtr Htr & OAC pt D1331 OOS
1EMXB3 F02B	$ EXCESS LETDOWN HX RETURN CONT ISOL VLV 1KC315B	Valve 1KC-315 Fails As Is, Mtr Htr & OAC pt D1332 OOS
1EMXB3 F02C	UNIT 1 BREATHING AIR CONT ISOL VLV 1VB49B	Valve 1VB-49 Fails As Is
1EMXB3 F02D	SPARE SIZE 1 CFVR STR	
1EMXB3 F03A	CONTAINMENT PRESSURE CHANNEL 2 ISOL VLV 1NSSV5570	Valve 1NSSV5570 Fails As Is
1EMXB3 F03B	CONTAINMENT PRESSURE CHANNEL 4 ISOL VLV 1NSSV5590	Valve 1NSSV5590 Fails As Is
1EMXB3	SPARE SIZE 1 CFVR STR	

F03C		
1EMXB3 F03D	SPARE SIZE 1 CFVR STR	
1EMXB3 F04A	SPARE SIZE 1 CFVR STR	
1EMXB3 F04B	SPARE SIZE 1 CFVR STR	
1EMXB3 F04C	SPARE SIZE 1 CFVR STR	
1EMXB3 F04D	SPARE SIZE 1 CFVR STR	
1EMXB3 R01A	$ VI SYST NON ESS UPPER CONT SUP CONT ISOL VLV 1VI148B	Valve 1VI-148 Fails As Is
1EMXB3 R01B	$ VI SYST NON ESS LOWER CONT SUP CONT ISOL VLV 1VI150B	Valve 1VI-150 Fails As Is
1EMXB3 R01C	$ VI SYST ESS SUPPLY FROM TANK 1B CONT ISOL VLV 1VI160B	Valve 1VI-160 Fails As Is
1EMXB3 R01D	SPARE 40 A FDBKR	
1EMXB3 R01E	$ CONT HYDROGEN ANALYZER 1B SAMPLE PUMP	Analyzer OOS E355since 480v sample pump oos
1EMXB3 R01F	SPARE 40 A FDBKR	
1EMXB3 R02A	RB DEMIN WATER SUPPLY CONT ISOL VLV 1YM115B	Valve 1YM-115 Fails As Is
1EMXB3 R02B	UNIT 1 STATION AIR CONT ISOL VLV 1VS12B	Valve 1VS-12 Fails As Is
1EMXB3 R02C	CONT VENT UNIT CONDENSATE CONT ISOL VLV 1WL322B	Valve 1WL-322 Fails As Is, Mtr Htr OOS
1EMXB3 R02D	$ VI SYST ESS SUP FROM TANK 1A CONT ISOL VLV 1VI129B	Valve 1VI-129 Fails As Is
1EMXB3 R03A	$ NCDT VENT CONTAINMENT ISOL VLV 1WL41B	Valve 1WL-41 Fails As Is, Mtr Htr OOS
1EMXB3 R03B	$ RB SUMP PUMP DISCHARGE CONT ISOL VLV 1WL65B	Valve 1WL-65 Fails As Is, Mtr Htr OOS
1EMXB3 R03C	SPARE SIZE 1 CFVR STR	
1EMXB3 R03D	SPARE SIZE 1 CFVR STR	
1EMXB3 R04A	NORMAL INCOMING BKR FED FROM 1EMXB	
1EMXB3 R04B	SPARE SIZE 1 CFVNR STR	
1EMXB3 R04C	$ NCDT PUMPS DISCHARGE CONT ISOL VLV 1WL1B	Valve 1WL-1 Fails As Is, Mtr Htr OOS
	1EMXB4 LOADS	
1EMXB4 01A	SPARE SIZE 1 CFVR STR	
1EMXB4 01B	NC PUMP 1B THERMAL BARRIER OTLT AUTO ISOL VLV 1KC364B	Valve 1KC-364 Fails As Is, OAC pts D0008 & D1056 OOS
1EMXB4 01C	NC PUMP 1D THERMAL BARRIER OTLT AUTO ISOL VLV 1KC413B	Valve 1KC-413 Fails As Is, OAC pts D1057 & D2077 OOS
1EMXB4 02A	NC PUMPS RETURN HDR INSIDE CONT ISOL VLV 1KC424B	Valve 1KC-424 Fails As Is, OAC pt D1058 OOS
1EMXB4 02B	REACTOR BLDG KC DRN HDR INSIDE CONT ISOL VLV 1KC429B	Valve 1KC-429 Fails As Is, OAC pt D1059 OOS
1EMXB4 02C	ACCUMULATOR 1B DISCHARGE ISOL VLV 1NI65B	Valve 1NI-65 Fails As Is, Loss of CB indication only
1EMXB4 03A	INCOMING FEEDER FROM L.C. 1ELXB	
1EMXB4	FDR TO 600 VOLT MCC 1EMXB5	Breaker 1EMXB4-03B load side is hard wired into bus

03B	BUS	1EMXB5
1EMXB4 03C	FUTURE	
1EMXB4 03D	ACCUMULATOR 1D DISCHARGE ISOL VLV 1NI88B	
.EMXB4 03E	HOTLEG INJ. CHECK 1NI124,1NI128 TEST ISOL VLV 1NI122B	Valve 1NI-122 Fails As Is
1EMXB4 04A	CONTAINMENT AIR RETURN FAN 1B DAMPER 1RAF-D-4	
1EMXB4 04B	SPARE SIZE 1 CFVR STR	
1EMXB4 04C	NI ACCUM 1A SMPL LINE INSIDE CONT ISOL VLV 1NM72B	Valve 1NM-72 Fails As Is, OAC pt D1015 OOS
1EMXB4 05A	NI ACCUM 1B SMPL LINE INSIDE CONT ISOL VLV 1NM75B	Valve 1NM-75 Fails As Is, OAC pt D1014 OOS
1EMXB4 05B	NI ACCUM 1C SMPL LINE INSIDE CONT ISOL VLV 1NM78B	Valve 1NM-78 Fails As Is, OAC pt D1013 OOS
1EMXB4 05C	$ ACC 1B B/U N2 TO PORV 1NC-32 BLACKOUT SUP VLV 1NI431B	Valve 1NI-431 Fails As Is, OAC pt D3370 OOS
1EMXB4 06A	NI ACCUM 1D SMPL LINE INSIDE CONT ISOL VLV 1NM81B	Valve 1NM-81 Fails As Is, OAC pt D1012 OOS
1EMXB4 06B	SG 1B UPPER SHELL SMPL CONT ISOL VLV 1NM197B	Valve 1NM-197 Fails As Is, OAC pt D1010 OOS
1EMXB4 06C	SG IB BLOW DOWN LINE SAMPLE CONT ISOL VLV 1NM200B	Valve 1NM-200 Fails As Is, OAC pt D1011 OOS
1EMXB4 07A	SPARE SIZE 1 CFVR STR	
1EMXB4 07B	SG 1D UPPER SHELL SAMPLE CONT ISOL VLV 1NM217B	Valve 1NM-217 Fails As Is, OAC pt D1009 OOS
1EMXB4)7C	SG 1D BLOW DOWN LINE SMPL CONT ISOL VLV 1NM220B	Valve 1NM-220 Fails As Is, OAC pt D1011 OOS
IEMXB4 08A	SPARE SIZE 1 CFVR STR	
1EMXB4 08B	SPARE SIZE 1 CFVR STR	
1EMXB4 08C	SPARE SIZE 1 CFVR STR	
	1EMXB5 LOADS	Ref MC-1703-007.09, 1EMXB5 fed from 1EMXB4 (No Alt)
1EMXB5 01A	$ H2 PURGE EXHAUST CONT VESSEL CONT ISOL VLV 1VE6B	Valve 1VE-6 Fails As Is
1EMXB5 01B	RV CONTAINMENT INSIDE ISOL VALVE 1RV33B	Valve 1RV-33 Fails As Is (1RV-32 from 1EMXA1 can isol pen)
1EMXB5 01C	H2 SKIMMER FAN 1B SUCTION ISOLATION VLV 1VX2B	Valve 1VX-2 Fails As Is, NOTE: must be open to start Skimmer Fan
1EMXB5 02A	$ INC FDR FROM MCC 1EMXB4-03B (HARD WIRED TO 1EMXB5)	
1EMXB5 02B	FUTURE	
1EMXB5 02C	SPARE SIZE 2 CFVNR STR.	
1EMXB5 02D	A S/G TEMPER ISOLATION VLV 1CF151B	Valve 1CF-151 Fails As Is, OAC pt D3364 OOS
1EMXB5)2E	B S/G TEMPER ISOLATION VLV 1CF153B	Valve 1CF-153 Fails As Is, OAC pt D3365 OOS
.EMXB5 03A	SPARE SIZE 1 CFVR STR.	
1EMXB5 03B	SPARE SIZE 1 CFVR STR.	
1EMXB5 03C	SPARE SIZE 1 CFVR STR.	

QuestionBank #	KA_system	KA_number
1807	SYS007	A1.01

KA_desc
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRTS controls including: (CFR: 41.5 / 45.5)□Maintaining quench tank water level within limits ....

Unit 1 was operating at 100% RTP when it was determined that 1NV-6 (Letdown Line Inside RB Relief) is leaking 9.0 GPM to the PRT.

1) Assuming a starting level in the PRT of 70%, what would be the indicated PRT level after 4 hours?

2) To which location is the PRT drained to prevent exceeding the design limit for PRT level per OP/1/A/6150/004 (Pressurizer Relief Tank)?

REFERENCE PROVIDED

A. 1) 86%
 2) Containment Floor and Equipment Sump

B. 1) 86%
 2) NCDT

C. 1) 90%
 2) Containment Floor and Equipment Sump

D. 1) 90%
 2) NCDT

General Discussion

Initial PRT level is given at 70% which represents a volume of 9750 gal. With a 9 GPM input for 4 hours (240 Minutes), a total of 2160 gal. The resulting volume in the tank will be 11910 gal. Using the reference provide this new volume would represent a new indicated level of 86%. The X axis on the tank curve is graduated in divisions of 250 gal, if the candidate was off 1/2 of this value Standard allowable margin for error reading curves, on each tank level, the new derived level would be 90%. Per station procedure OP/1/A/6150/004 (Pressurizer Relief Tank), Enc. 4.2 (Adjusting PRT level) the PRT level is lowered by draining to the NCDT via PRT Drain. The alternate option provided is via the PRT sample line. This flowpath is very limited and would not be sufficient to prevent exceeding the design maximum level in the tank.

KA is matched because given an input to the PRT the candidate must predict a resulting level after a stated period of time using a reference tank curve to determine this new level. "Operating the controls" knowledge is required due the required knowledge as to where to the PRT would be drained in this situation and all of the above is required in order to maintain the water level within limits.

This is a higher cognitive level question because the candidate must take the information given, interpret a tank curve and predict an outcome. He must also possess system operational knowledge. At the very least, the question requires a multi-part mental process to successfully answer.

Answer A Discussion

Incorrect: Level is correct, location to drain is wrong. Plausible because the level is correct, and the location is possible but would not used in the situation.

Answer B Discussion

CORRECT. See explanation above.

Answer C Discussion

Incorrect: Both answers are wrong. Plausible: As explained above, error reading the tank curve would provide this level and the location is possible but would not used in the situation given.

Answer D Discussion

Incorrect: First answer wrong, second is correct. Plausible: As explained above for tank level, an error reading the tank curve would provide this answer.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References
Technical Reference(s) Lesson Plan OP-MC-PS-NC, Reactor Coolant System, Rev. 31, page 35-37 Learning Objective: OP-MC-PS-NC Obj. 19

Student References Provided
U-1 Data Book Curve 7.2 (Q7)

QuestionBank #	KA_system	KA_number
1807	SYS007	A1.01

KA_desc
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRTS controls including: (CFR: 41.5 / 45.5)□Maintaining quench tank water level within limits ....

401-9 Comments:

401-9 Comments RESPONSE

Question 7 References:

	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
19	State the purpose of the pressurizer relief tank and the design features which accomplish the purpose.	X	X	X	X	

Pressurizer Relief Tank

1. Purpose

Describe the proper procedure for operation of the Pressurizer Relief Tank (PRT).

2. Limits and Precautions

2.1 PRT temperature should be maintained less than 114°F.

2.2 Shutdown Tank "B" or Bulk Nitrogen shall maintain a N2 blanket on the PRT during normal operations.

2.3 PRT level should be maintained 64 - 88% during normal operations.

2.4 Venting of PRT must be coordinated through Radwaste Chemistry.

2.5 The vent valve located between the containment penetration and respective containment outside isolation valve should be addressed in containment breach mitigation plans.

2.6 Valves operated in this procedure must be operated by normal means only. They must not be artificially assisted, such as tightening an MOV with the handwheel or using a cheater-bar on a manual valve.

2.7 Maximum NCDT Pump discharge flow is 150 gpm (one pump) in PRT cooling alignment (pump runout concern).

2.8 Minimum NCDT and PRT pressure is 0 psig. {PIP-M-99-5074}

3. Procedure

See Section 4.

Unit 1

1. Limits and Precautions

1.1 PRT temperature should be maintained less than 114°F.

1.2 Shutdown Tank "B" or Bulk Nitrogen shall maintain a N2 blanket on the PRT during normal operations.

1.3 PRT level should be maintained 64 - 88% during normal operations.

1.4 Venting of PRT must be coordinated through Radwaste Chemistry.

1.5 Minimum NCDT and PRT pressure is 0 psig. {PIP-M-99-5074}

2. Initial Conditions

____ 2.1 __IF__ PRT level to be raised, Reactor Makeup Water available per OP/1/A/6200/012 (Reactor Makeup Water System).

____ 2.2 __IF__ PRT level to be lowered using the NCDT system, NCDT system operating per OP/1/A/6500/001 (Liquid Waste System).

3. Procedure

☐ 3.1 Evaluate all outstanding R&Rs that may impact performance of this procedure.

3.2 Perform the applicable Section:

- ☐ Section 3.3, Raising PRT Level Using Gravity Fill
- ☐ Section 3.4, Raising PRT Level Using Reactor Makeup Water Pump
- ☐ Section 3.5, Lowering PRT Level Using INC-107A (PRT Drain)
- ☐ Section 3.6, Lowering/Stabilizing PRT Level Using INC-109 (PRT #1 Sample)

3.3 Raising PRT Level Using Gravity Fill

_____ 3.3.1 Open 1NC-58A (PRT Spray Supply Block).

_____ 3.3.2 **AFTER** desired level reached, close 1NC-58A (PRT Spray Supply Block).

3.4 Raising PRT Level Using Reactor Makeup Water Pump

☐ 3.4.1 Place RMWST in recirculation per OP/1/A/6200/012 (Reactor Makeup Water System).

_____ 3.4.2 Open 1NC-58A (PRT Spray Supply Block).

_____ 3.4.3 **AFTER** desired level reached, close 1NC-58A (PRT Spray Supply Block).

☐ 3.4.4 Secure RMWST recirculation per OP/1/A/6200/012 (Reactor Makeup Water System).

3.5 Lowering PRT Level Using 1NC-107A (PRT Drain)

☐ 3.5.1 Monitor NC Pump seal parameters closely while varying pressure in NCDT.

_____ 3.5.2 Notify Radwaste Chemistry that PRT level to be lowered.

_______________ _____ / _____
Person Notified Date Time

_____ 3.5.3 Close 1WL-41B (NCDT Vent Cont Outside Isol).

NOTE: Equalizing pressure between PRT and NCDT reduces possibility of NCDT Pump trips.

_____ 3.5.4 **IF** desired to raise PRT pressure, notify Radwaste Chemistry to raise PRT pressure per OP/0/A/6200/018 (Waste Gas Operation).

_______________ _____ / _____
Person Notified Date Time

CAUTION: NCDT pressure will rise rapidly to PRT pressure. **IF** NCDT pressure goes above VCT pressure, NC Pump #2 and #3 seals will be adversely affected.

_____ 3.5.5 **IF** 1NV-94AC (U1 NC Pumps Seal Water Return Cont Inside Isol) **AND** 1NV-95B (U1 NC Pump Seal Water Return Cont Outside Isol) open, check VCT pressure is greater than PRT pressure.

_____ 3.5.6 Open 1NC-107A (PRT Drain).

Unit 1

_____ 3.5.7 **AFTER** desired level reached, perform the following:

_____ 3.5.7.1 Close 1NC-107A (PRT Drain).

_____ 3.5.7.2 **IF** PRT over pressure initiated, notify Radwaste Chemistry to isolate PRT over pressure per OP/0/A/6200/018 (Waste Gas Operation).

_________________________ _____/_____
Person Notified Date Time

3.5.8 Align 1WL-41B (NCDT Vent Cont Outside Isol) as follows:

_____ 3.5.8.1 Notify Radwaste Chemistry of the following:

- ☐ It is desired to open 1WL-41B (NCDT Vent Cont Outside Isol)
- ☐ Radwaste must monitor WG Compressor for proper operation
- ☐ Current NCDT pressure ____________ psig

_________________________ _____/_____
Person Notified Date Time

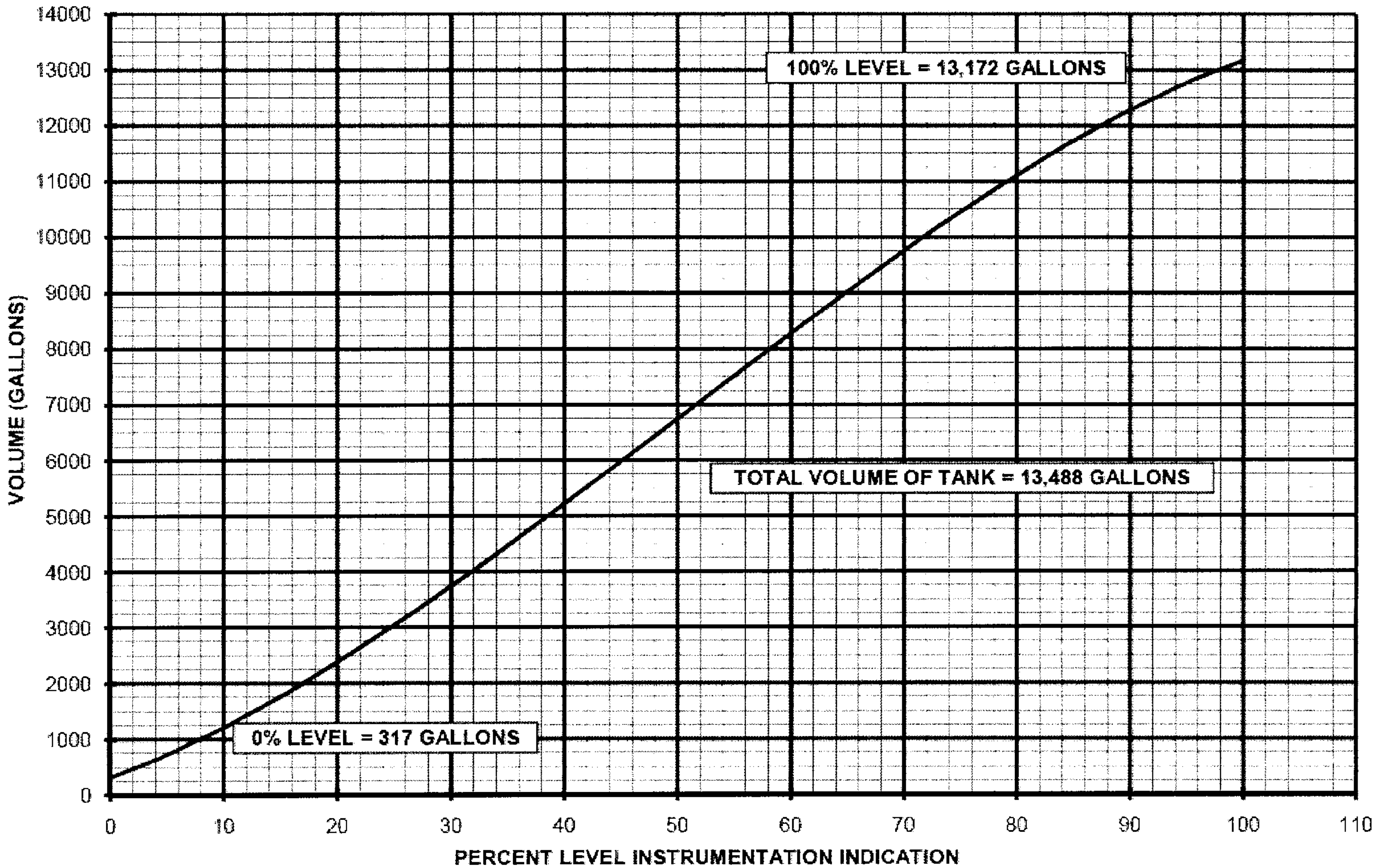
_____ 3.5.8.2 **WHEN** directed by Radwaste Chemistry, open 1WL-41B (NCDT Vent Cont Outside Isol).

_________________________ _____/_____
Person Notified Date Time

Unit 1

UNIT 1

OP/1/A/6100/22
ENCLOSURE 4.3
CURVE 7.2
PRESSURIZER RELIEF TANK
(VOLUME vs. LEVEL)



This data is also available on the OAC.

UNIT 1

QuestionBank #	KA_system	KA_number
1808	SYS008	A2.03

KA_desc
Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunc- tions or operations : (CFR: 41.5 / 43.5 / 45.3 / 45.13)□High/low CCW temperature ....

The following conditions exist on Unit 2:

- A normal plant shutdown is in progress
- All NC pumps are in service
- Train A of ND cooling was placed in service 5 minutes ago
- 3 minutes ago the following alarms were received on the OAC:
  - "2A KC HX Outlet Temp Hi Hi"
  - "NC Pump Thermal Barrier KC Outlet Temp Hi" for all NCPs
  - "NC Pump Mtr Upper BRG CLR KC Outlet Temp Hi" for all NCPs

- The following readings exist on all running NCPs:
  - Motor bearing temperatures are 185°F
  - Lower radial bearings are 200°F
  - Seal outlet temperatures are 165°F

Operator action in response to these conditions will be to __(1)___ because ___(2)___.

A. (1) reduce the KC heat load by reducing ND flow
(2) an NCP bearing temperature limit has been exceeded due to a loss of cooling flow

B. (1) reduce the KC heat load by reducing ND flow
(2) KC HX temperatures are approaching design limits

C. (1) immediately stop all running NCPs
(2) an NCP bearing temperature limit has been exceeded due to a loss of cooling flow

D. (1) immediately stop all running NCPs
(2) KC HX temperatures are approaching design limits

General Discussion

Explanation (Optional): In the scenario provided in this question, indications are provided in which an excessive heat load has been placed on the operating train of KC. NCP pump temperatures are elevated but have not exceeded any operational limits. To address this condition the crew will need to reduce the NC cooldown rate which will decrease the heat load on the KC system to provide additional cooling to the NCP's.

The K/A is matched because the applicant must evaluate the impact of the malfunction (Hi CCW temperature) on the system's ability to perform its design function (in this case provide cooling to the NC pumps). Based on the predicted impact to the system (design limits will be exceeded), the applicant must select the correct action to mitigate.

The question is higher cog because the candidate must predict an outcome and select an action to solve the problem. This requires using the knowledge and its meaning to solve a problem.

Answer A Discussion

Plausible: First part is correct, Lower radial bearing temperature is >195 deg with is the limit for motor bearings.

Answer B Discussion

CORRECT. See explanation above

Answer C Discussion

Plausible: Candidate may believe that NCP limits have been exceeded. The values given in the stem are close to design limits.

Answer D Discussion

Plausible Candidate may believe that NCP limits have been exceeded. The values given in the stem are close to design limits. Second part is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s): Lesson Plan OP-MC-PSS-KC, Rev. 25 Lesson Plan OP-MC-PS-NCP, Learning Objective: OP-MC-PSS-KC, Obj. 8	

QuestionBank #	KA_system	KA_number
1808	SYS008	A2.03

KA_desc
Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunc- tions or operations : (CFR: 41.5 / 43.5 / 45.3 / 45.13)□High/low CCW temperature ....

401-9 Comments:

401-9 Comments RESPONSE

Question 8 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 24 Rev. 11

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. **Symptoms**

- **NC pump number 1 seal leakoff flow going up**
- **NC pump number 1 seal leakoff flow going down**
- **NC pump number 1 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 NC pump parameters within operating limits:**	__ **IF trip criteria valid, THEN GO TO Step 5.**
__ • All NC pump lower radial bearing temperatures - LESS THAN 225°F	
__ • All NC pump number 1 seal outlet temperatures - LESS THAN 235°F	
__ • All NC pump number 1 seal delta Ps - GREATER THAN 200 PSID.	
__ 3. **IF AT ANY TIME any operating limit exceeded, THEN GO TO Step 5.**	
__ 4. **GO TO Step 6.**	

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:** __ • 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.	__ **IF trip criteria valid, THEN GO TO Step 5.**
__ 3. **IF AT ANY TIME any operating limit exceeded, THEN GO TO Step 5.**	
__ 4. **GO TO Step 6.**	

QuestionBank #	KA_system	KA_number
1809	SYS010	K6.04

.A_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

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) remain the same
(2) remain the same

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

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. Both parts are plausible if the applicant does not comprehend that the Safety Valve is now discharging to a lower pressure which affects the isenthalpic throttling characteristics and that the larger DP across the valve affects the leakage.

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:

401-9 Comments RESPONSE

Question 9 References:

From Lesson Plan BNT-CP02R8P pages 46 and 47:

Objective 15J

This method is used for both Continuous and Single Point measurement. A high frequency sound signal is generated and the interruption or detection of the generated signal is the basis for the Single Point measurement.

The Continuous measurement device measures the elapsed time from the signal emission to reception of the sound signal. The elapsed time is proportional to level.

Operation requires that sensors be mounted and aimed to direct the ultrasonic signal toward the material being sensed. A transmitter sensor sends the signal. The signal is terminated by reception of the echo returned by the material being measured.

The elapsed time determines the distance the signal traveled which directly relates to level indication.

6.0 FLOW MEASUREMENT

Flow is the passage of a quantity of a fluid past a point per unit time. Many methods have been developed to measure the flow of fluids. Each device uses specific principles to produce a flow measurement. Each device has its own particular advantages and limitations.

6.1 UNITS OF FLOW

Flow measurements are divided into two major categories: (1) flowrate, and (2) total flow (total quantity). Flowrate is the amount of fluid that moves past a given point per unit of time. Total flow is the amount of fluid that moves past a given point during a specified time.

Flowrate can be expressed in terms of mass or volume per unit of time. Mass flowrate is the quantity of material in units of pounds mass flowing past a point at a given instant in time. Mass flowrate is expressed as pounds mass per hour (lbm/hr) and pounds mass per second (lbm/sec). Steam flow is a parameter normally measured in units of mass flowrate.

Volumetric flowrate is the volume of material in cubic units flowing past a point per unit of time. For liquid flow measurements, the volumetric flow rate is normally expressed in units of gallons per minute. For measuring the flowrate of gases, units of standard cubic feet per second (scfs), standard cubic feet per minute (scfm), and standard cubic feet per hour (scfh) are commonly used.

Total flow is also expressed in terms of mass or volume. Total mass flow is the number of pounds mass of a material that has passed a point in a given time. Total volumetric flow is similar to total mass flow. Total flow is normally used when it is important to know how much material has flowed rather than how fast it is flowing, such as in radwaste sump drains.

6.2 FLOW RATE MEASUREMENT

Objective 16A

6.2.1 DIFFERENTIAL PRESSURE DETECTORS

Many different types of flow rate measurement devices are used in power plants and industry. A type called a "head flow meter" operates on the principle that placing a restriction in the fluid flow path causes a drop in pressure that is proportional to the rate of flow. The resulting differential pressure is measured to provide flow information.

In Thermodynamics we will derive proof that a flowing fluid contains energy associated with its motion (kinetic energy) as well as its pressure. Head flow meters work by converting some of the pressure "head" (energy) of the fluid to velocity head. As the fluid flows through a restriction its velocity increases and its pressure decreases. By sensing pressure upstream of the restriction and in the restriction, a differential pressure is sensed. The differential pressure varies with the flow rate. The volumetric flow rate ($\dot{V}$) remains constant as velocity increases and pressure decreases. The change in pressure (D/P is proportional to the square of the volumetric flow rate.

$$D/P \propto (\dot{V})^2$$

Equation 2

Therefore, since D/P is measured, the volumetric flow rate can be determined with the equation:

$$\dot{V} = K\sqrt{D/P}$$

Equation 3

Where:

K = a constant for the restriction

For example, if flowrate doubles, the D/P increases by a factor of four.

A differential pressure cell is used to measure the D/P. A special non-linear meter scale may be used which indicates volumetric flowrate directly from the D/P signal. Frequently, however, a square root extraction circuit is built into the instrument. This circuit creates a signal that represents the flow by taking the square root of the D/P. In this application, should flowrate double, the D/P increases by a factor of four. The square root device gives an output of the square root of four, or two. This way, the final signal undergoes a change identical to the change in flow. Orifice plates, flow nozzles, and venturi tubes use this principle. Each device will be discussed separately in the following sections, including their advantages and disadvantages.

6.2.2 SQUARE ROOT EXTRACTORS

Objective 17

Since the flow rate is proportional to the square root of the differential pressure, a square root extractor circuit performs the square root operation to convert the ΔP into flow rate. For a given flow detecting system, the proportionality constant, K, doesn't change as flow rate changes so we can derive a relationship to determine the either the flow rate or D/P as conditions change.

$$\frac{\dot{V}_2}{\dot{V}_1} = \frac{\sqrt{D/P_2}}{\sqrt{D/P_1}}$$

Equation 4

Objective 18

Examples and Solutions:

Main steam flow indicates 5 x 10^6 lbm/hr when the D/P senses a 40 psid differential pressure. If flow changes such that the D/P is 30 psid, what is the approximate main steam flow rate?

$$\dot{V}_2 = (5\times10^6\, lbm/hr)(\frac{\sqrt{30}}{\sqrt{40}}) = 4.3\times10^6\, lbm/hr$$

In many processes, subcooling is of considerable concern. A prime example is illustrated by the inadequate cooling of liquid at the intake of a pump. If the liquid is not sufficiently subcooled, the headloss (pressure drop) at the suction of the pump can result in some of the liquid flashing into a vapor (cavitation), the result of which is the erosion (pitting) of the internal pump components. In severe cases, if too much of the liquid is vaporized, the pump may actually become "vapor locked". A pump designed to pump liquid often requires the liquid flow to cool its components. If the pump is vapor locked, there is insufficient cooling and the resultant differential expansion of the dissimilar metals making up the pump rotor and casing can result in pump seizure.

7.0 THE MOLLIER DIAGRAM

Since the state of water can be determined if any two of its properties are given, several different graphical portrayals are possible. We have already examined a T-*h* plot and a T-s plot. Another plot that is often used is the Enthalpy-Entropy (*h-s*) plot.

The Mollier diagram is an *h-s* plot for steam. It is a very useful tool for quickly determining water properties and evaluating thermodynamic processes.

On the Mollier diagram (See Figure 8) constant enthalpy lines are drawn horizontally and constant entropy lines are drawn vertically. A saturation line can then be plotted since there is a unique combination of enthalpy and entropy for a saturated liquid and vapor at every pressure. On the Mollier diagram, the critical point is located near the lower left portion of the diagram.

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 $\uparrow$ and s $\rightarrow$ 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 $\downarrow$ and s $\leftarrow$ on the h-s diagram).

QuestionBank #	KA_system	KA_number
1810	SYS012	K6.03

KA_desc
Knowledge of the effect of a loss or malfunction of the following will have on the RPS: (CFR: 41.7 / 45/7)□Trip logic circuits ....

Given the following:

- Reactor power is steady state at 50% RTP
- Power Range Channel N-42 has just failed LOW
- Power Range Channels N-41, N-43, & N-44 are OPERABLE

Which ONE (1) of the following combinations of remaining OPERABLE channels indicate the status of the trip logic coincidence required for the High Neutron Flux Trip:

1) After the failure has occurred, but BEFORE Power Range Channel N-42 is removed from service?

2) AFTER all required I&E actions have been completed for removing Power Range Channel N-42 from service?

	BEFORE Channel Removal	AFTER Channel Removal
A.	1/3	1/3
B.	1/3	2/3
C.	2/3	1/3
D.	2/3	2/3

General Discussion

Since N-42 has failed low, the Hi Neutron Flux Trip Logic will never receive a trip signal from that channel. Since two high flux signals are required to initiate a trip signal and there are only three channels remaining which could potential generate a high flux trip signal, the logic for a Power Range Hi Flux trip is 2/3 channels.

When the I&E actions for removing N-42 have been completed the High Flux Trip Bistable is placed in the tripped position. Since only one more (of the remaining 3) High Flux Trip Bistable signals is required to intiate a Hi Flux Trip, the logic now becomes 1/3 channels.

The KA is matched because the question requires the applicant to know how the loss of a channel will effect the RPS trip logic before and after a channel is removed from service.

This is a comprehension level question because the applicant must recall the normal trip logic from memory, must understand that with the channel failed low the trip logic is unaffected, must understand that when the channel is removed from service the high flux trip bistable is placed in the trip condition, and must associate all of those pieces of information to determine the correct answer.

Answer A Discussion

Incorrect. Plausible if the applicant confuses the channel failing low with the channel failing high in which case this answer would be correct.

Answer B Discussion

Incorrect. Plausible if the candidate confuses the channel failing low the the channel failing high AND believes that the I&E actions for removing N-42 from service will de-energize the Hi Flux Trip Bistable for that channel.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible if the candidate does not understand that the failed channel Hi Flux Trip Bistable is placed in the tripped position when I&E actions are complete for removing the channel from service.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	Comanche Peak Bank EB878

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-IC-IPE	

QuestionBank #	KA_system	KA_number
1810	SYS012	K6.03

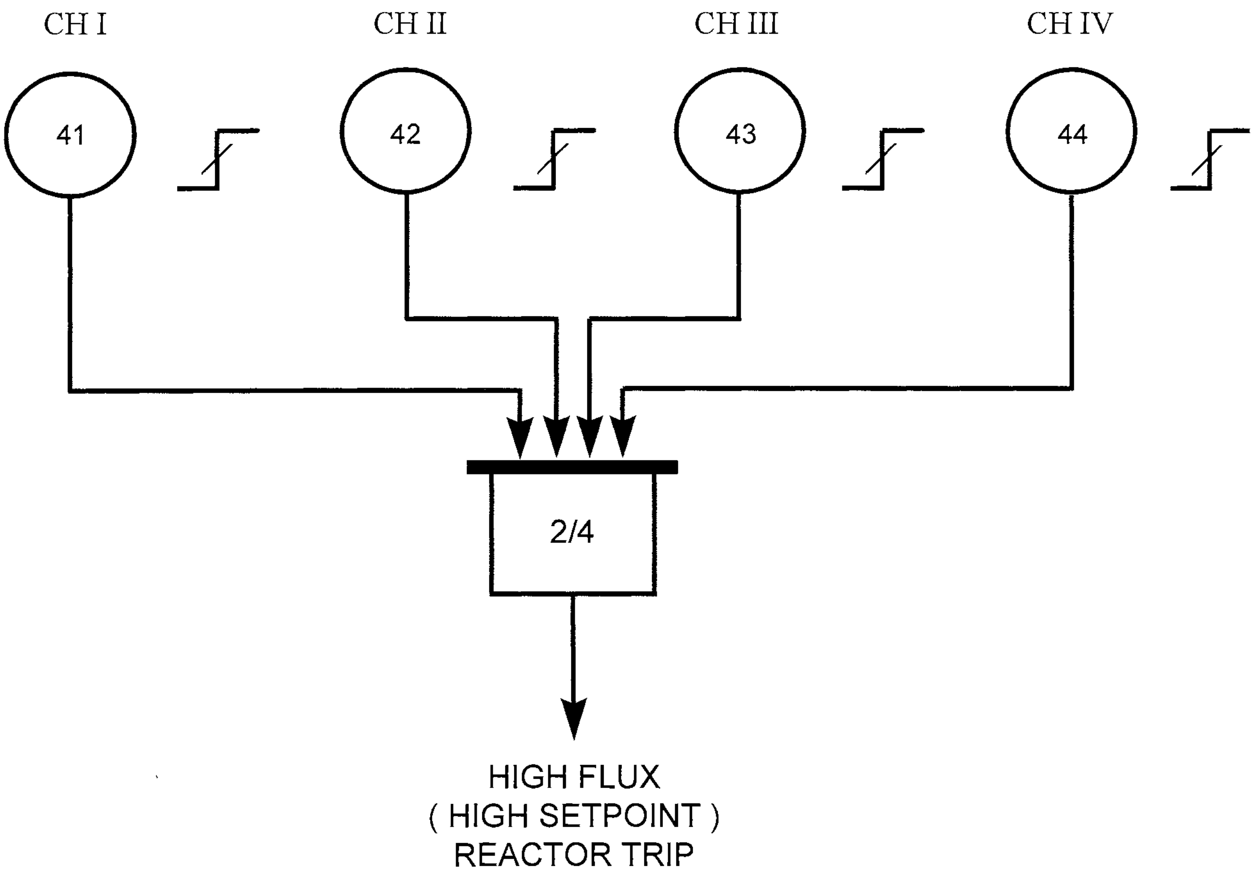
KA_desc

Knowledge of the effect of a loss or malfunction of the following will have on the RPS: (CFR: 41.7 / 45/7)□Trip logic circuits
....

401-9 Comments:

401-9 Comments RESPONSE

Question 10 References



Per TS Table 3.3.1-1 Condition D applies:

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
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	12 hours from discovery of THERMAL POWER > 75% RTP AND Once per 12 hours thereafter
	AND	
	D.1.2 Place channel in trip.	72 hours
	OR	
	D.2 Be in MODE 3.	78 hours

(continued)

Comanche Peak Question EB878:

QUESTION#: EB878 DETAILS

KA(S):

012 A2 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:

012 A2.02 Loss of instrument power 3.6 3.9

012 A3 Ability to monitor automatic operation of the RPS, including:

012 A3.06 Trip logic 3.7 3.7

012 K4 Knowledge of RPS design feature(s) and/or interlock(s) which provide for the following:

012 K4.01 Trip logic when one channel OOC or in test 3.7 4.0

NO COMMENT

	DIFFICULITY	AND	LEVEL
STP			
NRC			

USED ON EXAMS SINCE 10/95: NO

QUESTION ON NEXT PAGE

QUESTION#: EB878 SSPS, RPS, NI, power range

Given the following:

- Reactor power is steady state at 50%.
- Power Range Channel N-42 upper detector has just failed LOW.
- Power Range Channels N-41, N-43, & N-44 are OPERABLE.

Which ONE of the following combinations indicate the status of the trip logic coincidence required for the High Neutron Flux Trip:

1) After the failure has occurred, but BEFORE Power Range Channel N-42 is removed from service?

2) AFTER Power Range Channel N-42 has been removed from service per 0POP04-NI-0001, Nuclear Instrument Malfunction?

	BEFORE Channel Removal	AFTER Channel Removal
A.	1/3	1/3
B.	1/3	2/3
C.	2/3	1/3
D.	2/3	2/3

Answer:	C

C

QuestionBank #	KA_system	KA_number
1811	SYS013	A4.03

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□ESFAS initiation ....

Given the following:

- An inadvertent Reactor Trip/Safety Injection has occurred due to IAE testing
- Both reactor trip breakers opened as expected

Which of the following describes the effect of pushing the SI reset pushbuttons after the safety injection actuation?

A. After the SI reset pushbuttons are depressed ONLY, automatic SI reinitiation can occur.

B. After the SI timer has timed out and the SI reset pushbuttons are depressed, automatic SI reinitiation can occur.

C. After the SI timer has timed out and the SI reset pushbuttons are depressed, only a manual SI can be initiated, automatic SI reinitiation remains blocked.

D. After the SI reset pushbuttons are depressed and the reactor trip breakers are cycled, only a manual SI can be initiated, automatic SI reinitiation remains blocked.

C

General Discussion

Each train has a Safety Injection Reset pushbutton on the Control Board. In order to reset safety injection, one minute must have passed since the actuation (60 second timer has timed out) and the train related reactor trip breaker must be open (P-4). Following safety injection reset, only manual safety injection actuation is available. To reinstate the automatic actuation the reactor trip breakers must be reclosed.

This KA is matched because the applicant must understand the consequences of manual action taken (Ability to manually operate and/or monitor) with regards to depressing the SI reset pushbuttons and the impact on ESFAS initiation capability.

Answer A Discussion

Incorrect. Plausible because the SI reset pushbuttons do have to be depressed to reinstate automatic Safety Injection. However, the Reactor Trip breakers have to be cycled also to reinstate auto SI.

Answer B Discussion

Incorrect. Plausible because the SI timer must time out and the SI reset pushbuttons depressed to reinstate auto SI. However, the Reactor Trip breakers must also be cycled to reinstate auto SI.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible because this is true provided the SI timer has timed out and reactor trip breakers have not been cycled. Once the reactor trip breakers are cycled, automatic SI is reinstated.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Exam Bank Question AECCISER01

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Lesson Plan OP-MC-ECC-ISE Objective 12 page 25

Student References Provided

QuestionBank #	KA_system	KA_number
1811	SYS013	A4.03

KA_desc

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

401-9 Comments:

401-9 Comments RESPONSE

Question 11 References:

From Lesson Plan OP-MC-ECC-ISE page 25:

- Sends open signal to normally open cold leg accumulator isolation valves
- Provides Containment Isolation Phase 'A' (S_t)
- Starts ESS AHU's for ND, NS, and KF pumps
- Provides Main Feedwater (CF) Isolation
- Provides Containment Ventilation Isolation (S_H)
- Turbine Trip

Objective # 8 & 9

The <u>Low Pressurizer Pressure Safety Injection</u> signal can be manually blocked to allow cooldown and depressurization of the plant without causing a safety injection actuation.

Objective # 10

In order to block the <u>Low Pressurizer Pressure Safety Injection</u> signal, "2 of 3" pressurizer pressure channels must be less than 1955 psig (P-11). There are two <u>BLOCK</u> pushbuttons on the Control Board provided (1 for each train).

Objective # 11

Once the (P-11) permissive is satisfied, <u>BOTH</u> <u>BLOCK</u> pushbuttons must be depressed in order to prevent the actuation from occurring when the respective setpoint is reached. This actuation <u>BLOCK</u> signal will be automatically unblocked if pressurizer pressure increases above 1955 psig (P-11).

Objective # 12

Each train has a Safety Injection Reset pushbutton on the Control Board. In order to reset safety injection, one minute must have passed since the actuation <u>(60 second timer has timed out)</u> and <u>the train related reactor trip breaker must be open (P-4)</u>. Following safety injection reset, only manual safety injection actuation is available. To reinstate the automatic actuation the reactor trip breakers must be reclosed.

<u>NOTE</u>: **Resetting the Safety Injection (S_S) signal <u>will not</u> cause any equipment to stop or any valves to realign.**

MNS Exam Bank Question AECCISER01:

AECCISER01

1 Pt Given the following:

- An inadvertent Reactor trip/Safety Injection has occurred due to IAE testing.
- Both reactor trip breakers opened as expected.

Which of the following describes the effect of pushing the SI reset pushbuttons after the safety injection actuation?

A. After the SI reset pushbuttons are pressed and the reactor trip breakers are cycled, only a manual SI can be initiated, automatic SI reinitiation remains blocked

B. After the SI reset pushbuttons are pressed, automatic SI reinitiation can occur

C. After the SI timer has timed out and the SI reset pushbuttons are pressed, only a manual SI can be initiated, automatic SI reinitiation remains blocked

D. After the SI timer has timed out and the SI reset pushbuttons are pressed, automatic SI reinitiation can occur

Answer 488

C

ECC-ISE, section 3.1

D

QuestionBank #	KA_system	KA_number
1812	SYS013	K1.01

KA_desc
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)□Initiation signals for ESF circuit logic ....

Given the following on Unit 1:

- Unit is operating at 100% RTP
- Containment Pressure Channel III has been BYPASSED for testing

Which ONE (1) of the following lists the logic for a Safety Injection actuation based on the conditions above?

A. 1/3

B. 2/3

C. 1/2

D. 2/2

General Discussion

The normal logic for a Hi Containment pressure SI is 2/3 channels. The applicant must undertand that bypassing the channel means that a Hi Pressure signal from that channel will not be seen by the logic. However, two channels are still required to initiate a Safety Injection signal and there are only two channels remaining which could cause the initiation. Therefore, the logic is now 2/2.

The KA is matched because it requires the applicant to know the effect of bypassing a containment pressure channel on the initiation logic for a Safety Injection signal.

Answer A Discussion

Incorrect. Plausible if the applicant confuses bypassing a channel with placing the channel in trip AND confuses the SI and Spray logics.

Answer B Discussion

Incorrect. Plausible if the applicant believes that the bypassed channel will still provide an input to the SI actuation logic OR if the applicant confuses the SI and Spray logics.

Answer C Discussion

Incorrect. Plausible if the applicant confuses bypassing a channel with placing the channel in trip.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

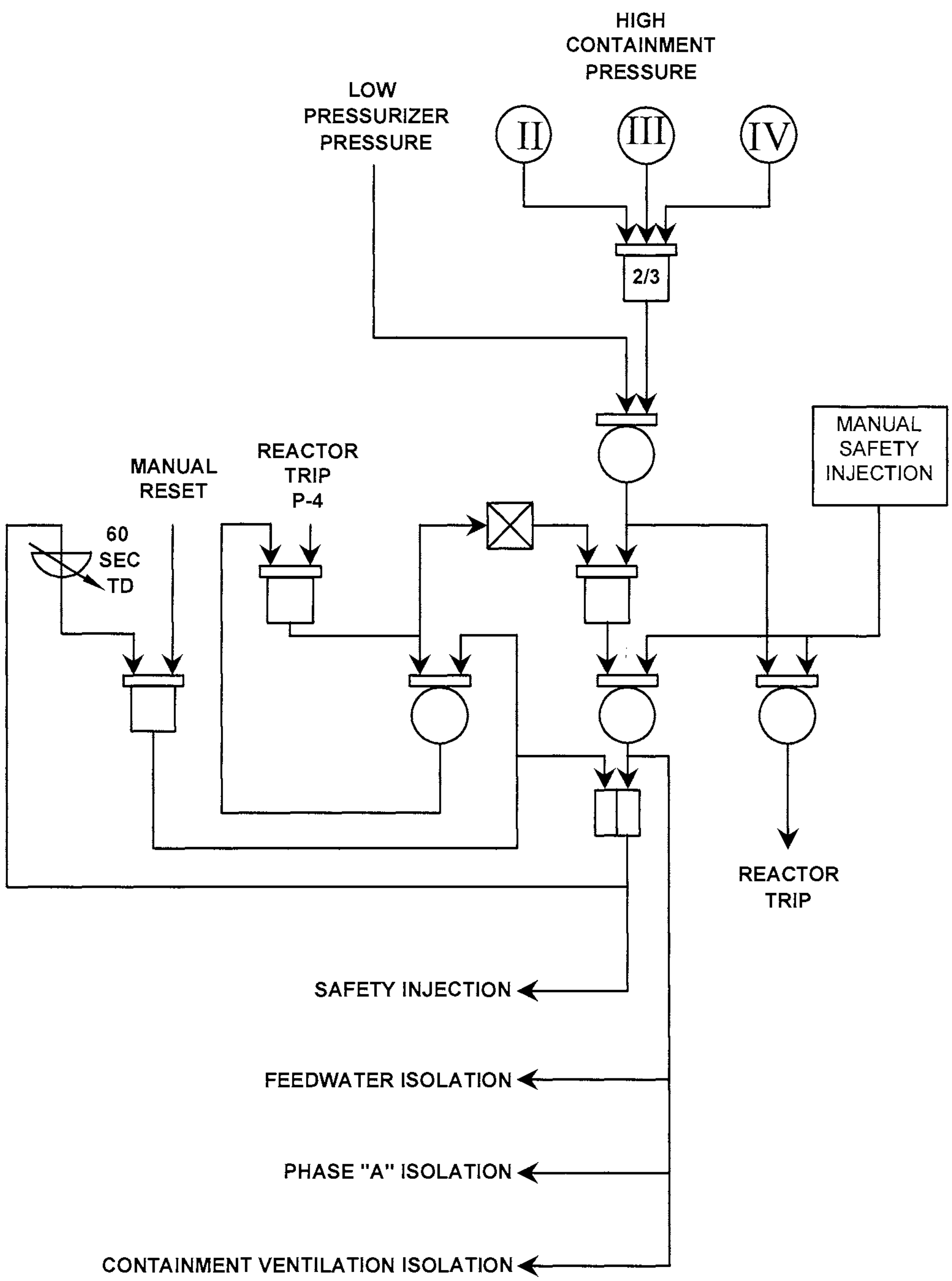
Development References	Student References Provided
Lesson Plan OP-MC-ECC-ISE, pages 59 and 77.	

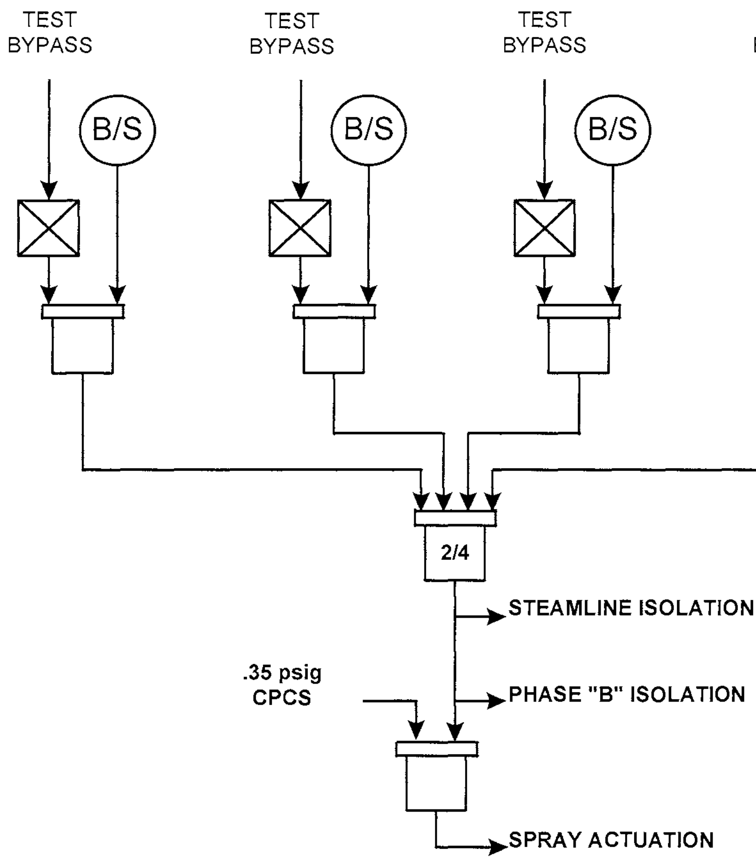
QuestionBank #	KA_system	KA_number
1812	SYS013	K1.01

KA_desc
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)□Initiation signals for ESF circuit logic ....

401-9 Comments: **401-9 Comments RESPONSE**

References for Question 12:





TEST BYPASS
B/S
TEST BYPASS
B/S
TEST BYPASS
B/S
TEST BYPASS
B/S
2/4
STEAMLINE ISOLATION
.35 psig CPCS
PHASE "B" ISOLATION
SPRAY ACTUATION

QuestionBank #	KA_system	KA_number
1813	SYS022	A2.03

.A_desc
Ability to (a) predict the impacts of the following malfunctions or operations on the CCS; 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)□Fan motor thermal overload/high-speed operation ....

Given the following conditions on Unit 2:

- The unit is operating at 100% RTP
- A small NC System leak occurs inside Containment
- Containment pressure is currently 0.25 PSIG and increasing slowly

When Containment pressure reaches 0.5 PSIG, the non-operating Lower Containment Ventilation (VL) fans will ____(1)____ AND when Containment pressure reaches 1.0 PSIG, the VL fans will ____(2)____.

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

A. (1) start in slow speed on their normal power supply
(2) swap to slow speed on their emergency power supply

B. (1) swap to emergency power and start in slow speed
(2) swap to high speed on their emergency power supply

C. (1) start in high speed on their normal power supply
(2) swap to slow speed on their emergency power supply

D. (1) start in high speed on their normal power supply
(2) swap to high speed on their emergency power supply

D

General Discussion

When containment pressure reaches 0.5 PSIG, all VL fans will start in high speed regardless of switch position. When containment pressure reaches 1.0 PSIG all VL fans will shunt trip off, swap to their emergency power supply, and start in high speed regardless of switch position.

This K/A is met. The conditions given for Part 1 of this question cause automatic actions which the applicant must verify as having occurred in accordance with the Annunciator Response for 1AD-9. In addition, the immediate actions for 1AD-9 / A8 would require the applicant to place the VL fans in high speed (even though they are already running in high speed), to prevent fan cycling. Therefore Part b of the K/A related to "use procedures to correct, control, or mitigate the consequences" is met.

Answer A Discussion

Incorrect. Plausible to believe that all fans would start in slow speed at 0.5 PSIG (since all fans may not be running). Part 2 is plausible since VL fans do swap to emergency power supply. However, they are running in high speed.

Answer B Discussion

Incorrect. Swap to emergency power is plausbile since it does occur at 1.0 PSIG. Also plausible to believe that all fans start in slow speed at 0.5 PSIG since all fans may not be running under normal conditions.

Answer C Discussion

Incorrect. Plausible since part 1 is correct. Part 2 is plausible since the VL fans do swap to emergency power supply. However, they will run in high speed.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

☑ Developed
☑ OPT Approved
☑ OPS Approved
☐ NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CNT-VUL Objectives 4 & 5 pages 31 and 39	

QuestionBank #	KA_system	KA_number
1813	SYS022	A2.03

KA_desc

Ability to (a) predict the impacts of the following malfunctions or operations on the CCS; 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)□Fan motor thermal overload/high-speed operation ....

401-9 Comments:

022A203
Under these conditions, I am not sure that swapping to high speed on their normal power is plausible. Suggest changing "A" and "C" part (2) to swap to slow speed on their emergency power.
U because Potentially 2 NP distracters.

Part 2 of the KA is not met (facility identified). Use procedures to

401-9 Comments RESPONSE

Modified question per Lead Examiner's comments. Changed Distracters A(2) and C(2) to read "swap to slow speed on their emergence power supply".

Question 13 References:

From Lesson Plan OP-MC-CNT-VUL page 31:

1.0 SYSTEM OPERATION

1.1. Normal Operation

VL System Operation

Objective #3

Typical configurations for operation of the VL ventilation units are listed as follows in order of increasing cooling capacity:

1. **Two to four units at low speed**
2. **Three units at high speed with one standby unit, and**
3. **Four units at high speed.**

The number of ventilation units needed to cool lower Containment depends upon the season of the year, the cooling water inlet temperature, and the Containment heat load. The lower containment heat load has decreased due to improvements in insulation techniques. Therefore, operation with only two VL AHUs in low speed is now possible. The most desirable configuration for operation of the ventilation units is low speed operation. This will minimize the wear and required maintenance on the units. Optimum VL AHU and RV Pump configuration is based on Lower Containment Weighted Average Temperature (LCWAT), the number of VL AHUs in operation and the speed the VL AHUs are operating in. In Modes 1 through 5 , RN is the preferred source of cooling water. RV pumps can supply cooling, but are not the preferred source. In Mode 6, or No Mode, cooling water is not required.

Objective #4

At the initiation of the 0.5 psig lower Containment pressure signal, all four VL air handling units and both Pipe Tunnel Booster Fans will start and switch to "HI" speed. HVAC switch control is regained when pressure is less than 0.5 psig.

The pressurizer booster fans have an electric interlock so that both fans can not be operated at the same time. One fan is operated during normal operation. One pipe tunnel booster fan is operated in "High" speed during normal operation. Each steam generator area booster fan operates during normal operation.

VR System Operation

Objective #3

Normal operation will consist of running a minimum of three (3) of the four (4) VR fans.

From Lesson Plan OP-MC-CNT-VUL page 39:

3.2.2 Safety Injection (S_S)

Objective #5

The VL units and Pressurizer Booster Fans are shunt tripped off their normal supply when an S_S signal is initiated. The Pressurizer Booster Fans swap to their emergency power supply, if available, and the selected fan will start. The VL units are transferred to the emergency power source, if available, and will start in high speed regardless of their switch position. When powered from this emergency power, control from the HVAC is disabled. (Refer to PIP #1-M97-1861) Once transferred, manual re-transfer to the normal source is required.

The VR units are shunt tripped from essential power when an S_S is initiated. If unit load center power is available, a transfer switch will automatically align to the emergency power source and start all units (regardless of their switch position). Once transferred, manual re-transfer to the normal source is required.

The VT units are shunt tripped from essential power when an S_S is initiated. If unit load center power is available, a transfer switch will automatically align to the emergency power source and start all units (regardless of switch position). The fans can not be stopped under these conditions, however, normal or max cool can be selected as desired during this event. Once transferred, manual re-transfer to the normal source is required.

The VU units, Return Air Fans, and the Pipe Tunnel Booster Fans are shunt tripped off on the S_S signal. Control power and indication is lost to all these fans when the shunt trip opens the respective breakers.

The Steam Generator Booster Fans do not receive a S_S signal nor are they powered from an essential bus, therefore they continue to run as they were prior to the Safety Injection.

NOTE: If a Loss of Offsite Power occurs prior to a Safety Injection, the transfer to emergency power will not occur. (PIP-2-M94-0027)

From Annunciator Response 1AD-9 / A8:

Nomenclature:	CONT .5 PSIG ALERT	Window:	A8

Setpoint: Greater than 0.5 psig

Origin: Pressure sensor monitoring Narrow Range Lower Containment Pressure (1NSPT-5550)

Probable Cause:
- Small LOCA
- Small Steam Line or Feedwater Line Break
- Instrument failure
- Channel test

Automatic Action: IF pressure sensor reaches 0.5 psig, Lower Containment Vent Fans that are NOT running start and all 4 fans switch to high speed.

Immediate Action:
1. Select hi speed on all VL AHUs to prevent fan cycling.
2. IF alarm is due to small LOCA, go to AP/1/A/5500/010 (NC System Leak Within the Capacity of NV Pumps).
3. IF due to instrument failure, notify WCC SRO.
4. IF due to small steam line OR feedwater line break, attempt to isolate break and go to AP/1/A/5500/001 (Steam Leak).
5. WHEN cause of Hi Containment Pressure resolved, evaluate restoring AHUs to original selections.

Supplementary Action: Refer to Tech Specs.

References:
- Tech Specs
- Equipment Database
- NSM MG-1-2126
- PIP 0-M97-1151

End Of Response

Unit 1

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 describes 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) lower

C. (1) decrease
(2) higher

D. (1) decrease
(2) lower

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	

- [x] Developed
- [x] OPT Approved
- [x] 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:

401-9 Comments RESPONSE

Question 14 References:

From Lesson Plan OP-MC-CNT-NF pages 58 and 59:

	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
15	Given a limit and/or precaution associated with an NF System Operating Procedure, discuss its basis and applicability.		X	X	X	X
16	State the problems which will occur as a result of operating with elevated Ice condenser temperature.		X	X	X	X

Objective # 15

- Glycol and ice making solution or demineralized water must be at proper levels to rotate ice machine drums.

  Basis: The drum floats in the ice making solution. If the levels are not correct, damage to the drum or seals could occur.

- Oil must be visible in sightglass to operate NF blower.

  Basis: Operation of blower without oil showing in sightglass will result in bearing damage.

- Air filter must be in place to operate NF blower.

  Basis: This is done to prevent foreign materials from being introduced into the system.

- Maximum DP on Ice Machine Glycol Simplex Strainer is 2 psid.

  Basis: Prevent crushing of strainer

- **WHEN** isolating a portion of NF System, always allow for expansion of cold Glycol to ambient temperatures.

  Basis: Prevent over-pressurization of system components due to thermal expansion.

Objective # 16

3.1.2 Normal Operation

The ice condenser is a passive system which requires no actuation signals. To keep the ice condenser at approximately $15^{0}F$, each unit will have 30 AHUs operating to circulate air in the ice condenser, 3 or 4 operating chillers circulating glycol as cooling medium and 2 operating glycol pumps maintaining it at approximately $15^{0}F$.

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.

From Lesson Plan OP-MC-CNT-NF page 13:

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The Ice Condenser is designed to absorb thermal energy released at the time of a LOCA for the purpose of limiting initial peak pressure in containment. After the initial incident the ice condenser continues to absorb thermal energy, thus it helps to maintain a lower containment pressure for a period of time.

The ice in the Ice Condenser contains Sodium Tetraborate to help in pH control of the water (after ice melts) to enhance iodine absorption and the boron acts as a neutron poison.

1.2 General Description

The Ice Condenser region is essentially an insulated cold storage room located inside containment around the outside wall. It has inlet doors located in lower containment and upper deck doors located in upper containment. When a high energy line break inside containment occurs, the pressure increase inside lower containment will open the lower ice condenser doors causing the steam/air mixture to be forced through the ice condenser. The steam/air mixture will be cooled as it passes through the ice condenser and will be exhausted to upper containment through the intermediate and upper deck doors. After the mixture becomes a liquid it will drain back to lower containment through the refueling cavity drains or through the ice condenser floor drains.

During normal operation, the ice bed temperature is maintained by a refrigeration system which passes cold air through the ice condenser and glycol through the ice condenser floor cooling coils.

The initial ice load and make-up to the ice condenser is provided by the ice fabrication sub-system and ice conveyor sub-system. Periodic makeup is performed during plant outages due to loss of ice as a result of sublimation. This makeup is performed using ice conveyor lines which are temporally installed for this evolution.

2.0 COMPONENT DESCRIPTION

2.1 Ice Condenser Section (refer to Drawing 7.1)

2.1.1 Ice Condenser Annulus and Ice Bays

The Ice Condenser annulus (about 13 ft wide) is located between the containment vessel wall and the crane wall and covers a 300^0 arc inside containment. It has 24 bays each containing 81 ice baskets for a total of 1,944 ice baskets. Each ice basket is 48 feet high and is made up of four sections for a total of 7,776 sections. Each ice basket section is 12 feet long and 12 inches in diameter. The ice condenser is required to maintain a minimum amount of ice by Tech. Specs. The ice bed temperature is maintained at approximately 15^{0}F by the Refrigeration System.

QuestionBank #	KA_system	KA_number
1815	SYS026	A2.08

KA_desc
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)□Safe securing of containment spray when it can be done) ....

The following conditions exist on Unit 1:

- LOCA inside containment
- 1ETB has experienced a ground fault
- Auto swap to Cold Leg Recirc. has failed due to 1NI-185A (Containment Sump Isolation Valve) not opening
- Attempts to manually open 1NI-185A have failed
- Control Room has implemented ECA-1.1 (Loss of Emergency Coolant Recirc)
- Containment pressure is 12 PSIG and slowly going up

Which ONE (1) of the following describes Operator actions associated with NS system operation following the receipt of "FWST Lo Lo Level?"

A. Open 1NS-18A (A NS Pump suct from Cont Sump) and close 1NS-20A (A NS Pump Suct From FWST), '1A' NS pump remains running.

B. Secure '1A' NS pump, close 1ND-19A (1A ND pump suct. from FWST or NC), swap NS suction to Containment Sump, restart NS pump.

C. Secure '1A' NS pump, NS cannot be aligned to Containment Sump until 1NI-185A is open.

D. Secure '1A' NS pump, close 1NS-20A and open 1NS-18A, restart '1A' NS pump.

General Discussion

Distracter Analysis: Operator must know that at FWST lo lo level the NS pump must be secured. Required within 45 sec. Operator must realize that due to the physical arrangement on the piping, the 1A NS pump cannot take suction from the Containment Sump without 1NI-185A open. Also, in order to swap suction, the NS pump must be secured, suction realigned and then restarted. Additionally, 1NS-1A is interlocked with 1NI-185A such that INO-185 must be closed before 1NS-18A can be opened.

KA is matched because the candidate is given a situation where a malfunction has occurred which will impact the operators ability to place NS in a CLR alignment. The candidate must then predict the impact of this malfunction and understand how this condition will affect the ability the perform the appropriate procedure to mitigate this consequence. The NS pump will have to be secured due to this malfunction and while in ECA 1.1 with containment pressure <15 psig this would constitute a safe situation where the pump could be secured.

This is a higher cognitive level question because evaluate a given set of conditions and predict an outcome. This will require using the system knowledge and applying its meaning to predict the impact.

Answer A Discussion

Incorrect: See explanation above. Plausible: Valve alignment is correct therefore plausible, pump remains running is plausible because the ND pumps remain running during swap to CLR.

Answer B Discussion

Incorrect: See explanation above. Plausible: The actions listed are correct with the exception of closing 1ND-19A . This action is required to swap the ND pump suction to the sump, candidate could confuse this with NS suction swap

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect: See explanation above. Plausible: The actions listed would be correct if 1NI-185A were open.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Bank Question ECCNSN012

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Technical Reference(s): OP-MC-ICC-NS, rev. 30, page 15,35 and 39.

Learning Objective: OP-MC-ECC-NS, Obj. 8

Student References Provided

QuestionBank #	KA_system	KA_number
1815	SYS026	A2.08

KA_desc

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)□Safe securing of containment spray when it can be done) ....

401-9 Comments:

026A208
CAF: Do you expect the applicants to know what 1NI-185A is? If you state the valve nomenclature, would that give away the answer?
RFA 10/08/09

401-9 Comments RESPONSE

The nomenclature for 1NI-185A was added to the question during validation. The version of the question sent to the Lead Examiner did not have the nomenclature.

Question 15 References:

From Lesson Plan OP-MC-ECC-NS pages 34 and 35:

5	Describe the signals and permissives required to initiate the NS System.	X				
6	Describe the signals, setpoints, permissives, and logic required to initiate and reset NS System.		X	X	X	X
8	Describe the NS System Operation (including automatic alignments).		X	X	X	X

0.1. Abnormal and Emergency Operation

Objective #5, 6, 8

The Containment Spray System will be initiated either manually from the Control Room or on coincidence of two out of four High-High Containment Pressure signal. For either initiating signal, CPCS must be at least 0.35 psig for the discharge valves to open or for the pumps to start. Either of the train related discharge valves must also be open to allow a pump start. An "Sp" signal will start the Containment Spray Pumps and open the discharge valves to the spray headers if CPCS interlock is met. If after an "Sp" signal, the containment pressure decreases to < .35 psig the containment spray pumps are automatically turned off and the discharge valves are automatically closed. If the pressure increases after the pumps have stopped, the Containment Pressure Control System will automatically open the discharge valves at ≥ .35 psig and if pressure continues to increase CPCS will restart the pumps at ≥ 0.8 psig. This provides a deadband and prevents frequent cycling of the pumps. The pumps and valves will continue cycling, at these setpoints until the spray signal is reset.

If an "Sp" signal exists and containment pressure increases above .35 psig (opening the valves), the pumps may be manually started from the control room. The NS Pumps can be started with the pump start pushbutton any time CPCS is ≥ .35 psig and its discharge valves are open.

The Residual Heat Removal System shifts from the injection phase to the recirculation phase automatically when the Refueling Water Storage Tank level reaches the low level alarm point (180”). If the automatic switchover fails, the operator is instructed to manually switch to the recirculation.

The NS pumps are manually aligned to the containment sump by the operator when the FWST reaches the low-low level alarm point (33"). When the FWST low-low level alarm is received, the operator has about 45 seconds to stop the NS Pumps before pump vortexing (air entrainment) begins. This 45 seconds assumes that both NS Pumps are running and some conservative assumptions on vortexing phenomena. To accomplish this swap the NS start signal can be reset even if containment pressure is above 3 psig. However the Safety Injection and DG sequencer signals must be reset also to allow the stopping of the NS pumps.

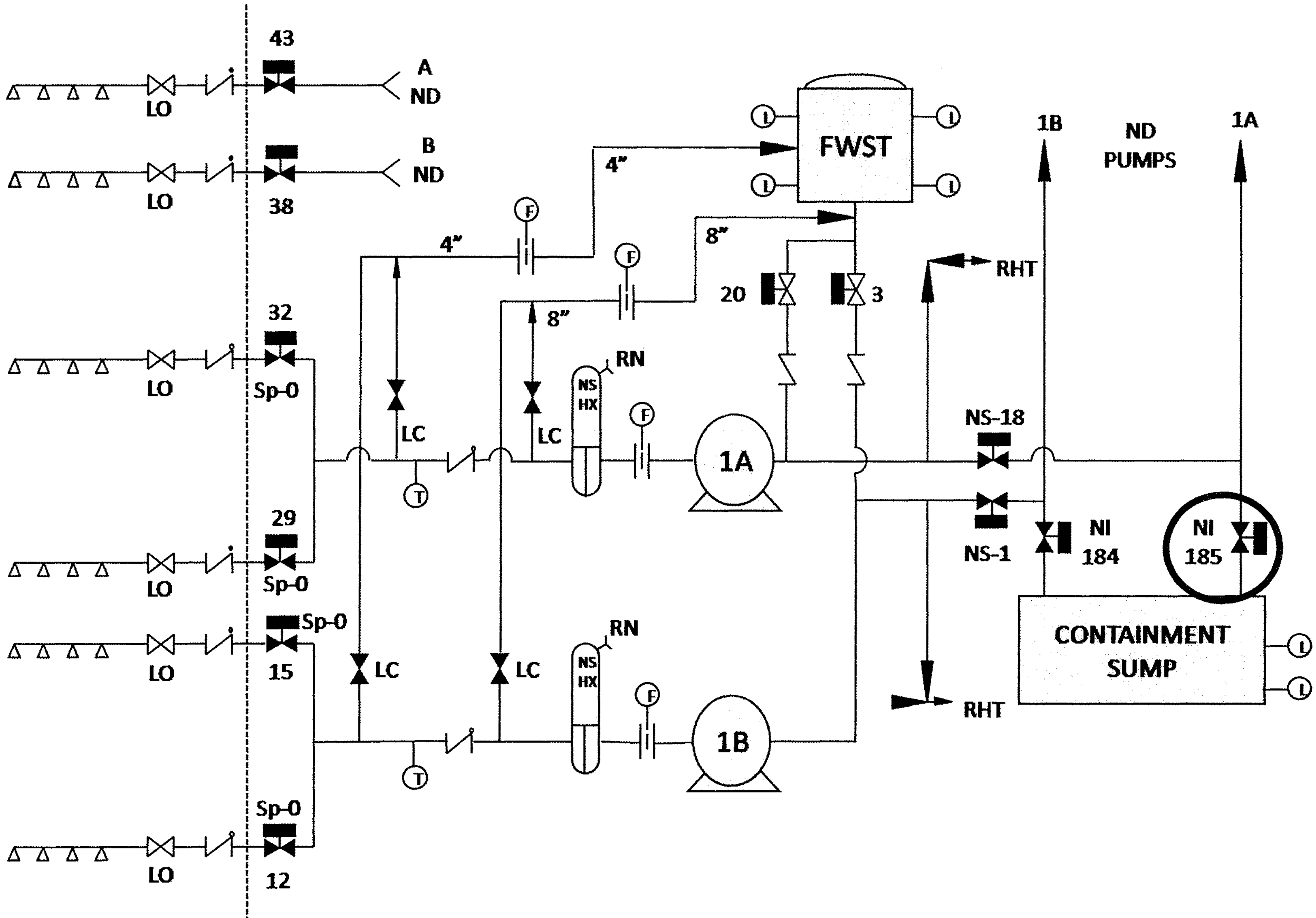
The spray flow from the Residual Heat Removal Pumps is initiated to assure adequate spray to counteract any rise in Containment pressure that might occur after all the ice has melted. FSAR Figure 6-12 shows the ice melt transient lasting about one hour.

NS System CPCS Failures (EP/1/A/5000/FR-Z.1, Enclosure 2)

Objective #3

In the event of a CPCS malfunction, some local operator actions may be required. A malfunction may require the operator to locally place valves in the desired position. Other malfunctions may require obtaining keys from the key locker, and proceeding to the CPCS Cabinet (Auxiliary Building, 750 - Train A, 733 - Train B, Electrical Penetration Room). Here the key would be used to place the appropriate control switch for the malfunctioning component in the "TEST" position. The test potentiometer would then be adjusted until the component responded as desired.

From Lesson Plan OP-MC-ECC-NS Page 39 Figure 7.1 Containment Spray (7/06/09):



MNS Bank Question ECCNSN012:

ECCNSN012

1 Pt. The following conditions exist on Unit 1:

- LOCA inside containment
- 1ETB has experienced a ground fault
- Auto swap to Cold Leg Recirc. has failed due to 1NI-185A not opening
- Attempts to manually open 1NI-185A has failed
- Control Room has implemented ECA-1.1, Loss of Emergency Coolant Recirc
- Containment pressure is 12 psig and slowly going up

Which one of the following describes the NS system operation following the receipt of "FWST Lo Lo Level?"

A. Open 1NS-18A (A NS Pump suct from Cont Sump) and close 1NS-20A (A NS Pump suct from FWST), '1A' NS pump remains running.

B. Secure '1A' NS pump, close 1NS-20A and open 1NS-18A, restart '1A' NS pump

C. Secure '1A' NS pump, close 1ND-19A (1A ND pump suct. from FWST or NC), swap NS suction to Containment Sump, restart NS pump

D. Secure '1A' NS pump, NS cannot be aligned to Containment Sump until 1NI-185A is open

Answer 48

D

Distracter Analysis: Operator must know that at FWST lo lo level the NS pump must be secured. Operator must realize that the NS pump cannot take suction from the Containment Sump without 1NI-185A open.

LEVEL: RO & SRO

KA: 026 A2.02 (4.2*/4.4*)

SOURCE: NEW

LEVEL OF KNOWLEDGE: Comprensive

AUTHOR: CWS

LESSON: OP-MC-ECC-NS

OBJECTIVES: OP-MC-ECC-NS, obj 2 & 6

OP-MC-EP-E1 OBJ 4

REFERENCES: OP-MC-ECC-NS, pages 39 & 35

QuestionBank #	KA_system	KA_number
1816	SYS026	2.2.12

KA_desc
SYS026 GENERIC□Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)

Unit 1 is at 100% RTP with the Ops Test Group (OTG) performing PT/1/A/4208/001 A (1A NS Pump Performance Test). The OTG Technician has reached the step in this PT which directs the starting of the 1A NS pump.

Which ONE (1) of the following describes the required positions of 1NS-29A (A NS Pump Disch Cont Outside Isol) and 1NS-32A (A NS Pump Disch Cont Outside Isol) AND the required system alignment for the performance of this PT?

A. Valves CLOSED
"A" Train NS system flowpath is through the HX and directly back to the pump suction.

B. Valves CLOSED
"A" Train NS system flowpath is through the HX to the FWST

C. Valves OPEN
"A" Train NS system flowpath is through the HX and directly back to the pump suction

D. Valves OPEN
"A" Train NS system flowpath is through the HX to the FWST

General Discussion

The 1A NS pump performance test is accomplished by aligning the discharge of the 1A NS pump via the normally aligned suction to the FWST. The pump discharges to the associated HX and then downstream of the HX, a manual valve alignment is performed which directs the discharge to the FWST. Full flow capability is provided and the containment isolation valves remain closed with their associated interlocks bypassed to allow pump operation.

KA is matched because the operator must be familiar with the operational alignment required to perform this surveillance procedure. The knowledge required is specific to its performance and cannot be answered with system knowledge alone.

Answer A Discussion

Plausible: first part is correct, second part is plausible because when the ND performance test is performed the flowpath is directed back to the pump suction.

Answer B Discussion

Correct

Answer C Discussion

Plausible: The containment isolation valves are interlocked such at least one must be open to allow pump start. This interlock is bypassed by this PT. Second part is plausible as described above.

Answer D Discussion

Plausible: First part is plausible as described above and the second part is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

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

Development References	Student References Provided
Technical Reference(s): OP-MC-ECC-NS, Rev. 30, page 21 PT/1/A/4208/001 A (1A NS Performance Test, Rev. 57, page 7 Learning Objective: OP-MC-ECC-NS, Obj. 6 & 8	

QuestionBank #	KA_system	KA_number
1816	SYS026	2.2.12

KA_desc
SYS026 GENERIC□Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)

401-9 Comments:

401-9 Comments RESPONSE

Question 16 References:

From PT/1/A4208/001 A page 5:

6. Limits and Precautions

6.1 IF using PT/1/A/4208/028 A (Slave Start NS Pump 1A) to start pump, venting per OP/1/A/6800/021 (1A NS Train Block Tagout) can **NOT** be performed because pump cannot be shut down from Control Room.

6.2 Only one train at a time shall be removed from service for testing.

6.3 Adequate care should be taken to prevent spraying the containment during pump testing. 1NS-29A (A NS Pump Disch Cont Outside Isol) and 1NS-32A (A NS Pump Disch Cont Outside Isol) should be operated only as directed by this procedure as the normal operational interlock on the valves (Containment Pressure Control System Interlock) is bypassed during the test.

6.4 1NS-18A (A NS Pump Suct From Cont Sump) should remain closed when high ND Pump suction pressure exists to prevent overpressurizing the NS System.

7. Required Plant Status

None

8. Prerequisite System Conditions

_____ 8.1 Ensure SRO informed that 1A NS Pump will be unavailable and inoperable for the performance of this test.

_____ 8.2 Containment pressure less than or equal to 0.35 psig.

_____ 8.3 An adequate supply of water available in the FWST for recirculation of 1A NS Pump.

_____ 8.4 IF test being performed in conjunction with PT/1/A/4208/010 A (NS 1A Heat Exchanger Heat Balance Test), NA Steps 8.5 and 8.6.

_____ 8.5 NS System aligned per OP/1/A/6200/007 (Containment Spray System).

_____ 8.6 1A NS Pump AHU capable of being supplied cooling water by RN System.

_____ 8.7 Check 1NSPG5120 (Unit 1 NS Pumps Flow To FWST) or test instrument used for this procedure in calibration.

Unit 1

12.5.2 Check the following open:

- ☐ 1NS-81 (1A NS Pump Overflow Isol)
- ☐ 1NS-54 (1A NS Pump Drn Header Isol)

NOTE: Vent time applies only to air passage and shall be measured using a calibrated stopwatch.

_____ 12.5.3 Throttle 1NS-127 (1A NS Pump Vent) to 1/4 turn and start stopwatch.

_____ 12.5.4 <u>WHEN</u> water solid, close 1NS-127 (1A NS Pump Vent).

☐ 12.5.5 Record 1A NS Pump vent time: ____________ seconds

_____ 12.5.6 <u>IF</u> vent time greater than 5 seconds, notify System Engineering.

_________________________ ______/______
Person Notified Date Time

NOTE: Steps 12.6 and 12.8 may be performed concurrently or in any order.

12.6 Establish 1A NS Pump recirculation alignment to the FWST as follows:

_____ 12.6.1 Throttle 1NS-70 (1A & 1B NS HX Outlet To FWST Throttle) to 50%.

☐ 12.6.2 Check locked closed 1NS-8 (1B NS HX Outlet To FWST Isol).

_____ CV _____ 12.6.3 Unlock and open 1NS-25 (1A NS HX Outlet To FWST Isol).

☐ 12.7 Check lock closed 1NS-165 (1A NS Test Loop Isol).

12.8 Ensure the following closed:

_____ 12.8.1 1NS-29A (A NS Pump Disch Cont Outside Isol).

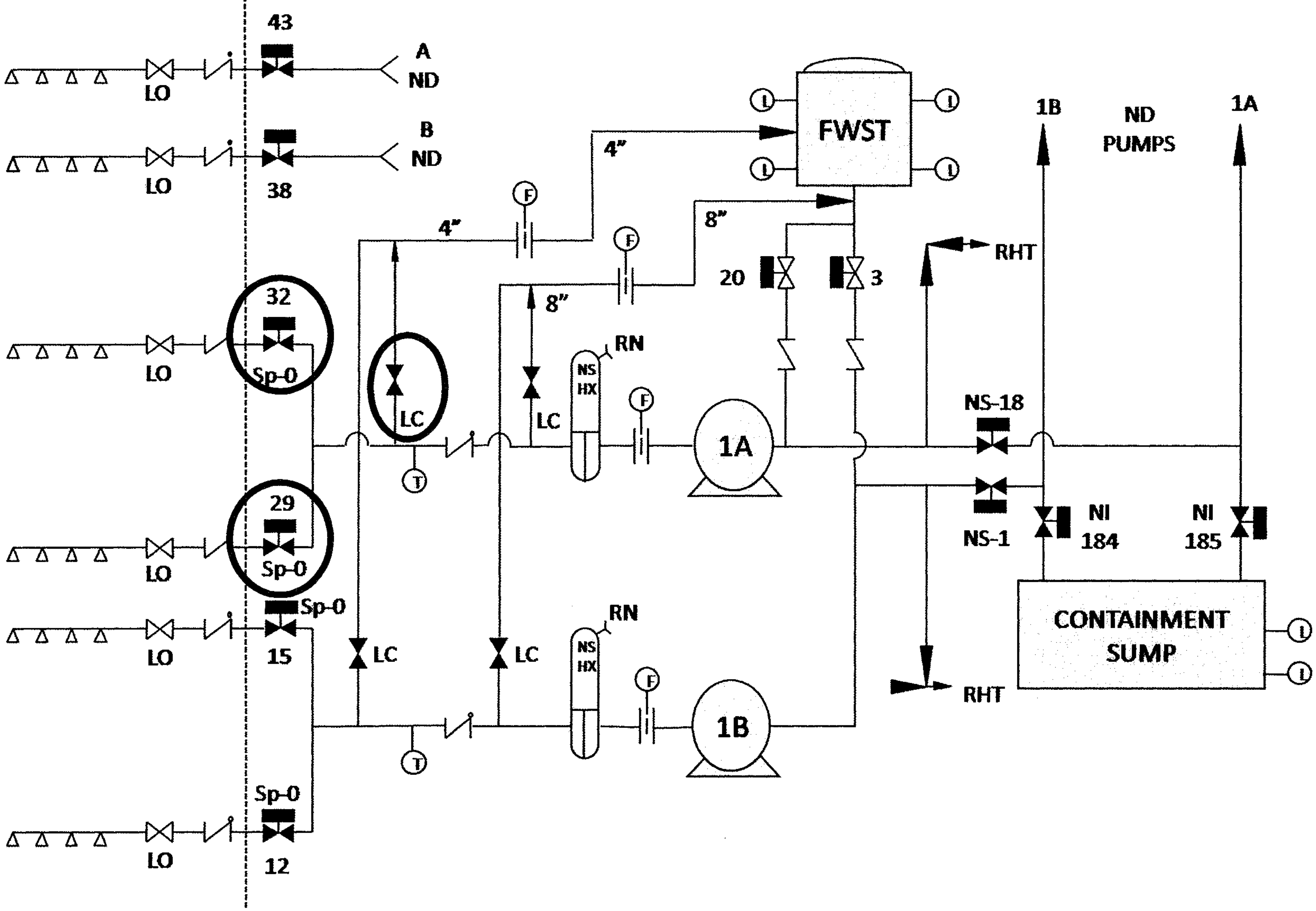
_____ 12.8.2 1NS-32A (A NS Pump Disch Cont Outside Isol).

_____ CV _____ 12.8.3 1NS-18A (A NS Pump Suct From Cont Sump).

12.9 Open the following:

- _____ CV _____ 1EMXA-R4A (1A NS Pump Suction From Cont Sump Isol Motor (1NS-18A))
- _____ CV _____ 1EMXA-R4C (1A NS HX Outlet Cont Outside Isol Motor (1NS-29A))
- _____ CV _____ 1EMXA-R4D (1A NS HX Outlet Cont Outside Isol Motor (1NS-32A))

From Lesson Plan OP-MC-ECC-NS Pa 9 Figure 7.1 Containment Spray (7/06/09):



A

QuestionBank #	KA_system	KA_number
1817	SYS039	K3.04

KA_desc
Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: (CFR: 41.7 / 45.6)□MFW pumps

Given the following:

- Unit 1 is at 100% RTP
- Due to a severe packing leak, the Plant SRO decides to close 1SP-1 (MAIN STEAM TO 1A CF PUMP TURB ISOL)

Assuming no additional operator actions are taken, what would be the effect of this action on the 1A FWPT operation?

The 1A FWPT would:

A. remain in operation supplied by MSR exhaust <u>ONLY</u>.

B. remain in operation but the steam supply would swap to Aux Steam <u>ONLY</u>.

C. remain in operation but the steam supply would now be a combination of Aux Steam <u>AND</u> MSR exhaust.

D. slow down and back out of the header due to the loss of its primary steam supply for full power operation.

General Discussion

The low pressure governor valve opens first and is supplied by the Auxiliary Steam System until the Moisture Separators Reheater (MSR) steam has sufficient capacity to supply which occurs above 80% power. The high-pressure governor is supplied by the Main Steam System and is used when the low-pressure governor is not able to meet the demand. High-pressure steam will be supplied automatically if low-pressure stream cannot maintain turbine speed. At 100% RTP the FWPT steam supply is from MSR exhaust only with the HP governor valves completely closed. With the given power level, closure of 1SP-1 would have no effect on FWPT operation. Aux Steam is normally isolated at 100% power but is the primary steam supply at low power levels.

KA is matched because the candidate is being asked to evaluate the loss of the main steam supply to a operating main feed pump with the plant operating at 100%.

This is a higher cognitive level question because the candidate must evaluate a given plant condition, evaluate a change in plant lineup and predict an outcome.

Answer A Discussion

Correct.

Answer B Discussion

Plausible because AS is the primary steam supply at lower power levels and AS pressure is high enough to provide this function but procedurally not aligned at high power.

Answer C Discussion

Plausible because this would be true at lower power levels.

Answer D Discussion

Plausible because at intermediate power levels 20% to 80% power this would be a true statement.

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): OP-MC-MT-MSR Rev 17 Pg 17 Learning Objective: OP-MC-MT-MSR Obj. 2	

QuestionBank #	KA_system	KA_number
1817	SYS039	K3.04

KA_desc
Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: (CFR: 41.7 / 45.6)□MFW pumps ....

401-9 Comments:

401-9 Comments RESPONSE

Question 17 References:

From Lesson Plan OP-MC-MT-MSR pages 12 and 13:

2	Describe the flowpaths for the Moisture Separator Reheaters including the following: • MSR shell side. • First Stage Reheater (Low Pressure) and Drain System. • Second Stage Reheater (High Pressure) and Drain System. • FWPT A and B.	X	X	X	X	

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The Moisture Separator Reheater (MSR) System is designed to take the high pressure turbine exhaust, remove the entrained moisture, provide heating through the first and second stage reheaters and supply moisture free, superheated steam to the low pressure turbines to improve efficiency and reduce maintenance on the low pressure turbine blading by reducing the low pressure turbine exhaust moisture.

The MSR shell and the first and second stage reheater tube bundle drains are then returned to the condensate cycle, which improves cycle efficiency.

1.2 General Description

At full power, exhaust steam exits the high pressure turbine at about 176 psia and 14% moisture content and flows to the Moisture Separator Reheaters (MSR's). The steam is first passed through a moisture (chevron) separator where approximately 10 percent of the flow is extracted as moisture and drained to a drain tank. The remaining 90 percent flows up through a two-stage steam-heated reheater where steam quality is increased and temperature is raised to approximately 150°F superheat. From high pressure turbine exhaust to low pressure turbine inlet, there is a pressure loss of approximately 8 to 9 psi at full power.

Objective # 2

A steam supply is provided for operation of the Turbine Driven Main Feedwater Pumps from the reheated steam prior to entering the low pressure turbines. Once turbine load is approximately 80%, the steam exiting “A1” and “B1” MSR's is the source of steam for the main feedwater pump turbines through the LP stop/governor valves.

2.0 COMPONENT DESCRIPTION

Objective # 6

In order to prevent turbine overspeed as a result of backflow or flashback, the first stage steam supply from “A” heater bleed, the MSR drain tank inlets and outlets and the first and second stage drain tank outlets are equipped with **piston operated check valves**. There are different types of these valves used in the MSR system.

One type, when supplied with air (open demand) a piston moves to compress the spring and fully open the valve. The valve is held in the open position. If flow were to reverse, the valve would close against actuator air pressure.

From Lesson Plan OP-MC-CF-CF page 17:

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The purpose of the Main Feedwater system is to take treated Condensate (CM) System water, heat it further to improve the plant's thermal efficiency, and deliver it at the required flow rate, pressure and temperature to the steam generators. The CF System is designed to maintain proper S/G water levels with respect to reactor power output and turbine steam requirements

The CF System provides feedwater isolation (FWI) to containment if a FWI signal is generated.

1.2 General Description

Objective # 2

Student will be required to draw a simplified system diagram as shown on Drawing 7.1. The Feedwater System begins at the Main Feedwater (CF) Pump suction header. The CF pumps discharge to the High Pressure Heaters (A1, A2, A3 and B1, B2, B3) where reclaimed steam from the Moisture Separator Heaters and High Pressure Turbine extraction steam is used to increase feedwater temperature from 360°F to 440°F. The flow continues from the HP heaters through the feedwater control valves, containment isolation valves to the steam generators. The steam generators are used to produce steam for use in the main turbine and other auxiliary loads.

2.0 COMPONENT DESCRIPTION

2.1 Main Feedwater Pumps

Objective # 3

There are two 50% capacity feedwater pumps driven by two 50% capacity variable speed turbines (refer to Drawing 7.2). **The main feed pumps increase system pressure from approx. 400 psig at its suction to approx. 1200 psig at its discharge at 100% power.** High and low-pressure governor valves control the turbine speed. The low pressure governor valve opens first and is supplied by the Auxiliary Steam System until the Moisture Separators Reheater (MSR) steam has sufficient capacity to supply which occurs above 80% power. The high-pressure governor is supplied by the Main Steam System and is used when the low-pressure governor is not able to meet the demand. High-pressure steam will be supplied automatically if low-pressure stream can not maintain turbine speed. A check valve is provided in the low-pressure supply to prevent reverse flow from the high-pressure turbine. For more information on the Main Feedwater Pump Speed control, refer to lesson plan OP-MC-CF-IWE.

C

QuestionBank #	KA_system	KA_number
1818	SYS059	K3.02

KA_desc
Knowledge of the effect that a loss or malfunction of the MFW will have on the following: (CFR: 41.7 / 45.6)□AFW system

Given the following conditions on Unit 1:

- Unit is in Mode 3
- NC pressure is 1940 PSIG
- CA auto start defeat "Defeated" lights are lit.

The following sequence of events occur on Unit 1 while in Mode 3:

1. A CF isolation occurs on S/G Hi-Hi level
2. The S/G Hi-Hi level clears
3. CF isolation is reset
4. T-ave increases and NC pressure increases to 1960 PSIG

Which ONE (1) of the following describes when (if at all) any CA pump(s) should have automatically started?

A. Following the CF isolation reset

B. When the S/G Hi-Hi level cleared

C. When pressure increased above 1955 PSIG

D. Should have remained off for these events

General Discussion

With both CF Pumps tripped, the CA Pumps would normally start. However, the CA Pump auto start has been defeated as evidenced by the "Defeated" lights being lit. When pressure increase above P-11 (1955 psig), the auto start defeat will be automatically unblocked and the CA Pumps will auto start.

The K/A is matched since the applicant must know how the Feedwater Isolation (loss or malfunction of the MFW) will affect the operation of the AFW system (i.e. AFW auto start).

Answer A Discussion

Incorrect: defeated by CA auto start defeat
Plausible: could result in a CA pump start

Answer B Discussion

Incorrect: defeated by CA auto start defeat
Plausible: normally true

Answer C Discussion

Correct answer The auto start defeat will Auto RESET when above P-11 and can be manually RESET at any time.

Answer D Discussion

Incorrect: auto resets
Plausible: candidate does not recall the signal auto resets above P-11

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2003 CNS NRC Q29 (Bank 229)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CF-CA, Objectives 4 & 6 Pages 13 and 15	

QuestionBank #	KA_system	KA_number
1818	SYS059	K3.02

KA_desc

Knowledge of the effect that a loss or malfunction of the MFW will have on the following: (CFR: 41.7 / 45.6)□AFW system

401-9 Comments:

059K302
Choice "C": Change P-11 to 1960 psig. This way they have to know what pressure P-11 is. This will increase plausibility and make the answer less obvious
RFA 10/08/09

401-9 Comments RESPONSE

Lead Examiner suggested changing C to say "above 1960 PSIG" instead of "above P-11". Changed to "above 1955 PSIG" since this is where the actuation would really occur. Can't say "above 1960 PSIG" since the actuation would have already occurred.

Question 18 References:

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The auxiliary feedwater system is provided as a backup for the main feedwater system. **It is designed as a means to dissipate heat from the Reactor Coolant System when normal systems are not available. The auxiliary feedwater system may also be used in normal plant startup and shutdown, as main feedwater, when the flow is less than 3% maximum design feedwater flow.**

1.2 General Description

Objective # 2

Refer to Figure 7.1, 7.2, 7.3, 7.13. The CA system assures required feedwater flow to the steam generators for reactor coolant thermal energy dissipation when the CF system is not available through loss of power or other malfunctions. The CA system is required to operate until normal feedwater flow is restored or until the reactor coolant temperature is lowered to the point where the ND system can be utilized. The CA system is designed to start automatically for any event requiring emergency feedwater. Since the CA system is the only source of makeup water to the steam generators for reactor coolant heat removal when the main feedwater system becomes inoperable, it has been designed with redundancy and diversity. The CA system contains two motor driven pumps and one steam turbine driven pump for each unit.

2.0 COMPONENT DESCRIPTION

2.1 Motor Driven CA Pumps

Objective # 4, 7, 8

The motor driven CA pumps are powered from essential power, ETA (pump A) and ETB (pump B). 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.”

Refer to Figure 7.12. **The auto-start signals for the CA Motor Driven pumps are:**

- **2/4 detectors low-low level in any one SG (17%)**
- **Trip of both Main Feedwater pumps**
- **AMSAC**
  - **Both Feedwater pumps tripped**
  - **Loss of flow to 3/4 SGs**
- **S_S signal**
- **Blackout signal**

QuestionBank #	KA_system	KA_number
229	SYS061	A2.05

KA_desc
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)□Automatic control malfunction ....

Unit 1 is in mode 3. NC pressure is 1940 psig. CA auto start defeat "Defeated" lights are lit.

The following sequence of events occur on unit 1 while in mode 3:

1. CF isolation and the running CFPT trips on S/G Hi-Hi level
2. The S/G Hi-Hi level clears
3. CF isolation is reset
4. T-ave increases and NC pressure increases to 1960 psig

Which of the following correctly explains when (if at all) any CA pump(s) should have automatically started?

A. Following the CF isolation reset.

B. When the S/G Hi-Hi level cleared.

C. When pressure increased above P-11.

D. The CA pumps have remained off for these events.

General Discussion

Tests the candidates' knowledge of the low suction pressure protection circuitry when the CA has been reset.

Answer A Discussion

Incorrect: defeated by CA auto start defeat
Plausible: could result in a CA pump start

Answer B Discussion

Incorrect: defeated by CA auto start defeat
Plausible: normally true

Answer C Discussion

Correct answer The auto start defeat will Auto RESET when above P-11 and can be manually RESET at any time.

Answer D Discussion

Incorrect: auto resets
Plausible: candidate does not recall the signal auto resets above P-11

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	Bank Question: 592.1

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References

Lesson Plan Objective: CA Obj: 9
References:
1. OP-CN-CF-CA pages 10 and 11

Student References Provided

QuestionBank #	KA_system	KA_number
229	SYS061	A2.05

KA_desc

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)□Automatic control malfunction ....

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1819	SYS059	K3.03

KA_desc
Knowledge of the effect that a loss or malfunction of the MFW will have on the following: (CFR: 41.7 / 45.6)□S/GS

Given the following conditions on Unit 1:

- Unit 1 is operating at 60% RTP
- Channel 41 of Nuclear Instrumentation fails to 120%
- “PR TO S/G PROGRAM LEVEL CHANNEL DEFEAT” switch is in the "Normal" position

Which ONE (1) of the following describes the effect this failure will have on the S/G level control system?

A. The feedwater regulating valves on "A" and "D" S/G will open to increase the levels to 65% since NI Channel 41 is now the controlling channel for these S/G's.

B. The feedwater regulating valves will remain in the same position for all S/G's. Trip program for "A and "D" S/G's will increase.

C. All feedwater regulating valves will open to feed all S/G levels to 65%. Since the programmed level is a "High Select" circuit, Channel 41 will be controlling.

D. The feedwater regulating valves on "B" and "C" S/G will open to increase the levels to 65% since NI Channel 41 is now the controlling channel for these S/G's.

General Discussion

With the Unit initially at 60% power, the S/G program will maintain S/G levels at approximately 55%. When N41 fails high, it becomes the "High Select" controlling channel for 1A and 1D S/G level programs. The program level for A and D S/Gs will now be the 100% RTP program level or 65% NR S/G level. Therefore the feed reg valves on A and D will open to increase level to the new program level.

This question matches the KA in that a malfunction of the Main Feedwater System has occurred (Feedwater Regulating Valves opening) as a result of the failure of N41 (a malfunction of the S/G Level Control portion of the Main Feedwater System). This malfunction results in an increase in S/G levels (the affected component).

This question is Comprehension level because the applicant must associate two pieces of information (one given and one recalled from memory) to correctly answer the question. The given information is that N41 has failed high. From memory, the applicant must recall that S/G A and D program levels are controlled by the High Select of N41 and N43.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Plausible if the S/G Level Program Select switch were in the "Defeat 41/43" Position.

Answer C Discussion

Incorrect. Plausible if the S/G Level Program Select switch were in the "Defeat 42/44" Position.

Answer D Discussion

Incorrect. Plausible if the applicant does not understand which S/G level programs are controlled by which NIs.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Exam Bank Question #ACFIFER07

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CF-IFE Objective 6 & 10, pages 19 and 21.	

QuestionBank #	KA_system	KA_number
1819	SYS059	K3.03

KA_desc

Knowledge of the effect that a loss or malfunction of the MFW will have on the following: (CFR: 41.7 / 45.6)□S/GS

401-9 Comments:

401-9 Comments RESPONSE

Question 19 References:

Steam Generator Level Error

Purpose is to provide a level error signal based upon the difference between program level (based upon nuclear power) and actual level.

Objective #6 & #10

Program Level

The programmed Level Setpoint is calculated for each steam generator as a function of nuclear power (Refer to Figure 2, Nuclear Power High Select Circuit, below). The nuclear power signal is derived from the Nuclear Instrumentation System power range channels. Channels N-41/ 43 (auctioneered high) provide S/G A&D program and Channels N-42/ 44 (auctioneered high) provide S/G B&C program. This is provided the 'PR TO SG PROGRAM LEVEL CHANNEL DEFEAT' select switch is in the 'NORMAL' position. If the need arises, Channels N-41/43 can feed all four S/G level programs, by going to the 'Defeat 42-44' position, or Channels N-42/44 can feed all four S/G programs by going to the 'Defeat 41-43' position.

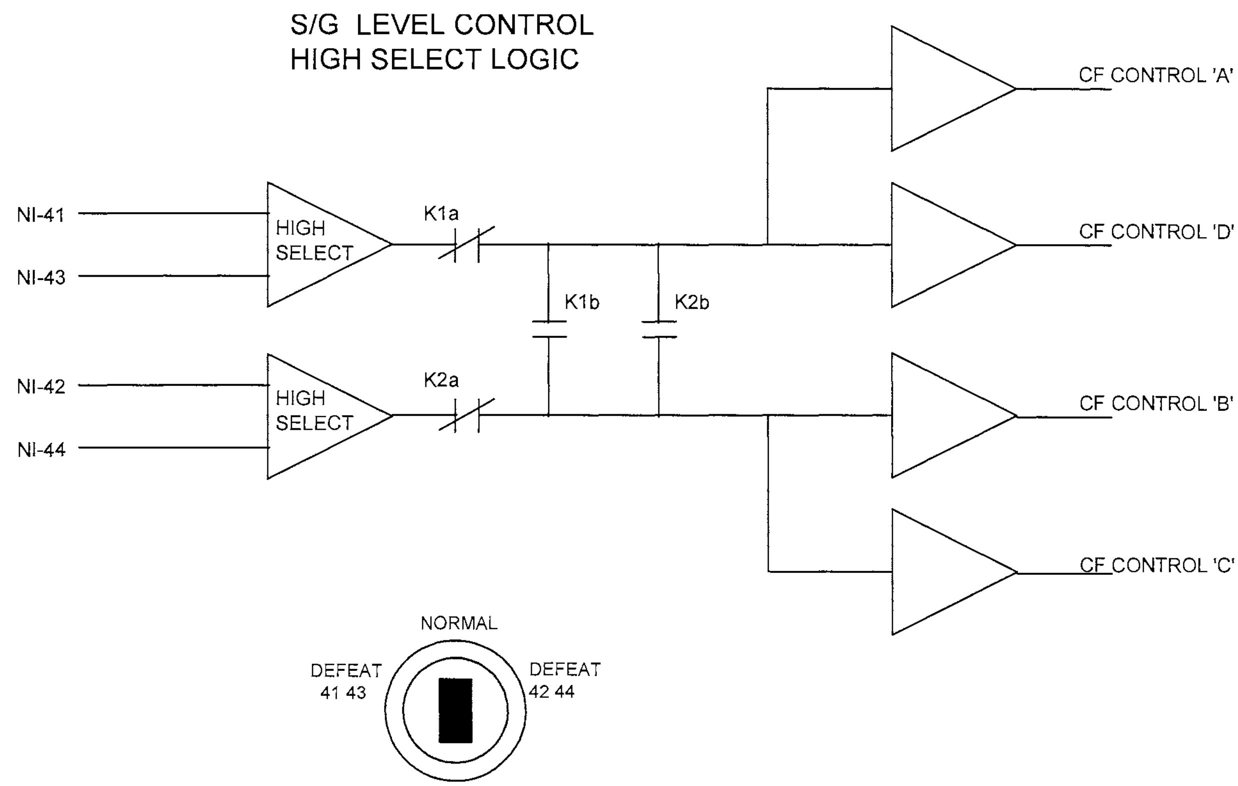
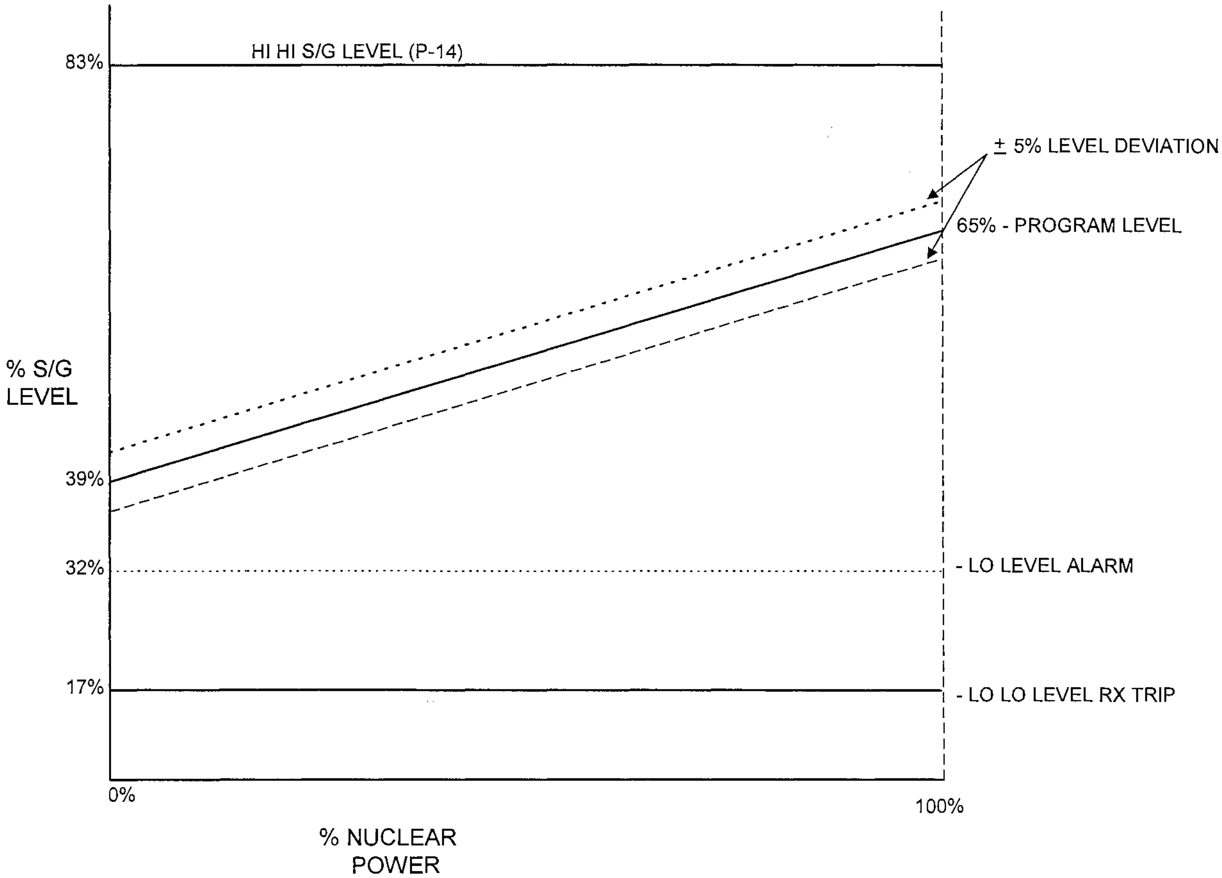


FIGURE 2, NUCLEAR POWER HIGH SELECT CIRCUIT (MC-CF-IFE-2) 3/31/95

The programmed level setpoint is recorded on a 3 pen recorder along with the two WR levels for the two S/Gs that the setpoint is applicable to. For example, one recorder would have 'A' & 'D' WR levels and the programmed level setpoint used for 'A' & 'D' S/G. The programmed level setpoint, as a function of nuclear power, is shown below on Figure 3, S/G Level Program.



MNS Exam Bank Question ACFIFER07:

ACFIFER07

1 Pt

With Unit 1 at 60% RTP, Channel 41 of Nuclear Instrumentation fails to 120%. If the S/G level program select switch is in the "Normal" position, which of the following describes the effect this failure will have on the S/G level control system?

A. The feedwater regulating valves on "A" and "D" S/G will open to increase the levels to 65% since NI Channel 41 is now the controlling channel for these S/G's

B. The feedwater regulating valves will remain in the same position for all S/G's. Trip program for "A and "D" S/G's will increase

C. All feedwater regulating valves will open to feed all S/G levels to 65%. Since the programmed level is a "High Select" circuit, Channel 41 will be controlling

D. The feedwater regulating valves on "B" and "C" S/G will open to increase the levels to 65% since NI Channel 41 is now the controlling channel for these S/G's

Answer 31

A

CF-IFE, section 2.2.2

QuestionBank #	KA_system	KA_number
1820	SYS061	K1.01

.\A_desc
Knowledge of the physical connections and/or cause-effect relationships between the AFW and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)□S/G system ....

Given the following on Unit 2:

- A reactor trip from 100% RTP has occurred
- The TD CA pump tripped on overspeed upon starting
- Bus 2ETA locked out

Which ONE (1) of the following describes which S/Gs are currently being fed and the associated flow rates?

A. A and B S/Gs at 450 GPM total flow

B. C and D S/Gs at 450 GPM total flow

C. A and B S/Gs at 450 GPM to each S/G

D. C and D S/Gs at 450 GPM to each S/G

General Discussion

The Turbine Driven CA pump is tripped. If it were running it would feed all 4 S/Gs. 1A CA Pump normally feeds S/Gs 1A and 1B. 1B CA Pump normally feeds S/Gs 1C and 1D. With the loss of power to Emergency Bus 1ETA, the 1A CA Pump will not be running. Therefore, only 1B CA Pump will be running feeding 1C and 1D S/Gs.

Each motor driven CA Pump is capable of supplying two S/Gs at a design total flow rate of 450 GPM.

The K/A is matched because the applicant must know both the physical connections (i.e. which S/Gs are fed by which CA pumps) and the cause-effect relationship (i.e. the effect of the TD CA pump and 2ETA lockout) as a result of the malfunctions related to the CA system.

This is a comprehension level question because the applicant must associate mulitple pieces of information, some given and some recalled from memory. First, the candidate must recall that with Emergency Bus 1ETA locked out, the 1A MDAFW pump will be unavailable. The candidate must then recall which S/Gs are fed from each MDAFW pump. The applicant must also recall that the rated flow for the MDAFW pumps

Answer A Discussion

Incorrect. Plausible if the applicant does not recall which S/Gs are fed by each MDAFW pump. The flowrate is correct.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Plausible if the applicant does not recall which S/Gs are fed by each MDAFW pump. Also, the flowrate number is correct but it is total flow and not flowrate to each S/G.

Answer D Discussion

Incorrect. The S/Gs supplied are correct and the flowrate numerical value is correct but it is total flowrate and not flowrate to each S/G.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 NRC Q21 (CNS NRC Bank 98)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CF-CA Objectives 4, 7, & 8 page 13	

QuestionBank #	KA_system	KA_number
1820	SYS061	K1.01

KA_desc

Knowledge of the physical connections and/or cause-effect relationships between the AFW and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)□S/G system ....

401-9 Comments:

401-9 Comments RESPONSE

Question 20 References:

From Lesson Plan OP-MC-CF-CA page 13:

1.0 INTRODUCTION

1.1 Purpose

Objective # 1

The auxiliary feedwater system is provided as a backup for the main feedwater system. **It is designed as a means to dissipate heat from the Reactor Coolant System when normal systems are not available. The auxiliary feedwater system may also be used in normal plant startup and shutdown, as main feedwater, when the flow is less than 3% maximum design feedwater flow.**

1.2 General Description

Objective # 2

Refer to Figure 7.1, 7.2, 7.3, 7.13. The CA system assures required feedwater flow to the steam generators for reactor coolant thermal energy dissipation when the CF system is not available through loss of power or other malfunctions. The CA system is required to operate until normal feedwater flow is restored or until the reactor coolant temperature is lowered to the point where the ND system can be utilized. The CA system is designed to start automatically for any event requiring emergency feedwater. Since the CA system is the only source of makeup water to the steam generators for reactor coolant heat removal when the main feedwater system becomes inoperable, it has been designed with redundancy and diversity. The CA system contains two motor driven pumps and one steam turbine driven pump for each unit.

2.0 COMPONENT DESCRIPTION

2.1 Motor Driven CA Pumps

Objective # 4, 7, 8

The motor driven CA pumps are powered from essential power, ETA (pump A) and ETB (pump B). 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."

Refer to Figure 7.12. **The auto-start signals for the CA Motor Driven pumps are:**

- **2/4 detectors low-low level in any one SG (17%)**
- **Trip of both Main Feedwater pumps**
- **AMSAC**
    - **Both Feedwater pumps tripped**
    - **Loss of flow to 3/4 SGs**
- **S_S signal**

- Blackout signal

QuestionBank #	KA_system	KA_number
98	SYS061	K6.02

KA_desc
Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: (CFR: 41.7 / 45.7)□Pumps

Given the following on Unit 2:

- A reactor trip from 100% power has occurred.
- The TD CA Pump tripped on overspeed upon starting.
- Bus 1ETA locked out.

Assuming NO action has been taken, which one of the following describes which S/Gs are currently being fed and the approximate magnitude of total flow?

A. A and B S/Gs at GREATER than 450 gpm.

B. C and D S/Gs at GREATER than 450 gpm.

C. A and B S/Gs at LESS than 450 gpm.

D. C and D S/Gs at LESS than 450 gpm.

General Discussion

Answer A Discussion

A is incorrect. A and B S/Gs are supplied by "A" MD CA Pump, which is not running if 1ETA is dead

Answer B Discussion

Answer C Discussion

C is incorrect. Wrong S/Gs and 1 CA Pump will provide Heat Sink of >450

Answer D Discussion

D is incorrect. Correct S/Gs, but wrong capacity

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References	Student References Provided
CFCA3	

QuestionBank #	KA_system	KA_number
98	SYS061	K6.02

KA_desc
Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: (CFR: 41.7 / 45.7)□Pumps ....

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1821	SYS062	K4.10

KA_desc
Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)□Uninterruptable ac power sources ....

Given the following conditions:

- The loads supplied by Static Inverter 1KU are being supplied by their alternate power source due to an automatic transfer on low inverter output voltage.

Which ONE (1) of the following describes the response of the Auxiliary Control Power system when inverter voltage is restored to normal?

A. No response, loads must be manually restored to the inverter.

B. No response, the alternate power source must be deenergized and the loads will then auto swap back to the inverter.

C. Loads will auto swap back to the inverter if the inverter voltage remains stable for 30 seconds.

D. Loads will auto swap back to the inverter as soon as inverter voltage returns to normal.

General Discussion

The static automatic transfer switch will automatically swap auxiliary control power from its alternate source back to the inverter is the condition that caused the auto-swap has cleared (in this case low voltage) and conditions are stable for 30 seconds.

This KA is met because the applicant must understand the system design features which provide for automatic transfer of auxiliary control power from its normal source (static inverter) to its backup source and vice versa.

Answer A Discussion

Incorrect. Plausible because in some cases loads must be manually transferred back to their normal power supply.

Answer B Discussion

Incorrect. Plausible because loads will automatically transfer back to normal power supply. However, the alternate source does not have to be de-energized to cause this to happen.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible because the loads will automatically transfer back to the inverter when voltage is returned to normal. However, the inverter voltage must be stable for 30 seconds instead of 3 seconds.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank Question ELEPK032

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

Development References	Student References Provided
Lesson Plan OP-MC-EP-EPK Objective 16 pages 25 and 27.	

QuestionBank #	KA_system	KA_number
1821	SYS062	K4.10

KA_desc

Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)□Uninterruptable ac power sources ....

401-9 Comments:

401-9 Comments RESPONSE

Question 21 References:

From Lesson Plan OP-MC-EL-EPK pages 25 and 27:

0.1. 125 VDC Auxiliary Control Power Distribution Centers (DCA, DCA-1, DCA-2, DCB, DCB-1 and DCB-2)

Distribution centers DCA-1(2) and DCB-1(2) are fed from DCA and DCB respectively. Each of the distribution centers receive power from a battery and/or a battery charger, and supplies power to their associated DC loads.

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 were 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).

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 <u>thirty (30) seconds</u>. However, a manual transfer of the Static Switch using the "Alternate AC Source to Load" push button on the front of the Static Switch Panel will require the operator to depress the "Inverter to Load" push-button to re-transfer back to the normal ("Inverter Supplying Load") position.

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.**

Manual bypass switch associated with KXA, KXB and SKX has three positions:

- Normal – aligns inverter output through static transfer switch to load
- Inverter to Load – aligns output to bypass static transfer switch to load
- Alternate AC Source to Load – aligns alternate AC source to the load, bypassing inverter and static transfer switch

Bank Question ELEPK032:

ELEPK032

1 Pt Given the following conditions:

- The loads supplied by Static Inverter 1KU are being supplied by their alternate power source due to an automatic transfer on low inverter output voltage.

Which ONE (1) of the following describes the response of the Auxiliary Control Power system when inverter voltage is restored to normal?

A. No response, loads must be manually restored to the inverter.

B. No response, the alternate power source must be deenergized and the loads will then auto swap back to the inverter.

C. Loads will auto swap back to the inverter if the inverter voltage remains stable for 30 seconds.

D. Loads will auto swap back to the inverter if the inverter voltage remains stable for 3 seconds.

Answer 119

C

EL-EPK, section 2.4

Objective 16

C

QuestionBank #	KA_system	KA_number
1822	SYS063	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□Major DC loads ....

Which ONE (1) of the following receives power from 250VDC Auxiliary Power System?

A. D/G Fuel Oil Booster Pump

B. Reactor Trip Switchgear Control

C. Turbine Emergency Bearing Oil Pump

D. Power Operated Relief Valves Solenoids (both NC and SV systems)

C

General Discussion

All loads are DC loads, D/G booster pump comes from 1DGDA. And rx trip switchgear and PORVs come from 125VDC vital

The K/A is matched because the applicant is required to know and differentiate from memory the power supplies to major DC components.

Answer A Discussion

Incorrect. Plausible because it is supplied by DC power.

Answer B Discussion

Incorrect. Plausible because it is supplied by DC power.

Answer C Discussion

CORRECT

Answer D Discussion

Incorrect. Plausible because it is supplied by DC power.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	2008 CNS NRC Q48 (Bank 554)

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

Development References	Student References Provided
Lesson Plan OP-MC-EL-EPJ Objective 4	

QuestionBank #	KA_system	KA_number
1822	SYS063	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□Major DC loads ....

401-9 Comments:

401-9 Comments RESPONSE

Question 22 References:

From Lesson Plan OP-MC-EL-EPJ pages 12 and 13:

4	List the typical loads powered by the 250 VDC Auxiliary Power System.	**X**	**X**	**X**	**X**	

2.4 250 VDC Deadlight Panelboards and Motor Load Power Supplies

Objective # 4

The following is a listing of the deadlight panelboards and their service location(s):

Deadlight Panelboard	Service Location
1DLA	Service Building, Control Room, and the Equipment Room.
1DLB	Auxiliary Building and Unit 1 Diesel Rooms.
1DLC	Turbine Building Unit 1
*1DLD	Reactor Building Unit 1
*1DLE	Administration Building
2DLA	Service Building, Control Room, and the Equipment Room.
2DLB	Auxiliary Building and Unit 2 Diesel Rooms.
2DLC	Turbine Building Unit 2
*2DLD	Reactor Building Unit 2

* These loads are shed 90 minutes after a Loss of all AC Power along with other DC motor loads to extend the capability of supplying the Generator Air-side Seal Oil Backup Pump.

Note: *These deadlight panelboards provide a dc power source for plant lighting in the event that our ac power source is removed. Deadlight relays, attached to various essential and non-essential power panelboards throughout the plant, will sense the loss of their ac power source and transfer to the dc power source. This is done to enhance personnel safety in the event of a loss of normal power.*

Objective # 4

DC motors fed from 1DP and 2DP are:

- **Turbine Backup Vapor Extractor(s)**
- **Turbine Emergency Bearing Oil Pump(s)**
- **Generator Air-side Seal Oil Backup Pump(s)**
- **FWPT A Emergency Oil Pump(s)**
- **FWPT B Emergency Oil Pump(s)**

From Lesson Plan OP-MC-DG-DGA page 73:

There is also a breaker on the MCC, which sends a 600 VAC supply to the diesel Battery Charger. The charger converts the 600 VAC to 125 VDC. Connected in parallel to the charger is a 125 VDC battery bank used as a backup. The battery bank will automatically assume all DC loads without assistance upon a loss of the charger. The charger and battery outputs go to various 125 VDC loads. A list of those loads are as follows:

- *Electronic Governor*
- *Voltage Regulator (field flashing)*
- *Speed Switches*
- *Starting Air Solenoid Valves*
- *Diesel Control Panel*
- *Fuel Oil Booster Pump*

Each of the items listed above share a common supply breaker (Diesel Generator Control Power) except the Fuel Oil Booster Pump, which has a separate supply breaker. If the Diesel Generator Control Power breaker is opened, the diesel is then inoperable and unable to be started.

3.0 SYSTEM OPERATION

Objective # 55

3.1 Limits and Precautions

OP/0/A/6550/10A, Diesel Generator Fuel Oil Receiving

RP/0/A/5700/022, Spill Response Procedure, is controlling procedure for oil spills

Basis: Fire hazard concern.

Smoking, sparks, or open flame is prohibited around Fuel Oil.

Basis: Fire hazard concern.

When receiving Fuel Oil, an Operator must be present at all times.

Basis: To ensure proper valve alignment to the correct fuel tank and to prevent spills.

AD and FD Systems are Level III cleanliness area per NDS 104, Material Condition/Housekeeping, Cleanliness and Foreign Material Exclusion and Seismic Concerns.

Basis: To ensure no Foreign Material or other contaminants enter the Diesel Fuel Oil System.

When receiving Fuel Oil, extreme caution shall be used (PIP M-97-04581 and M-97-03563)

From AP-15:

6. **NC System:**

__ • NCP UF-UV Monitor Panel 1A loses power, and all Reactor trip bistables actuate.

__ • 1NC-25A (RX Head Gasket Leakoff Drn Blk) fails open.

• The following valves fail closed:

__ • 1NC-34A (PZR PORV)– Both "LOW PRESS" and "NORMAL" mode affected.

__ • 1NC-58A (PRT Spray Supply Block)

__ • 1NC-107A (PRT Drain)

__ • 1NC-272AC (U1 A Train Head Vent to PRT Isol)–Control from SSF is unaffected if Distribution Center 1EVDA-1 is swapped to its alternate power supply.

__ • 1NC-273AC (U1 A rain Head Vent to PRT Isol)– Control from SSF is unaffected if Distribution Center 1EVDA-1 is swapped to its alternate power supply.

7. **ND System:**

__ • 1ND-29 (1A ND Hx Outlet Isol) fails open.

8. **NF System:**

• The following valves fail closed:

__ • 1NF-228A (U1 Ice Cond AHUS Glycal Supply Hdr Cont Outside Isol)

__ • 1NF-234A (U1 Ice Cond AHUS Glycal Return Hdr Cont Outside Isol).

9. **NS System:**

__ • 1NSSV5551 (Unit 1 Cont NR Press Outside Isol) fails closed.

15. **SB System:**

__ • All Condenser Steam Dump valves fail closed.

16. **SM System:**

- The following valves fail closed:

__ • 1SM-1AB (1D Main Steam Isol)

__ • 1SM-3ABC (1C Main Steam Isol)

__ • 1SM-5AB (1B Main Steam Isol)

__ • 1SM-7AB (1A Main Steam Isol)

__ • 1SM-9AB (1D Main Steam Isol Bypass)

__ • 1SM-10AB (1C Main Steam Isol Bypass)

__ • 1SM-11AB (1B Main Steam Isol Bypass)

__ • 1SM-12AB (1A Main Steam Isol Bypass).

17. **SV System:**

- The following valves fail closed:

__ • 1SV-1AB (1D Main Steam Line PORV)

__ • 1SV-7ABC (1C Main Steam Line PORV)

__ • 1SV-13AB (1B Main Steam Line PORV)

__ • 1SV-19AB (1A Main Steam Line PORV).

18. **VQ System:**

- The following valves fail closed:

__ • 1VQ-1A (U1 Cont Air Release Inside Isol)

__ • 1VQ-6A (U1 Cont Air Addition Inside Isol).

19. **Hydrogen Analyzer 1A:**

 __ • Sample containment isolation valves fail closed.

20. **Loss of Control Power to the following breakers prevents remote operation; however, local manual operation of these breakers is possible provided the Charging Springs are "Charged":**

 __ • All Breakers on 4160 V Switchgear 1ETA

 __ • All Breakers on 600 V Load Center 1ELXA

 __ • All Breakers on 600 V Load Center 1ELXC.

21. **The shunt trip coils associated with the following breakers will not operate. Breaker trip capability is still functional via the "UV" coils.**

 __ • Reactor Trip Breaker 1RTA

 __ • Reactor Trip Bypass Breaker 1BYA.

__ 22. **Loss of all protective relaying for 4160 V Switchgear 1ETA.**

C

QuestionBank #	KA_system	KA_number
554	SYS063	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□Major DC loads ....

Which of the following receives power from 250VDC Auxiliary Power System?

A. D/G Fuel Oil Booster Pump

B. Reactor Trip Switchgear Control

C. Unit 1 Turbine Emergency Bearing Oil Pump

D. Power Operated Relief Valves Solenoids (both NC and SV systems)

General Discussion

All loads are DC loads, D/G booster pump comes from 1DGDA. And rx trip switchgear and PORVs come from 125VDC vital

Answer A Discussion

Answer B Discussion

Answer C Discussion

CORRECT

Answer D Discussion

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

- [x] Developed
- [ ] OPT Approved
- [ ] OPS Approved
- [x] NRC Approved

Development References	Student References Provided
EPL	

QuestionBank #	KA_system	KA_number
554	SYS063	K2.01

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□Major DC loads ....

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1823	SYS064	A3.01

KA_desc
Ability to monitor automatic operation of the ED/G system, including: (CFR: 41.7 / 45.5)□Automatic start of compressor and ED/G ....

The Diesel Generator Starting Air compressors are designed to automatically maintain the Starting Air Header pressure between __(1)__. During an automatic start of the Diesel Generator, the Starting Air solenoid will open to supply the diesel for __(2)__ or until Diesel Generator speed is >40%.

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

A. (1) 225 – 235 PSIG
(2) 10 seconds

B. (1) 220 – 250 PSIG
(2) 10 seconds

C. (1) 225 – 235 PSIG
(2) 20 seconds

D. (1) 220 – 250 PSIG
(2) 20 seconds

C

General Discussion

The Diesel Generator Starting Air compressors will automatically cycle to maintain the starting air headers pressurized between 225-235 psig. When the Diesel Generator gets an auto start signal, four starting air solenoids open to supply the diesel for 20 seconds or until Diesel Generator speed is greater than 40%.

The K/A is matched because in order to monitor the automatic operation of the EDG starting air comperssors and the automatic operation of the EDG, the applicant must know the setpoints at which the EDG starting air compressor will automatically start and stop and must know the amount of time the EDG starting air solenoids will remain open on an auto start.

Answer A Discussion

Incorrect. Pressure is correct. Second part is plausible if applicant does not recall the amount of time air is supplied to the diesel as the speed is correct.

Answer B Discussion

Incorrect. Both parts incorrect. Plausible if the applicant does not recall air compressor auto starts or time that diesel generators are supplied starting air.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect.First part incorrect. Second part the time is correct but speed is incorrect. Plausible if the applicant does not recall air compressor auto starts or time that diesel generators are supplied starting air.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [ ] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-DG-DGA Objective 5 page 25 and Objective 8 page 31	

QuestionBank #	KA_system	KA_number
1823	SYS064	A3.01

KA_desc

Ability to monitor automatic operation of the ED/G system, including: (CFR: 41.7 / 45.5)□Automatic start of compressor and ED/G ....

401-9 Comments:

401-9 Comments RESPONSE

Question 23 References:

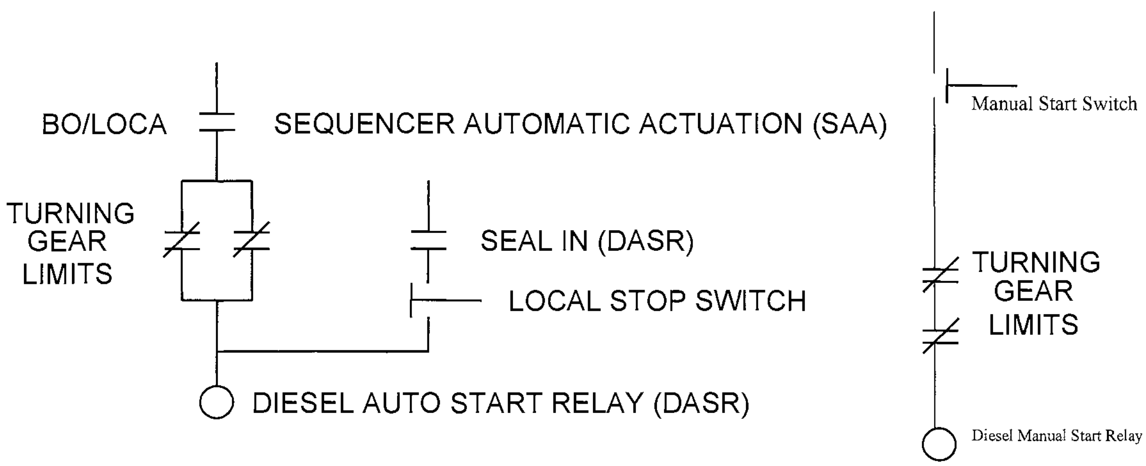
From Lesson Plan OP-MC-DG-DGA Objective 5 page 25:

To **operate** the turning gear while engaged, open the Cylinder Port Valves from each cylinder on the diesel engine, start the before & after lube oil pump and plug in the remote unit.

To **disengage** the turning gear, release the pressure of the drive gear against the flywheel, slowly remove the locking pin and then lower assembly to its resting-place.

Objective # 3

There are two limit switches associated with the turning gear that will prevent an automatic or manual start of the diesel if the turning gear is engaged. Both limit switches must be made to prevent an auto start. Only one switch must be made to prevent a manual start. A failure of either limit switch while the diesel operates will result in a manual mode trip. If both limit switches fail while operating in the auto mode, the diesel will not trip. If the diesel is prevented from automatically starting then it is



inoperable.

2.2 Starting Air System

Objective # 4

The Starting Air System provides fast start capability by using high-pressure air to roll the diesel engine until it is firing on its own.

Objective # 5

Each air compressor is designed to maintain its associated header pressure at 225-235 psig. As header pressure decreases to 225 psig the compressor will automatically start. Once pressure increases to 235 psig, the compressor will automatically stop.

Each compressor inlet is filtered. This reduces/prevents damage to compressor components and also helps reduce the overall air system particulate contamination.

A relief valve is installed on each compressor outlet (set at 275 psig) to provide overpressure protection.

The VG Compressors are not safety related equipment and is therefore an unnecessary load during a Safety Injection event. Each compressor is equipped with a shunt trip device that will load shed the compressor on a Safety Injection actuation. This load shed does not occur during a Blackout.

From Lesson Plan OP-MC-DG-DGA Objective 8 page 31:

Once the event is over, I&E must remove the jumpers, which allows the VG solenoids to close. An **FSAR Commitment (PIP M-02-02353, Revise MCS-1605.VI-00-0001 sections 4.1.2 and 5.1.2 to add: "The use of VG for the VI Blackout Header will be only at the discretion of the Technical Support Center during a plant event.")** requires that this flow path be used only as a last resort. This flow path will only be used at the direction of the TSC during a plant Emergency.

Objective # 8

Four starting air solenoids (2 per header) auto open on a diesel start to supply 235-psig air to the engine. Once speed is ≥ 40%, the solenoids receive a signal to close. A time delay allows the diesel twenty (20) seconds to obtain 40% speed. If speed is < 40% after the 20 second delay, the diesel stops and the solenoid valves auto close.

If an auto start signal is present, the sequencer will continue to try engine restarts until either, the start is successful, the emergency stop pushbutton is depressed or the auto start signal is taken away.

Objective # 9

Other components receiving the air supply downstream of the starting air solenoids are the Governor Booster Servomotor and the Starting Air distributors.

The Governor Booster Servomotor pressurizes governor actuator oil to open the fuel racks faster on an engine start. As the Diesel Engine comes up to speed, a gear pump located internal to the Mechanical Governor builds fluid pressure beneath a speed setting servo. The speed setting servo uses a set of rotating flyweights to control governor oil pressure beneath the fuel supply servo. At 40% speed, starting air is removed from the diesel engine via the starting air solenoids closing. As oil pressure within the Mechanical Governor increases, the Governor Booster Servomotor resets to its initial condition allowing for a subsequent diesel start.

The Starting Air Distributor sends an air signal to pilot valves on each cylinder which open allowing air from the starting air header to be admitted in a timed manner. The Starting Air Distributor consists of an air supply connection routed up to a rotating disc physically connected to the diesel camshaft. This rotating disc has a single hole in it. Also located in the same area is a stationary disc with eight holes in it. Coming off of the back side of the stationary disc are ¼" piping connections routed to pneumatically operated pilot valves located on the diesel engine cylinders. When the single hole on the rotating disc matches up with any one of the eight holes on the stationary disc, 235 psig starting air is allowed to pass through and deliver a pilot air signal to the pilot air valve allowing it to open. When the pilot air valve opens, air is admitted into the diesel engine cylinder associated with that pilot air valve. The rotating and stationary discs are set up in conjunction with the cam shaft timing to allow this pilot air signal to be admitted whenever the piston associated with that engine cylinder is at top dead center of its power stroke. There are two camshafts associated with each diesel and thus two starting air distributors (one for each camshaft). This pilot air signal is removed when diesel speed goes above 40%. This is when the starting air solenoids close and remove starting air from the diesel.

QuestionBank #	KA_system	KA_number
1824	SYS064	K6.08

KA_desc
Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: (CFR: 41.7 / 45.7)□Fuel oil storage tanks

The following on Unit 1:

- A unisolable leak develops on the 1A Fuel Oil Storage Tank (FOST)
- At 0800 hours 1A FOST level is 41,250 gal
- At 0930 hours 1A FOST level is 40,000 gal

Assuming the leak rate from the FOST remains constant, when will the 1A D/G fail to meet the LCO requirements for TS 3.8.3 and what action is required?

REFERENCE PROVIDED

A. 0954 hours
Immediately declare the associated DG inoperable

B. 1006 hours
Immediately declare the associated DG inoperable

C. 0954 hours
Restore fuel oil level to within limits within 48 hours.

D. 1006 hours
Restore fuel oil level to within limits within 48 hours

General Discussion

In accordance with Tech Spec 3.8.3 Diesel FOST level must be >/= 39500 gal. If FOST is <39500 gal but >31600 gal a 48 hour LCO is entered to refill the FOST.

The leak rate from the tank = (41250 - 40000) / 90 = 13.89 GPM

LCO 3.8.3 Condition A will be entered when FOST decreases to less than 39,500 gal. With a 13.89 gpm leak rate it will take approximately 36 minutes for FOST level to reach 39500 gal.

(40000 - 39500 gal) / 13.89 gpm = 36 min.

36 min from 0930 would be 1006.

The FOST leak will eventually lead to a condition where FOST level will place the unit in an LCO condition. Therefore, the K/A is matched.

This is an analysis level question because the applicant must evaluate Tech Specs to determine the level at which the Diesel Generator operability will be effected, then calculate a leak rate, and based on the leak rate determine the time at which Diesel Generator operability will be effected and the action that must be taken.

Answer A Discussion

Incorrect. Plausible if the applicant believes that the Diesel becomes inoperable when FOST decreases to the Tech Spec min level of 39500 gal and miscalculates the leak rate using 60 min instead of 90 min. That would make this the correct answer.

Answer B Discussion

Incorrect. Plausible if the applicant believes that the Diesel becomes inoperable when FOST decreases to the Tech Spec min level of 39500 gal as calculating based on that level would make this the correct answer.

Answer C Discussion

Incorrect. Plausible if the applicant uses 60 min to calculate the leak rate instead of 90 min. Calculating using that incorrect leak rate with the ·rrect level at which the Diesel becomes inoperable would make this the correct answer.

.iswer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

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

Development References	Student References Provided
Technical Specification 3.8.3, Diesel Fuel Oil and Starting Air Lesson Plan OP-MC-DG-DGA page 65	Tech Spec 3.8.3 (Q24)

QuestionBank #	KA_system	KA_number
1824	SYS064	K6.08

KA_desc

Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: (CFR: 41.7 / 45.7)□Fuel oil storage tanks ....

401-9 Comments:

401-9 Comments RESPONSE

Question 24 References:

From Technical Specification 3.8.3:

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Diesel Fuel Oil and Starting Air

LCO 3.8.3 The stored diesel fuel oil and starting air subsystem shall be within limits for each required diesel generator (DG).

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

---NOTE---
Separate Condition entry is allowed for each DG.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more DGs with fuel oil inventory < 39,500 gal and > 31,600 gal.	A.1 Restore fuel oil level to within limits.	48 hours
B. One or more DGs with stored fuel oil total particulates not within limit.	B.1 Restore fuel oil total particulates within limit.	7 days
C. One or more DGs with new fuel oil properties not within limits.	C.1 Restore stored fuel oil properties to within limits.	30 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or more DGs with 1 of 2 starting air receiver pressures < 210 psig.	D.1 Initiate action to isolate the degraded starting air receiver. <u>AND</u> D.2 Restore both starting air receiver pressures to ≥ 210 psig.	Immediately 48 hours
E. Required Action and associated Completion Time not met. <u>OR</u> One or more DGs diesel fuel oil or starting air subsystem not within limits for reasons other than Condition A, B, C, or D.	E.1 Declare associated DG inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify the fuel oil storage system contains ≥ 39,500 gal of fuel for each DG.	31 days
SR 3.8.3.2	Verify fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program
SR 3.8.3.3	Verify each DG air start receiver pressure is ≥ 210 psig.	31 days
SR 3.8.3.4	Check for and remove accumulated water from the fuel oil storage tank.	31 days

From Lesson Plan OP-MC-DG-DGA page 65:

2.12 Instrumentation and Control

Three Redundant Speed Switches are provided for each diesel. They monitor speed of the diesel using magnetic pickups installed over the camshaft gear and perform certain functions at predetermined settings.

During startup the speed switches utilize four (4) adjustable internal relay outputs to initiate certain functions at 40%, 95%, 97% and 112% speed.

- At 40% speed, starting air is removed and the generator field is flashed.
- At 95% speed, the low lube oil pressure diesel trip is enabled with a 30-second time delay. The diesel overspeed trip is enabled allowing for a trip at 112%
- At 95% speed, D/G breaker closure is enabled.
- At 97% speed, an accelerated sequence permissive is given to the Diesel Generator Load Sequencer.
- At 112% speed (2/3 sensors) the diesel trips.

A computer based **Diesel Generator Monitoring System** includes a local display monitor in each diesel generator room that is linked to the OAC. The purpose of this system is to provide real time operating parameter, trend data and sequence of event data (for troubleshooting). For each diesel generator there are approximately 90 inputs (60 analog and 30 digital). System graphics are available for KD, LD, FD, VG, ZD, battery voltage, exhaust temperatures and 4160V bus. Exhaust temperatures are on two graphic displays with each fed from separate thermocouples. If an exhaust temperature indication is lost on one graphic, then the second graphic may be used to check that cylinder temperature. All process gauges on the local control panel have associated OAC indication. Most parameters have associated computer alarms.

Each diesel generator is monitored by numerous annunciator alarms. One Control Room Annunciator for the diesel generator, "DIESEL GENERATOR PANEL TROUBLE", is actuated by the local annunciator panel when any local alarm is energized. Annunciators are powered by a non-safety source KXA (KXB).

Local Annunciators

	1	2	3	4	5	6	7
A	JACKET WTR TEMP HIGH	EXHAUST TEMP HI/LO	LUBE OIL TEMP HI/LO	FUEL OIL DAY TANK LEVEL HI/LO	GEN STATOR TEMP HIGH	ENGINE OVERSPEED	TURBO CHARGER OVERSPEED
B	JACKET WTR TEMP LOW	CRANKCASE VACUUM LOW	LUBE OIL FILTER HI D/P	FUEL OIL STOR TANK LEVEL LOW	BUILDING VENTILATION MALFUNCTION	CONTROL SWITCH NOT IN AUTO	TURNING GEAR ENGAGED
C	JACKET WTR PRESS LOW	JACKET WTR LEVEL LOW	LUBE OIL PRESS LOW	FUEL OIL PRESS LOW	STARTING AIR PRESS LOW	CONTROL AIR PRESS LOW	EMERGENCY STOP/FIRE LOCKOUT

QuestionBank #	KA_system	KA_number
1825	SYS073	A4.03

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□Check source for operability demonstration ....

While performing daily surveillance checks on 1EMF-33 (Condenser Air Ejector Exhaust), you determine that the OPERATE light is OFF. The Control Room Supervisor asks you to perform an operability check of 1EMF-33.

Which ONE (1) of the following is required to be performed for this check per PT/1/A/4600/003 B (Daily Surveillance Items)?

A. Have RP perform a setpoint check.

B. Have RP perform a source check.

C. Verify the sample pump is in operation.

D. Verify the correct sample point is selected.

General Discussion

1EMF-33 is a process radiation that monitors the gaseous activity levels released to the unit vent by the condenser air ejector exhaust. As part of the daily surveillance checks performed by the reactor operators, the OPERATE light associated with the EMF control module is verified to be illuminated. If it is dark the PT being performed requires a source check to be performed. A successful source check ensures operability and usually results in the recovery of the operate light.

KA is matched because know that due to indications on the EMF control module located in the C/R (Operate light dark) the question examines ability to monitor and understand that because of this indication, a source check is required.

Answer A Discussion

Incorrect: See explanation above. Plausible: In order for this EMF to perform its design function of detection of a primary to secondary leak, the setpoints would need to be correct therefore this action is plausible but not required by this PT.

Answer B Discussion

CORRECT: See explanation above

Answer C Discussion

Incorrect: See explanation above. Plausible: This would be a correct action if this EMF had an sample pump which it does not. Plausible because we have other EMFs that do which are checked by the PT.

Answer D Discussion

Incorrect: See explanation above. Plausible: This would be a correct action if this EMF had sample point selection capability. Plausible because we have other EMFs that do which are checked by the PT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	MODIFIED	2006 NRC Q25 (Bank 102)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Technical Reference(s): PT/1/A/4600/003 B (Daily Surveillance Items) Rev 128

Student References Provided

QuestionBank #	KA_system	KA_number
1825	SYS073	A4.03

KA_desc

Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□Check source for operability demonstration
....

401-9 Comments:

073A403
In accordance with the reference, it appears that a source check is required not a setpoint check. Please reverify correct answer..
The stem ask for a requirement. The word "Ensure" (distractors "C" and "D") are NOT "requirements". These two distracters will be immediately eliminated.
U because "C" and 'D" are NP

401-9 Comments RESPONSE

Version sent to Ron had wrong answer listed as correct, OK in access program.
Removed "ensure" from dist C & D and replaced with "Verify".
Not sure what his problem is with this question, need to discuss during review.

Qu…stion 25 References:

From PT/1/A/4600/003 B:

Surveillance Item	Acceptance Criteria	Applicable Mode(s)							Notes	Initials	Tech Spec / SLC
		1	2	3	4	5	6	No Mode			
Standby Nuclear Service Water Pond (SNSWP) Level	Greater than or equal to 739.5 feet	1	2	3	4				11		ITS SR 3.7.8.1
SNSWP Temperature (Minimum)	Greater than or equal to 36°F	1	2	3	4				16		TAC MCTC-1574-RN.5001-01
SNSWP Temperature (Maximum)	Less than or equal to 78°F	1	2	3	4				3		ITS SR 3.7.8.2
FWST Solution Temperature (Minimum)	Greater than or equal to 70°F as read on 1FWP-5030	1	2	3	4	5	6		17		ITS SR 3.5.4.1 SLC TR 16.9.14.1 SLC TR 16.9.11.1
FWST Solution Temperature (Maximum)	Less than or equal to 100°F as read on 1FWP-5030 (Begin cooling FWST at 95°F.)	1	2	3	4				12, 17		ITS SR 3.5.4.1 SLC TR 16.9.11.1
Train A Modulating Valves Reset (1MC11)	Reset lit	1	2	3	4	5	6		19		PIP M-96-02018
Train B Modulating Valves Reset (1MC11)	Reset lit	1	2	3	4	5	6		19		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	4, 21		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	4, 22		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	4, 5, 7, 15		SLC 16.11.7-1 (5)
0EMF-53 (Contaminated Material Whse) Channel Check	Operate light lit and loss of sample flow annunciator is **NOT** in alarm status	1	2	3	4	5	6	No Mode			SLC 16.11.7-1 (7a)

Unit 1

NOTE:

1. **WHEN** greater than or equal to 15% RTP:
   - First surveillance is required within 12 hours after reaching 15% RTP.
   - For subsequent surveillances, if PR NIS channel absolute difference is greater than 2% RTP during stable conditions, 4 hours is allowed to adjust PR NIS channels to ±2% of heat balance calculation.
   - **IF** adjustment **CANNOT** be made within time allowed, PR NIS channel shall be declared inoperable.
2. OAC Graphics Vent Menu provides Upper/Lower Containment average temperature readings:
   - Upper and Lower Compartment lower limit may be reduced to 60°F in Modes 2 – 4.
   - Lower Compartment upper limit may be between 120 – 125°F for up to 90 cumulative days per calendar year provided the Lower Compartment temperature averaged over the previous 365 days is less than 120°F. Within this 90 cumulative day period, lower compartment temperature may be between 125 – 135°F for 72 cumulative hours. See OAC point M1P1544 (U1 Avg Lower Cont Temp - Previous 365 Days).
   - Upper Compartment average air temperature shall be computed using only those temperature points corresponding to AHUs with operable sensors (using Average Temperature on OAC Graphic), regardless of whether AHU is running or **NOT** (based on large Air Volume mass) in upper containment) {PIP 0 M00-0552}
   - Lower Compartment average air temperature shall be computed using only those temperature points corresponding to running AHUs with operable sensors (using Weighted Average Temperature on OAC Graphic) {PIP 0 M00-0552}
3. Tech Spec limit for SNSWP temperature is 82°F. Due to process instrument loop inaccuracy, if indicated SNSWP temperature is 78°F or greater, instruct Work Control to activate Model Work Order #00406151 for manual determination of SNSWP temperature. Temperature is checked year round as a conservative decision. {PIP 0-M93-1221}
4. **IF** operate light dark a source check must be performed on EMF.
5. **IF** Loss of Sample Flow Alarm is lit, place sample pump in operation to clear alarm.
6. **IF** system is **NOT** in operation, Loss of Sample Flow Alarm is invalid.

Unit 1

QuestionBank #	KA_system	KA_number
102	SYS073	A4.03

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□Check source for operability demonstration ....

While performing daily surveillance checks on 1EMF-33 (Condenser Air Ejector Exhaust), you determine that the OPERATE light is OFF. The Control Room Supervisor asks you to perform an operability check of 1EMF-33.

Which one of the following describes the item(s) required to be performed for this check per OP/0/A/6500/080 (EMF Output Modules)?

A. Perform a source check and ensure the sample pump is in operation.

B. Attempt to restore the OPERATE light and perform a source check.

C. Perform a setpoint check and ensure the sample pump is in operation.

D. Attempt to restore the OPERATE light and ensure the sample pump is in operation.

General Discussion

Answer A Discussion

A incorrect. The setpoint check is not required.

Answer B Discussion

Answer C Discussion

C incorrect. Neither of the checks are required.

Answer D Discussion

D incorrect. Sample pump check is not required.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References
OP/0/A/6500/080

Student References Provided

QuestionBank #	KA_system	KA_number
102	SYS073	A4.03

KA_desc

Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□Check source for operability demonstration ....

401-9 Comments:

401-9 Comments RESPONSE

B

QuestionBank #	KA_system	KA_number
1826	SYS076	K4.06

KA_desc
Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41/7)□Service water train separation

Given the following conditions:

- Unit 1 @ 100% RTP
- 1B RN Pump is in service with suction aligned to the Low Level Intake
- A spurious Safety Injection Signal occurs (on both trains)

Which ONE (1) of the following describes the alignment of the RN Pumps after the spurious Safety Injection?

A. RN Pump 1A is running with suction from SNSWP and RN Pump 1B is running with suction from the Low Level Intake.

B. RN Pump 1A running with suction from the Low Level Intake and RN Pump 1B is running with suction from the SNSWP.

C. RN Pump 1A is running with suction from the RC Crossover and RN Pump 1B is running with suction from the SNSWP.

D. RN Pump 1A and RN Pump 1B are running with suction from the SNSWP.

General Discussion

Whan an SI signal occurs the RN trains are automatically aligned to split the trains and 1A RN pump is started taking a suction from the LLI while 1B RN pump takes suction from the SNSWP.

The KA is match because the applicant must be familiar with the RN system automatic alignment during an SI which provides for train separation which assures an RN supply to the units from at least one train.

Answer A Discussion

Incorrect. Plausible as both RN pumps do get an auto-start signal and the Low Level Intake and SNSWP are the correct suction sources for the RN system. However, the alignment is incorrect.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Plausible since both RN pumps get an auto start signal on an SI and the RC Crossover is one of the suction sources for the RN system. However, it is not a suction source during an SI.

Answer D Discussion

Incorrect. Plausible since both RN pumps get an auto start signal on an SI. It is also plausible to believe that the SNSWP will supply both trains since it is the assured source of water for the RN system.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS NRC Bank Question 1046 (Never Used)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-PSS-RN, Objective 8 Section 3.2	

QuestionBank #	KA_system	KA_number
1826	SYS076	K4.06

KA_desc

Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41/7)□Service water train separation

401-9 Comments:

401-9 Comments RESPONSE

Question 26 References:

From Lesson Plan OP-MC-PSS-RN section 3.2 page 49 and 51:

3.2 Abnormal and Emergency Operation

3.2.1 Abnormal Procedure AP/1or2/A/5500/20

AP20 purpose, Cases, Symptoms, and basis for steps are covered in the AP Lesson Plan.

Objective # 16

3.2.2 Blackout Alignment

Blackout is a loss of power to the 4160 vac bus. When the low voltage condition is detected, the D/G will start and the sequencer will load the Blackout loads onto the bus.

On receipt of a **Blackout signal**, Train A valves automatically assume low level alignment; Train B assumes SNSWP alignment. Many shared valves receive signals from both units to prevent loss of water from SNSWP. Isolation valves for all heat exchangers which are needed open automatically and the train related RN pump will start. All nonessential discharge is isolated except the containment vent units and NC pump motor cooler discharge. The containment vent units and the NC pump motor coolers are supplied with cooling water from "A" RN pump. The "A" RN pumps supply the containment ventilation units with cooling water because they have more NPSH since their suction is aligned to the LLI and because the RV pumps may not have power. **Drawings 7.10 and 7.11** provides the unit blackout flow path. **Drawings 7.12 and 7.13** provides the flow path for Train A and Train B Blackout respectively.

If a Blackout occurs on the opposite unit, the non-blackout unit will have its non-essential header isolated from the B RN pump as a result of RN41B and RN43A closing **(Refer to Drawing 7.5)**. In order to supply the non-essential header on the non-blackout unit, the A Train RN pump must be started.

3.2.3 Safety Injection Alignment

On receipt of a **Safety Injection signal** basically the same automatic actuation occurs as after a blackout. The exceptions are that the supply to all nonessential equipment except the NC pump motor coolers and crossovers between essential trains are isolated. The "A" RN pump supplies Reactor Building non-essential header. The RV pumps will start automatically and supply the containment ventilation units if a blackout does not occur concurrently with the LOCA. **Drawings 7.14 and 7.15** provides the flow path for a unit safety injection.

NOTE: An S_S signal will affect both units suction, discharge and AB non-essential headers. Refer to Drawing 7.14

On receipt of a **Phase B isolation signal (S_P)** the RV pump suction is isolated to conserve water. The containment isolation valves close to isolate the NC pump motor coolers. All nonessential supply is isolated providing double isolation at this time between all essential and nonessential equipment. The NS heat exchanger inlet isolation valve is opened from the control room when required. During all modes of operation, water is available for assured makeup. **Drawings 7.16** provides the flow path following a unit safety injection with a phase B signal.

4.0 TECHNICAL SPECIFICATIONS

Objective # 17

4.1 Tech Spec 3.7.7 Nuclear Service Water System (NSWS)

4.2 Tech Spec 3.7.8 Standby Nuclear Service Water Pond (SNSWP)

QuestionBank #	KA_system	KA_number
1827	SYS078	A3.01

KA_desc
Ability to monitor automatic operation of the IAS, including: (CFR: 41.7 / 45.5)□Air pressure ....

Due to a leak on the VI system the Unit 1 OATC observes the following indications:

- 1AD-12 C1 (VI/VS Lo Pressure) is LIT
- 0VIP-5090 (VI/VS Press) dropped to a lowest reading of 86 PSIG and is now 89 PSIG and increasing.

Which ONE (1) of the following describes automatic actions which have occurred as a result of the indicated pressure transient?

A. G and H VI Compressors Auto Started ONLY

B. 1VI-820 (VI to VS Supply) Auto Closed ONLY

C. 1VI-820 Auto Closed AND 1VI-1812 (VI Dryer Bypass Vlv) has Auto Opened

D. G and H VI Compressors Auto Started AND 1VI-820 (VI to VS Supply) Auto Closed

General Discussion

At a decreasing VI pressure of 90 PSIG the following actions occurr:
1VI-820 (VI to VS Supply) Auto closes
G and H (Diesel VI compressors) Auto Start
If VI pressure continues to decrease to 85 PSIG, 1VI-1812 (VI Dryer Bypass) will OPEN.

KA is matched because the candidate, given information obtained from monitoring a trend of VI pressure indications located in the control room, what automatic actions have occurred associated with the Instrument Air system.

This is an analysis level question because the applicant is given set of plant conditions and must recall a setpoint from memory to determine if a set of automatic actions should have occurred.

Answer A Discussion

Incorrect: Answer is not complete and incorrect due to the ONLY designation. Plausible because this action would have occurred but is not complete.

Answer B Discussion

Incorrect: Answer is not complete and is incorrect due to the ONLY designation. Plausible because this action would have occurred but is not complete.

Answer C Discussion

Incorrect: 1VI-1812 will not open until pressue decreased to 85 PSIG. The lowest pressure given in the stem is 86 PSIG. Plausible: First part of the answer is correct, candidate may believe 1VI-1812 actuates with the other components at 90 PSIG.

Answer D Discussion

Correct as described above.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-SS-VI Objective 7 Section 1.2.10 page 67 and Objective 2 Section 1.3.1 page 89 ARP for 1AD-12 C1 (VI/VS Low pressure)	

QuestionBank #	KA_system	KA_number
1827	SYS078	A3.01

KA_desc
Ability to monitor automatic operation of the IAS, including: (CFR: 41.7 / 45.5)□Air pressure ....

401-9 Comments:

401-9 Comments RESPONSE

Question 27 References:

From Lesson Plan OP-MC-SS-VI page 67:

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

From Lesson Plan OP-MC-SS-VI page 89:

Objective # 2

The Centrifugal Compressors normally operate, supplying all plant VI demands. The two diesel powered VI Compressors will automatically start upon decreasing air pressure, failure of the VI Compressor Sequencer panel, or loss of KR flow to VI Compressors D, E, and F. They also can be started manually at the respective diesel compressor's control panel. The Reciprocating Compressors are capable of supplying VI loads should the Centrifugal and Diesel Compressors become unavailable. The Reciprocating Compressors will automatically start if VI Receiver Pressure drops to the setpoint for the Standby-2 Mode Of Operation. If necessary, the Reciprocating Compressors can be started manually at the local compressor control panel.

Air is normally supplied to the VS System through valve 1VI-820. The valve is normally open but will automatically close on low VI System pressure (90 psig) to prevent VI System depressurization. In addition, the output of the Diesel Powered VI Compressors can be directed to supply the VS System through a manual isolation valve if needed.

Although the VI System is not classified as a ***"safety-related"*** system, McGuire Nuclear Station relies on the Instrument Air System during normal operation to actuate and/or control safety-related equipment.

However, during transient and accident conditions, a loss of instrument air is assumed. Since air-operated equipment failure modes are predictable (equipment mode and/or position is known); a backup pneumatic source is provided for the equipment needed during transient and/or accident conditions to ensure this equipment can perform its intended function. Safety grade accumulators or nitrogen provide the backup pneumatic source.

Many significant industry-related operational events have been traced to the design of Instrument Air Systems. But because these air system failures pose no significant challenge to plant safety, changes to existing NRC System Design Criteria are not required.

Nomenclature:	VI/VS LO PRESS	Window:	C1

Setpoint: 90 psig decreasing

Origin: Pressure switch 0VIPS-5380 on VI Dryer Outlet Header

Probable Cause:

- Improper compressor lineup
- Hi DP on VI Dryers
- Air leak
- VI Dryer purging malfunction

Automatic Action:

1. 1VI-820 (VI to VS Supply) will close separating VS from VI. (Pressure Switch 0VIPS-6441)
2. VI Dryer purge exhaust isolation valves 1VI-1838, 1839, and 1840 failed closed. (Pressure switch 0VIPS-5380)
3. G and H VI Compressors may have Auto Started and are supplying VI header.
4. IF VI pressure decreases to 85 psig, 1VI-1812 (VI Dryer Bypass Vlv) will open. (Pressure Switch 0VIPS-5381)

Immediate Action:

1. Monitor VI pressure on 1MC-13 to ensure VI pressure recovers to normal.
2. Send an Operator to G and H VI Compressor to monitor for proper operation. IF they did NOT Auto Start, and at the discretion of the Control Room, perform an Emergency Manual Start on each per OP/0/A/6450/005 (Instrument Air System).
3. IF pressure continues to decrease, go to AP/1/A/5500/022 or AP/2/A/5500/022 (Loss of VI).

Supplementary Action:

1. Send operator to D, E, and F compressors to check proper operation of compressors.
2. IF started, monitor G and H VI Compressors for proper operation.

Continue On Next Page

3. Send operator to VI Dryers to check the following:

   A. **IF** Hi DP condition exist, put additional dryers in service per OP/0/A/6450/005 (Instrument Air System).

   B. Check VI Dryer 3-way valves (inlet and outlet) are aligned correctly by checking that movable white arrows point horizontally and to same dryer chamber.

      1) **IF** any 3-way valve is misaligned, ensure the 2 other VI dryers are placed in service, and shutdown affected dryer.

      2) For each dryer in service, select "OFF" at local VI Dryer control panel (VI header flow will remain uninterrupted).

      3) Ensure VI header pressure restored to normal, then depress yellow left side "RESET" on local VI Dryer Reflash Panel (this will open the purge exhaust valves).

      4) For each dryer to be returned to service, select "ON" at local VI Dryer control panel for one dryer at a time, while monitoring VI header pressure.

4. Send operators to locate any leaks.

References:

- Flow Diagram - MCFD -1605
- MCEE-24 Series
- Equipment Database

End Of Response

Nomenclature:	VI DRYERS PNL. TROUBLE	Window:	E1

Setpoint: Alarm Condition on Desiccant VI Dryer:

- Loss of Power
- Red Dryer Alarm Light Lit on Dryer Control Panel
- Yellow Dryer Warning Light lit on Dryer Control Panel
- 1VI-1812 (VI Dryer Bypass Vlv) open

Origin: VI Air Dryers Reflash Panel

Probable Cause:

- Placing VI Dryer in service, first 24 hours of operation, may have a yellow warning "High Humidity". This warning will also be seen as an alarm on VI Air Dryers Reflash Module. Dryer may still be started and operated with this warning and alarm in service.
- Loss of power
- VI Dryer Malfunction
- VI Dryer Purge Exhaust Outlet Isolation Valves closed
- 1VI-1812 (VI Dryer Bypass Vlv) opened (85 psig on 0VIPS-5381)

Automatic Action: None

Immediate Action:

1. Send Operator to VI Dryers Reflash Module Panel to determine cause of alarm.
2. Send Operator to VI Dryer Control Panel and depress "Mode F1" pushbutton and view "STATUS" window displaying existing alarms.
3. <u>IF</u> VI pressure decreases to 85 psig, 1VI-1812 (VI Dryer Bypass Vlv) will open. (Pressure Switch 0VIPS-5381)

Supplementary Action:

1. <u>IF</u> red alarm light lit on Dryer Control Panel, perform the following:

   A. Place standby Dryer in service.

   B. Remove alarming Dryer from service per OP/0/A/6450/005

Nomenclature:	VI/VS LO-LO PRESS	Window:	D1

Setpoint: 82 psig decreasing

Origin: Pressure switch 0VIPS-6440 on outlet of VI Dryers

Probable Cause:
- Header rupture
- VI Dryer Hi DP

Automatic Action: G and H VI Compressors have Auto Started and are supplying the VI header.

Immediate Action:
1. Go to AP/1 or 2/A/5500/022 (Loss of VI).
2. Send Operator to check G and H VI Compressors have Auto Started and are supplying the VI header.
3. Send Operator to ensure 1VI-1812 (VI Dryer Bypass Vlv) opened.

Supplementary Action:
1. Send operator to check all compressors are fully loaded.
2. IF G and H VI Compressors did NOT Auto Start, perform an Emergency Manual Start of each per OP/0/A/6450/005 (Instrument Air System).
3. Send operator to VI Dryer Local Panel(s) to determine if Hi DP exists.
4. IF Hi DP exists, place additional Dryers in service per OP/0/A/6450/005 (Instrument Air System).
5. Send operators to locate rupture.
6. Go to 1AD-12, C1 (VI/VS Lo Press) Supplementary Actions.

References:
- Flow Diagram - MCFD -1605
- MCEE-24 Series

End Of Response

Unit 1

QuestionBank #	KA_system	KA_number
1828	SYS103	A4.03

.A_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□ESF slave relays ....

Given the following conditions on Unit 1:

- A Steam Break has occurred inside Containment
- Containment pressure is 3.5 PSIG and decreasing

Which ONE (1) of the following describes the MINIMUM action(s) required to allow restoration of Component Cooling Water to the NC pumps?

A. Reset Phase A ONLY

B. Reset Phase B ONLY

C. Reset Phase A AND Phase B

D. Reduce Containment pressure below 3.0 PSIG AND reset Phase A AND Phase B

General Discussion

KC to the NC pump motor coolers isolates on a Phase B signal. The Phase B can be reset with the signal still present. When the Phase B reset pushbuttons are depressed, control of valves that close on a Phase B signal is regained.

This KA is matched because the applicant must understand the operation of Containment Isolation Phase B valves (operated by ESF slave relays) and how control is regained for those valves after a Phase B actuation to correctly answer the question.

Answer A Discussion

Incorrect. Plausible if the applicant does not understand that until the Phase B is reset they do not have control over the valves which were operated by the Phase B signal.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Plausible because frequently SI, Phase A and Phase B signals are reset simultaneously during the performance of Emergency Procedures.

Answer D Discussion

Incorrect. It is plausible to assume that since a Phase B signal occurs at 3.0 PSIG that Containment pressure must be reduced to less than 3.0 PSIG to be able to reset Phase B. However, it may be reset at any time.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Exam Bank Question ECCISEN04

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-ECC-ISE Objective 13 page 31	

QuestionBank #	KA_system	KA_number
1828	SYS103	A4.03

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□ESF slave relays ....

401-9 Comments:

401-9 Comments RESPONSE

Question 28 References:

Objective # 13

Phase "B" Containment Isolation is actuated by:

Hi Hi Containment Pressure	**> 3.0 psig on $^{2}/_{4}$ channels**
Manually	**$^{1}/_{2}$ pushbuttons**

Phase B actuation secures Component Cooling Water (KC) to the Reactor Coolant pumps, Nuclear Service Water (RN) to the Reactor Coolant Pump Motor Coolers, Containment Ventilation Cooling Water (RV) and Instrument Air (VI) to the containment.

Phase "B" can be reset with signal still present, once resets are pushed, we regain control of valves that close on the Phase "B" signal.

Containment Ventilation Isolation (S_H) is initiated by any of the following:

- **Safety Injection (S_S)**
- **Manual Phase "A" (S_t)**
- **Manual NS/Phase "B"**
- **Trip 2 alarm on EMF-38, 39, or 40**

Containment Ventilation Isolation (S_H) signal secures VQ and VP.

To "Reset" Containment Ventilation Isolation following a Safety Injection, Manual Phase "A", or Manual Phase "B", the Containment Ventilation (S_H) "Reset" Pushbuttons must be depressed (can reset without resetting the initiating signal).

To "Reset" Containment Ventilation following an EMF 38, 39, 40 Trip II, the EMF must be reset, then the Containment Ventilation "Reset Pushbuttons must be depressed.

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 Manual "NS/Phase B" 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 NS/Phase B pushbutton and CPCS after a 10 minute time delay.

MNS Exam Bank Question ECCISEN04:

ECCISEN04

1 Pt Given the following conditions:

1) Containment pressure is 3.8 psig

2) Phase B containment isolation has occurred

What are the minimum steps required to restore Component Cooling water to containment?

A. Restore KC to operation immediately

B. Reset Phase B, restore KC to operation

C. Reset SI, reset Phase B, restore KC to operation

D. Reduce containment pressure below 3.5 psig, reset Phase B, restore KC to operation

Answer 599

Answer *B*

MISCINFO: RO&SRO

SOURCE: BCH

REFERENCES: OP-MC-ECC-ISE page 29

LESSON: OP-MC-ECC-ISE TASK:

OBJECTIVE: 1.N.2 TIME:

K/A: 022000K403 (3.6*/4.0*) DATE: 11/29/95

QuestionBank #	KA_system	KA_number
1829	SYS002	K3.03

.\A_desc
Knowledge of the effect that a loss or malfunction of the RCS will have on the following: (CFR: 41.7)□Containment

The following conditions exist on Unit 1:

- Unit 1 is at 100% RTP with a small NC system leak in Containment
- Containment pressure is 0.28 PSIG and slowly increasing
- The BOP places all VL fans in High Speed

Which ONE (1) of the following correctly describes the impact of this action on the following Containment parameters?

A. Containment Pressure AND Temperature will DECREASE.

B. NO IMPACT on either Containment Temperature OR Pressure.

C. NO IMPACT on Containment Temperature. Containment pressure will DECREASE.

D. NO IMPACT on Containment Pressure. Containment Temperature and will DECREASE.

General Discussion

The student must recognize that high speed effects more than just the air flow for the AHU. The student must determine what the higher air flow will impact.

The KA is matched because under the conditions where a small NC system leak has occurred in containment, the applicant must determine the effect on containment conditions when additional ventilation flow is provided to containment.

Answer A Discussion

CORRECT

Answer B Discussion

Incorrect. If the student does not understand the relationship of temperature and pressure to increased cooling from the VL units.

Answer C Discussion

Incorrect. If the student does not understand the relationship of temperature and pressure or the methodology of dehumidification he will assume only the pressure goes down.

Answer D Discussion

Incorrect. If the student does not understand the relationship of temperature and pressure or the methodology of dehumidification he will assume only the temperature goes down.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 CNS NRC Q55 (Bank 661)

- [x] Developed
- [x] OPT Approved
- [ ] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-CNT-VUL pages 11, 15, and 17	

QuestionBank #	KA_system	KA_number
1829	SYS002	K3.03

KA_desc

Knowledge of the effect that a loss or malfunction of the RCS will have on the following: (CFR: 41.7)□Containment

401-9 Comments:

401-9 Comments RESPONSE

Question 29 References:

From Lesson Plan OP-MC-CNT-VUL page 11:

1.0 INTRODUCTION

1.1. Purpose

Objective #1

The purpose of the Upper Containment Ventilation System (VU) is to provide cooling to the upper compartment of Containment during normal operation and shutdown. This system performs no safety-related functions, but is regulatory-required per Technical Specification surveillance requirements.

The purpose of the Lower Containment Ventilation System (VL) is to provide cooling to the lower compartment of Containment during normal operation and shutdown. This system performs no safety-related functions, but is regulatory-required per Technical Specification surveillance requirements.

The purpose of the Control Rod Drive Ventilation System (VR) is to provide cooling to the control rod drive mechanism shroud during normal plant operation. This system performs no safety-related functions and is not regulatory-required.

The purpose of the Incore Instrumentation Ventilation System (VT) is to maintain the incore instrumentation room during normal operation and shutdown to within the design temperature range for operation of equipment and for personnel access for inspection, maintenance and testing as required. This system performs no safety-related functions and is not regulatory-required.

1.2. General Description

The Containment Ventilation systems control the pressure and temperature of the air mass inside Containment. These parameters, defining the initial Containment conditions, serve as inputs into various accident analyses that determine peak Containment pressure and temperature.

The VL, VR, VT, and VU systems are sub-systems of the Containment Ventilation System and are designed to maintain the temperature of the air within the lower Containment Compartment, Control Rod Drive Mechanism Shroud Area, Incore Instrumentation Room, and Upper Containment Compartment, respectively. Temperature limits were established based on acceptable limits for operation of equipment and for personnel access for inspection, maintenance, and testing as required.

From Lesson Plan OP-MC-CNT-VUL page 15:

These units are shunt-tripped from the essential power system upon receipt of an S_S signal. Once the shunt trip occurs, the fan's HVAC panel "ON – OFF" indication and control power is lost. The motors are overload protected.

The purpose of the upper containment return air fans is to remove air from the dome area of the Containment to prevent stratification. The fans draw the air from the dome and discharge near the suction of an associated upper containment ventilation unit. There are four (4) fans associated with this purpose, two are normally operating. Each fan is interlocked with a corresponding upper containment ventilation unit so that the fans operate in conjunction with their associated upper containment ventilation unit. These are driven by 1HP, 3 phase, non-nuclear safety related motors and perform no emergency functions. The motors are overload protected.

Objective #8

Each Return Air Fan is provided with a selector switch ("AUTO-START-STOP" pushbutton) on the HVAC panel. Each may be manually started or placed in the auto mode. If in auto, the return air fan will start when its corresponding air handling unit is started. Status indication is provided on the HVAC panel.

The normal power supply for these units is a 600VAC Essential Motor Control Center. Following a Blackout, all units will be sequenced on regardless of switch position. Under these conditions, these fans can not be stopped until the sequencer is reset. These units are shunt-tripped from the essential power system upon receipt of an S_S signal and the "ON-OFF" indication on the HVAC panel is lost.

1.3. Lower Containment Ventilation System (VL)

The VL system is regulatory-required per Technical Specification surveillance requirements and performs no safety-related functions. The VL system is designed to maintain a maximum temperature (120°F) inside the lower Containment compartment during normal operation and a minimum temperature (60°F) during shutdown.

Per Tech Spec 3.6.5, the average air temperature for Lower Containment shall be $\geq$ 100°F and $\leq$ 120°F in Modes 1 - 4.

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.

This temperature range was determined by incorporating the following temperature limits: (1) the lower Containment compartment temperature assumed in the

Containment accident analyses, (2) the equipment qualification temperatures, and (3) temperature requirements for personnel access.

From Lesson Plan OP-MC-CNT-VUL page 17:

The Lower Containment Weighted Average Temperature (LCWAT) is used by the operator to determine optimum VL/RV/RN operations. The LCWAT program calculates the LCWAT using only the operating VL units inputs (temperatures associated with idle fans are not used).

> **NOTE:** In normal operation 4 VL AHU's operating in low speed is the preferred VL configuration.

It is desirable for the VL system to operate during events such as a small isolable LOCA, small main steam break inside Containment, blackout and LOOP to avoid a rise in Containment pressure such that Containment Spray is unnecessarily actuated. Provisions in the design were made such that selected equipment from this system is capable of receiving safety-related 1E power.

The VL system consists of four (4) recirculating ventilation units and their associated cooling coils, fans, and associated ductwork. This equipment is located in the annular concrete chambers around the periphery of the lower Containment compartment (Fan Rooms). The temperature in the annulus between the reactor vessel and the primary shield may exceed the maximum average temperature of lower Containment (This temperature may be allowed to reach 135°F without detrimental effects to the installed instrumentation.)

Objective #8

Each VL AHU has an "OFF-LOW-HIGH" selector switch on the HVAC panel. The VL fan motors are overload protected and status indication is provided on the HVAC panel. Annunciators are provided to indicate mixed speed operation, transfer to emergency power, high speed start and high vibration. Bearing temperatures are monitored by the OAC. The 2A, 2B & 2C VL fan motors are a different design motor which is designed to operate at a higher temperature than the others on Unit 1 & 2. Therefore, these same VL fan motors have higher bearing temperature alarm setpoints on the OAC (see MM-10562). Discharge check damper position is provided on the HVAC panel. Each VL AHU has a suction damper control switch ("AUTO-OPEN-CLOSE" pushbutton) on the HVAC panel. Each VL ventilation unit fan has two-speed capability. At high speed the associated fan operates at 1800 rpm and at low speed the fan operates at 900 rpm.

Objective #2

The cooling water supply is from the Containment Ventilation Cooling Water (RV) system. Nuclear Service Water (RN) through the RV System is the preferred source of cooling water in Modes 1 through 5. In Mode 6 or No Mode, cooling water is not required. Cooling water flow is maintained to the VL ventilation units until the "Phase B" signal is received. Since the cooling water for the VL ventilation units is raw water, fouling of these tubes is a problem. As the fouling of the heat transfer area increases, the efficiency of the cooling coil is decreased, thus increasing the temperature of lower Containment.

QuestionBank #	KA_system	KA_number
661	N/A	

KA_desc

Unit 1 is at 100% Power with a small NC leak in containment. Containment pressure is 0.28 PSIG and slowly increasing. The CRS asks you to place all Lower Containment Ventilation Fans in "High Speed".

Which one of the following correctly describes the impact of this action on containment parameters?

A. No impact on containment pressure or temperature. Containment Humidity will decrease.

B. No impact on containment pressure or humidity. Containment temperature will decrease.

C. No impact on containment pressure. Containment humidity and temperature will decrease.

D. Containment pressure, temperature and humidity will decrease.

General Discussion

The student must recognize that "high speed" effects more than just the air flow for the AHU. A cooling water bypass valve or "full flow" valve is installed in parallel with the normal cooling water flow control valve. This valve will automatically open when the LCVU is selected to HIGH speed. The student must determine what the higher air flow with more cooling flow will impact.

Answer A Discussion

If the student does not understand the full flow valve operation then he will assume more air flow but the same cooling water flow. This would have an effect on humidity

Answer B Discussion

If the student does not understand the relationship of temperature and pressure or the methodology of dehumidification he will assume temperature goes down.

Answer C Discussion

The student must determine what the higher air flow with more cooling flow will impact. If the student does not understand the relationship of temperature and pressure, he will assume the temperature and humidity will decrease.

Answer D Discussion

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References	Student References Provided
References: 1. TS 3.6.4 and Bases 2. VV Lesson	

QuestionBank #	KA_system	KA_number
661	N/A	

KA_desc

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1830	SYS014	A1.02

KA_desc
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPIS controls, including: (CFR: 41.5 / 45.5)□Control rod position indication on control room panels ....

Given the following plant conditions:

- Reactor Startup in progress

IMMEDIATELY after the Control Board Annunciator 1AD-2 D9 (RPI at Bottom Rod Drop) extinguishes, the Digital Rod Position Indication (DRPI) displays will indicate which ONE (1) of the following?

A. All Shutdown Bank rods >6 steps.

B. All Shutdown Bank rods withdrawn and Control Bank 'A' rods >6 steps.

C. All Shutdown Bank rods and Control Bank 'A' rods fully withdrawn.

D. All Shutdown Bank rods withdrawn and ALL Control Bank rods >6 steps.

General Discussion

The "RPI at Bottom Rod Drop" clears when all Shutdown Bank rods are withdrawn and Control Bank 'A' rods are >6 steps.

Difficult K/A match as there are no controls associated with the DRPI system to operate which could cause a change in parameters or prevent exceeding design limits. The closest K/A match possible is related to the DRPI indications in the Control Room as the system is operated. The "RPI at Bottom Rod Drop" annunciator was chosen since when it clears the indication for a rod being dropped is now enabled. Additionally, once the rod drop alarm is enabled, if a rod remains on the bottom as the other rods in that bank are withdrawn (>6 steps) the annunciator would alarm to alert the operator and potentially prevent exceeding design limits on the fuel (i.e. peaking factors).

Answer A Discussion

Incorrect. Plausible because >6 steps is the correct setpoint for the alarm to clear.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Plausible because the Shutdown Banks being withdrawn is correct and clearing the alarm is associated with withdrawal of Control Bank 'A'. However, it is >6 steps withdrawn and not fully withdrawn.

Answer D Discussion

Incorrect. Plausible because the Shutdown Banks being withdrawn is correct and the setpoint (>6 steps) is correct. However, it is the first bank (Control Bank 'A') and not all Control Banks being withdrawn >6 steps that clears the alarm.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Exam Bank Question ICEDA022

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-IC-EDA Objectives 7 & 9 page 33	

QuestionBank #	KA_system	KA_number
1830	SYS014	A1.02

KA_desc

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPIS controls, including: (CFR: 41.5 / 45.5)□Control rod position indication on control room panels ....

401-9 Comments:

401-9 Comments RESPONSE

Question 30 References:

Nomenclature:	RPI AT BOTTOM ROD DROP	Window:	D9

Setpoint: One or more full length rods are at position "0"

> **NOTE:** WHEN all Shutdown Bank Rods are full out and Control Bank A rods are off bottom, the alarm will clear.

Origin: Rod Bottom Bistable

Probable Cause:
- Urgent Failure in Rod Position Indication System
- Failure in Rod Control System causing one or more full length rods to drop

Automatic Action:
1. "RB" light lit for affected rod(s).
2. With rods in automatic, controlling group will step out to maintain T_{avg} with T_{ref}.

Immediate Action: Go to AP/1/A/5500/014 (Rod Control Malfunction).

Supplementary Action:
1. IF desired to have Engineering evaluation as to cause for alarm, freeze the Transient Monitor.
2. Refer to Tech Specs.

References:
- Tech Specs
- Westinghouse Digital Rod Position Indication System
- MCM-1399-95-192
- Westinghouse Rod Control System
- NSM MG-12126

End of Response

Unit 1

3.2.2 Control Room Annunciators

RPI Urgent Failure

Indicates that at least one rod has invalid data for both A and B trains, or that there is a 'Rod Deviation'. This alarm output has full reflash capability, i.e. if any rod is in an urgent alarming condition and another rod has a problem, the alarm output to the annunciator will go momentarily "normal" then back to "alarm", causing the plant annunciator to go into a flashing alarm condition. **Note: this annunciator comes in when and only when the DRPI Display "Urgent Alarm" comes in**.

RPI Non-Urgent Failure

Indicates that at least one rod is in half-accuracy (either A or B data is invalid), or a logic error is detected (one rod has gray codes that don't agree, they must be either equal or A can be 1 more than B). This alarm output has full reflash capability.

RPI At Bottom Rod Drop

Objective #7,9

NOTE: On a reactor startup, starting with all rods on the bottom (control and shutdown) the alarm will be in. The alarm will not clear while withdrawing Shutdown Banks. The alarm will clear when all Control Bank A rods' are 6 steps withdrawn. **After that**, any Shutdown or Control Bank A rod dropping would bring in the alarm. Control Banks B, C, and D function the same way as Control Bank A (i.e., a rod dropping in Bank B (C and D) would not activate the alarm until **after** that bank has been sequenced out 6 steps). Any control bank rod left in as its' bank is withdrawn will also cause the alarm to come in (for Control Bank 'A', alarm would remain in).

This annunciator alarms when the best calculated position for that rod is "0". Note this includes scenarios where there is a Data A and a Data B failure on a rod, since it's calculated position defaults to "0" even though the rod has not dropped.

RPI At Bottom > 1 Rod Dropped

Same as the above 'RPI At Bottom Drop', except for two or more rods.

3.2.3 "Rod Position Deviation" Computer Alarm

The computer compares Bank Demand to Individual Rod Position. If any deviates greater than 12 steps the computer will alarm. This alarm is the "Rod Position Deviation Monitor".

NOTE: This is stated in the surveillance requirements of Tech Spec 3.1.3.2

3.2.4 OAC "RODS"

This program provides step counter and Data 'A' and Data 'B' Grey codes.

MNS Exam Bank Question ICEDA022:

ICEDA022

1 Pt Given the following plant conditions:

- Unit 1 in Mode 3 of operation.
- Reactor Startup in progress; withdrawing the Shutdown Banks at this time.

Which ONE (1) of the following explains when the Control Board Annunciator "RPI at Bottom Rod Drop" will clear (light will go off)?

A. After all Shutdown Banks are withdrawn > 6 steps.

B. After all Shutdown Banks are fully withdrawn (assuming proper rod withdrawal sequence).

C. After all Shutdown Banks are withdrawn and Control Bank A rods indicate 6 steps off the bottom.

D. After all Shutdown Banks and Control Bank A rods are fully withdrawn (assuming proper rod withdrawal sequence and bank overlap).

Answer 2449

C

IC-EDA, section 3.2.2.

Objective 9

C

QuestionBank #	KA_system	KA_number
1831	SYS017	K6.01

KA_desc
Knowledge of the effect of a loss or malfunction of the following ITM system components: (CFR: 41.7 / 45.7) Sensors and detectors

Given the following conditions on Unit 1:

- Unit is operating at 100% RTP
- It is discovered that ONLY three (3) Core Exit Thermocouples (CETs) are OPERABLE in core Quadrant 2

Which ONE (1) of the following describes the status of CETs in Quadrant 2 and the requirements of Tech Spec 3.3.3 (PAM Instrumentation) if any, based on these conditions?

REFERENCE PROVIDED

A. Both channels of CETs are OPERABLE. No further actions required.

B. Both channels of CETs are INOPERABLE. Restore one channel to OPERABLE within 7 days.

C. One channel of CETs is INOPERABLE. Restore required channel to OPERABLE within 30 days.

D. One channel of CETs in INOPERABLE. Initiate the actions of T.S. 5.6.7 immediately.

General Discussion

Tech Spec 3.3.3, PAM Instrumentation requires channels per core quadrant be operable in MODES 1, 2, and 3 with two operable detectors per channel.

The KA is matched because the applicant must take a given set of conditions and apply technical specifications to determine the operability of the system and the required actions. In doing so, the applicant must demonstrate that they know the difference between an operable detector and an operable channel.

Answer A Discussion

Incorrect. Plausible if the applicant does not read the note associated with operable channels and does not realize that there is a difference between operable detectors and operable channels.

Answer B Discussion

Incorrect. Plausible if the applicant does not understand that with 3 detectors operable, there has to be one operable channel. The action is correct.

Answer C Discussion

Incorrect. Plausible because one channel is inoperable. However, the is no information to imply that the LCO time has been exceeded.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-IC-ICM Objective 19 Tech Spec 3.3.3, PAM Instrumentation	Copy of TS 3.3.3 (Q31)

QuestionBank #	KA_system	KA_number
1831	SYS017	K6.01

KA_desc

Knowledge of the effect of a loss or malfunction of the following ITM system components: (CFR: 41.7 / 45.7)□Sensors and detectors
....

401-9 Comments:

017K601
I do not see where "A" is plausible given the circumstances.
Replace "A" or prove plausibility.
RFA 10/08/09

401-9 Comments RESPONSE

The distracter analysis is fine as written, should be able to convince Ron that this one is plausible. No Changes, will discuss during review.

Question 31 References:

From Tech Spec 3.3.3 PAM Instrumentation:

3.3 INSTRUMENTATION

3.3.3 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.3 The PAM instrumentation for each Function in Table 3.3.3-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

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 3.3.3-1 for the channel.	Immediately
B. One or more Functions with one required channel inoperable.	B.1 Restore required channel to OPERABLE status.	30 days
C. Required Action and associated Completion Time of Condition B not met.	C.1 Initiate action in accordance with Specification 5.6.7	Immediately
D. One or more Functions with one required channel inoperable.	D.1 Restore required channel to OPERABLE status.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One or more Functions with two required channels inoperable.	E.1 Restore one channel to OPERABLE status.	7 days
F. Not Used	F.1 Not Used	Not Used
G. Required Action and associated Completion Time of Condition D or E not met.	G.1 Be in MODE 3. AND G.2 Be in MODE 4.	6 hours 12 hours
H. Required Action and associated Completion of Condition D not met.	H.1 Initiate action in accordance with Specification 5.6.7.	Immediately

Table 3.3.3-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

	FUNCTION	REQUIRED CHANNELS	CONDITIONS
1.	Neutron Flux (Wide Range)	2	B,C,E,G
2.	Reactor Coolant System (RCS) Hot Leg Temperature	2	B,C,E,G
3.	RCS Cold Leg Temperature	2	B,C,E,G
4.	RCS Pressure (Wide Range)	2	B,C,E,G
5.	Reactor Vessel Water Level (Dynamic Head Range)	2	B,C,E,G
6.	Reactor Vessel Water Level (Lower Range)	2	B,C,E,G
7.	Containment Sump Water Level (Wide Range)	2	B,C,E,G
8.	Containment Pressure (Wide Range)	2	B,C,E,G
9.	Containment Atmosphere Radiation (High Range)	1	D,H
10.	Not Used	Not Used	Not Used
11.	Pressurizer Level	2	B,C,E,G
12.	Steam Generator Water Level (Narrow Range)	2 per steam generator	B,C,E,G
13.	Core Exit Temperature - Quadrant 1	2(a)	B,C,E,G
14.	Core Exit Temperature - Quadrant 2	2(a)	B,C,E,G
15.	Core Exit Temperature - Quadrant 3	2(a)	B,C,E,G
16.	Core Exit Temperature - Quadrant 4	2(a)	B,C,E,G
17.	Auxiliary Feedwater Flow	2 per steam generator	B,C,E,G
18.	RCS Subcooling Margin Monitor	2	B,C,E,G
19.	Steam Line Pressure	2 per steam generator	B,C,E,G
20.	Refueling Water Storage Tank Level	2	B,C,E,G
21.	DG Heat Exchanger NSWS Flow(b)	1 per DG	D,G
22.	Containment Spray Heat Exchanger NSWS Flow(b)	1 per train	D,G

(a) A channel consists of two core exit thermocouples (CETs).

(b) Not applicable if the associated outlet valve is set to its flow balance position with power removed or if the associated outlet valve's flow balance position is fully open.

QuestionBank #	KA_system	KA_number
1832	SYS029	A2.03

KA_desc
Ability to (a) predict the impacts of the following malfunctions or operations on the Containment Purge 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)□Startup operations and the associated required valve lineups ....

Unit 2 has entered Mode 5 for a refueling outage. Containment personnel airlocks are currently in service. VP Train B is being placed in service.

- Containment pressure begins to increase at 0.1 PSIG per minute
- An Operator in the plant reports that supply and exhaust flow rates indicate flow is balanced

Which ONE (1) of the following is the probable cause of the Containment pressure increase and how can it be stabilized?

A. VP SUPPLY AIR FLOW indication is reading LOWER than actual flow. Supply flow to Containment must be DECREASED.

B. VP EXHAUST AIR FLOW indication is reading HIGHER than actual flow. Exhaust flow from Containment must be DECREASED.

C. VP SUPPLY AIR FLOW indication is reading HIGHER than actual flow. Supply flow to Containment must be INCREASED.

D. VP EXHAUST AIR FLOW indication is reading LOWER than actual flow. Exhaust flow from Containment must be INCREASED.

General Discussion

More air is being supplied to containment than is being exhausted which has resulting in an increase in containment pressure. This has been caused by the fact that 1VPPG9140 Supply Air Flow is indicating low or 1VPPG9250 Exhaust Air Flow is indicating high and the subsequent flow balance based on the erroneous indication is admitting more air to containment than is being exhausted. To correct the imbalance, supply air flow must be decreased or exhaust air must be increased.

This KA is matched because the applicant must evaluate and adverse condition (containment pressure increasing) that has resulted from operation of the Containment Purge system during startup of the system and determine what actions must be taken to correct the problem.

This is a comprehension level question because the applicant must analyze the given indications, determine what is causing the containment pressure increase, and determine what erroneous indications could have resulted in an imbalance in the supply and exhaust flows.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. First part could be correct. However, if Exhaust flow was indicating higher than actual the correct action would be to increase exhaust flow to balance the Supply and Exhaust flows.

Answer C Discussion

Incorrect. First part incorrect. Containment pressure would be decreasing if actual supply flow was < indicated. Second part is incorrect. Increasing supply flow or decreasing exhaust flow would be the correct action for containment pressure decreasing.

Answer D Discussion

Incorrect. The first part is incorrect. If exhaust flow was reading lower than actual flow, containment pressure would be decreasing. Increasing exhaust flow would correct this problem.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 NRC Q61 (Bank 667)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CNT-VP Objective 2 & 4 Section 3.1.2	

QuestionBank #	KA_system	KA_number
1832	SYS029	A2.03

KA_desc

Ability to (a) predict the impacts of the following malfunctions or operations on the Containment Purge 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)□Startup operations and the associated required valve lineups ....

401-9 Comments:

401-9 Comments RESPONSE

Question 32 References:

From Lesson Plan OP-MC-CNT-VP Section 3.1.2 page 23:

3.1.2 Operating procedures

The Containment Purge System is normally de-energized. It is used to purge Containment and the Incore Instrument Room when testing and maintenance are to be performed on equipment inside these areas. Manual actuation is provided from the HVAC Controls in the Main Control Room. Should the system be active at the time of a LOCA or detection of radiation leakage, the units are automatically de-energized and the associated isolation valves are closed upon receipt of a Containment Ventilation Signal (S_h).

To start the Purge Supply and Exhaust Fans select 100% capacity (normal operation) or 50% capacity on Purge and Supply Mode Switch. If for some reason it is necessary to operate the purge system at 50% capacity select Train "A" or Train "B" position.

Objective #2 & 4

Place the Purge Mode Selector Switch, on local panel RB-CP-1, to the desired position "NORMAL" or "REFUEL". In the NORMAL position dampers RBPS-D-8 and 9 in the supply air lines position to provide a flow split of 2/1 ratio of supply air (Upper vs. Lower Containment). Upper and lower supply flows are indicated on RB-CP-1. In the REFUEL position the flow split is 4/1. To operate the system in the Refuel mode, the missile shield must be removed (procedure requirement).

Operation of the supply and exhaust fans should be such that the total air flow rate entering the containment equals that exhausting containment to avoid placing the Containment vessel under a positive or negative pressure. Air flow rates into and out of containment are controlled by throttling a set of pneumatic dampers, one on the discharge and one on the recirculation line, for the supply (RBPS-D-5 and 6) and exhaust (RBPE-D-4 and 5). As one of the dampers throttles closed the other will open to maintain the desired flow rate.

For the supply air VPMPS-5 on RB-CP-1 controls dampers RBPS-D-5 and 6 in the supply duct system. When this control is rotated in the clockwise position the discharge damper, RBPS-D-6 closes. As D-6 closes, supply air flow rate to the Containment decreases and D-5 opens to maintain flowrate for the operating supply fan(s). An air monitor mounted in the supply duct to the Containment furnishes air flow rate (cfm) read-out on RB-CP-1 indicating the rate (cfm) air is being supplied to the Containment.

For the exhaust air VPMPS-6 on RB-CP-1 control dampers RBPE-D-4 and 5 in the exhaust duct system. When this control is rotated in the clockwise position the discharge damper, RBPE-D-4 closes. As D-4 closes, exhaust air flow rate from the Containment decreases and D-5 opens to maintain flowrate for the operating exhaust fan(s). An air monitor mounted in the exhaust duct from the Containment furnishes air flow rate (cfm) read-out on RB-CP-1 indicating the rate (cfm) air is being exhausted from the Containment.

QuestionBank #	KA_system	KA_number
667	N/A	

KA_desc

Unit 2 has entered Mode 5 for a refueling outage. Containment personnel airlocks are currently in service. B Train VP is being placed in service.

- Containment pressure begins to increase at 0.1 PSIG per minute.
- NLO's report that supply and exhaust flow rates are equal.

Which one of the following is the probable cause of the containment pressure increase and how can it be stabilized?

A. 1VPP5150 (CONT. PURGE SUPPLY AIR FLOW) is out of calibration and reading low. Supply flow to containment must be decreased to stabilize containment pressure.

B. 1VPP5200 (CONT. PURGE EXHAUST AIR FLOW) is out of calibration and reading high. Exhaust flow from containment must be decreased to stabilize containment pressure.

C. 1VPP5150 (CONT. PURGE SUPPLY AIR FLOW) is out of calibration and reading low. Supply flow to containment must be increased to stabilize containment pressure.

D. 1VPP5200 (CONT. PURGE EXHAUST AIR FLOW) is out of calibration and reading low. Exhaust flow from containment must be increased to stabilize containment pressure.

General Discussion

More air is being supplied to containment than indicated on 1VPP5150. This would result in a containment pressure increase if exhaust flow is matched to the erroneous supply flow. Decreasing the supply flow or increasing the exhaust flow can be performed to stabilize containment pressure.

Answer A Discussion

Answer B Discussion

First part incorrect. Containment pressure would be decreasing if actual exhaust flow was > indicated. Second part is incorrect. Increasing supply flow or decreasing exhaust flow would be the correct action for containment pressure decreasing.

Answer C Discussion

First part incorrect. Containment pressure would be decreasing if actual supply flow was < indicated. Second part is incorrect. Increasing supply flow or decreasing exhaust flow would be the correct action for containment pressure decreasing.

Answer D Discussion

The first part is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

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

Development References	Student References Provided
References: 1. VP Lesson 2. OP-CN-CNT-VP-03	

QuestionBank #	KA_system	KA_number
667	N/A	

KA_desc

401-9 Comments: **401-9 Comments RESPONSE**

C

QuestionBank #	KA_system	KA_number
1833	SYS034	A3.03

KA_desc
Ability to monitor automatic operation of the Fuel Handling System, including: (CFR: 41.7 / 45.5)□High flux at shutdown ....

Given the following conditions:

- Reactor is in MODE 6
- Core reload is in progress
- Source range instrument N31 has read approximately 80 CPS for the past hour
- Electronic noise from a welder inadvertently caused N31 to reach 3000 CPS for 30 seconds

Which ONE (1) of the following describes the correct plant response?

A. If a VQ release is in progress, it should be secured.

B. The Containment Purge Supply and Exhaust dampers close ONLY.

C. The Containment Evacuation alarm sounds.

D. A Containment Ventilation Isolation actuates.

General Discussion

If the 'High Flux at Shutdown' is unblocked on the affected source range instrument which it would be required to be in Mode 6 during core alterations, an increase in count rate in excess of .5 decades above background would result in the actuation of the containment evacuation alarm. A related alarm which would result in a containment evacuation alarm would be a Trip 2 from on the containment radiation monitors, 1EMF 38,39 & 40. This would also result in a containment ventilation signal which in turn isolate a VQ release, VP release and secure the containment floor & equipment sump pumps.

It is not possible to completely match this KA at MNS because there is no automatic action associated with the fuel handling equipment affected by a high flux shutdown alarm. A high flux at shutdown alarm would actuate a containment evacuation alarm which would require fuel handling activities to be suspended, equipment to be placed in a safe configuration and the fuel handling crew to leave containment. With this in mind, the question is testing the candidates ability to monitor what should have occurred in the event of a high flux at shutdown alarm.

This is an analysis level question since the applicant is given a set of plant conditions and is required to recall from memory the setpoint for high flux at shutdown to determine what automatic actions should have occurred.

Answer A Discussion

Incorrect: A VQ release be unaffected. Plausible: If the candidate believes the high flux condition described should have resulted in a containment ventilation isolation signal then this would be a correct answer

Answer B Discussion

Incorrect: A VP release would be unaffected. Plausible: . If the candidate believes the high flux condition described should have resulted in a containment ventilation isolation signal then this would be a correct answer

Answer C Discussion

CORRECT: See explanation above

Answer D Discussion

Incorrect: Containment sump pumps would be unaffected. Plausible If the candidate believes the high flux condition described should have resulted in a containment ventilation isolation signal then this would be a correct answer.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Exam Bank Question AICENBR05

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Lesson Plan IC-ENB Rev 27 Pg 19

Learning Objective: OP-MC-IC-ENB Obj # 4

Student References Provided

QuestionBank #	KA_system	KA_number
1833	SYS034	A3.03

KA_desc

Ability to monitor automatic operation of the Fuel Handling System, including: (CFR: 41.7 / 45.5)□High flux at shutdown
....

401-9 Comments:

034A303
No comment at this time
RFA 10/08/09

401-9 Comments RESPONSE

Instrument Power Fuses - Overcurrent protection for power supply circuits. Instrument power supplies the meters, circuit processing components, high voltage supply and detector power. This is true for the IR and PR drawers/circuits also.

MNS Exam Bank Question AICENBR05:

AICENBR05

1 Pt Given the following conditions:

- Reactor is in MODE 5
- Source range instrument N31 has read approximately 80 cps for several hours
- Boron concentration is 1300 ppm
- Electronic noise from a welder inadvertantly caused N31 to reach 3000 cps for 30 seconds

Which of the following describes the correct plant response?

A. If a VQ release is in progress, it should be secured

B. The containment purge supply and exhaust dampers close

C. The containment evacuation alarm sounds

D. A containment ventilation isolation actuates

Answer 5

C

IC-ENB, section 2.1.2 and 3.1.4

C

QuestionBank #	KA_system	KA_number
1834	SYS045	K4.13

KA_desc
Knowledge of MT/G system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)□Overspeed protection

Which ONE (1) of the following best describes the overspeed protection for the Main Turbine?

A. Electrical trip at 103% and mechanical trip at 113%.

B. Electrical trip at 111% and mechanical trip at 113%.

C. Mechanical trip at 110% and electrical trip at 111%.

D. Mechanical trip at 110% and electrical trip at 115%.

General Discussion

The mechanical overspeed trip mechanism trips the Main Turbine at 110%. The electrical overspeed device trips the Main Turbine at 111%.

The K/A is matched because the applicant must know the setpoints for the Main Turbine overspeed protection trips.

Answer A Discussion

Incorrect. The mechanical overspeed trip is correct. An electrical trip at 103% is plausible since the OPC overspeed protection actuates at 103%.

Answer B Discussion

Incorrect. The electrical overspeed trip is correct. A mechanical overspeed trip at 113% is plausible if the applicant confuses the Main Turbine trip with the EDG Overspeed trip.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. The mechanical overspeed trip is correct. An electrical overspeed trip at 115% is plausible if the candidate confuses the Main Turbine trip with the SSF Diesel Overspeed trip.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS NRC Exam Bank 1048 (Never Used)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-MT-MT Objective 22	

QuestionBank #	KA_system	KA_number
1834	SYS045	K4.13

KA_desc

Knowledge of MT/G system design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)□Overspeed protection

....

401-9 Comments:

401-9 Comments RESPONSE

Question 34 References:

From Lesson Plan OP-MC-MT-MT page 29:

In a purely impulsive turbine the blade speed is half that of the speed of the steam. This provides more work than reaction (analogous to the low gear in a truck) and steam velocity is higher than in a purely reactionary turbine.

The turbine was designed to maintain the main generator speed so that it will provide a 60 cycle output frequency under all load conditions. Steam demand is determined by the generator's electrical load. Maximum efficiency and the required work output is obtained by using combination blading.

2.7 Reheat Stop and Intercept Valves

Steam leaving a Moisture Separator Reheater (MSR) passes through a Reheat Stop Valve (RHSV) and then an Intercept Valve before reaching the LP turbine.

Objective # 3

The reheat stop valves separate the LP turbine from the MSR on a turbine trip. These valves are either open (turbine reset) or closed (turbine tripped).

Objective # 3

The Intercept valves are used to control turbine speed during an overspeed of 103% or a complete loss of load condition sensed by the GBX relay.

If turbine speed increases to >103% (on 2/3 speed sensors), the Overspeed Protection Control circuit (OPC) valves open to bleed off pressure in the LH emergency trip header which causes the Governor Valves and Intercept Valves to close. When speed decreases to <103% the OPC solenoid valves reclose causing the LH header to repressurize and open the Governor and Intercept Valves.

GBX Relay

The Unit 1 GBX relays monitor Generator breakers 1A, 1B and switchyard PCB's 8, 9, 11 and 12. The Unit 2 GBX relays monitor Generator breakers 2A, 2B and switchyard PCB's 58, 59, 61 and 62.

When the cross-over pressure supply to the low pressure turbine # 3 reaches a pressure equivalent to **22% load, the Load Drop Anticipatory Circuit (LDA) is armed. This circuit stays in effect until first stage impulse pressure is > 50%.**

If the generator becomes separated from the grid, EHC shifts to SPEED control mode. Also, the GBX relays become de-energized, thus detecting a “Complete Loss of Load” condition. This initiates the actuation of the LDA Circuit, which causes the two OPC valves to open, which closes the GV's and IV's. After 2.5 seconds the OPC valves close and the IV's reopen. The GV's will reopen after 5.5 seconds.

If a complete loss of load occurs when Channel 2 Turbine Impulse Pressure is > 50% (360PSIG), a "Turbine Load Reject Turbine Trip" will be actuated.

From Lesson Plan OP-MC-MT-MT page 41:

With either type of valve, when air is removed (close demand) the spring expands and applies force to close the valve. While this action may or may not stop flow in the forward direction (depending on DP across the disk, see PIP M-03-03204 or lesson plan MT-MSR), it does ensure rapid closure upon (or just prior to) establishing reverse flow conditions, which would occur following a turbine trip. Steam hammer events due to valve slamming are therefore prevented.

These valves are air assisted via the Fluid Operated Air Pilot (FOAP) valve and each has its own individual air controller. They are held open by Instrument Air supplied to the valves via the FOAP Valve. The FOAP valve will close the VI supply and open the vent path to allow the check valves to close when LH emergency header pressure is lost due to 103% OPC, GBX relay de-energizing or a turbine trip.

2.16 Front Standard

The front standard is located on the north end of the HP turbine. Monitoring, trip protection device and the shaft driven lube oil pump are located here. The HP Turbine Shroud has been permanently removed to facilitate maintenance.

The **Stub Shaft**, also called the control rotor, is a small extension of the main turbine shaft which is bolted to the main shaft. The components located on or mounted to the stub shaft are the main shaft oil pump, speed sensors and the mechanical overspeed trip device.

The Main Shaft Oil Pump supplies Auto Stop Oil for turbine trips, provides a backup high pressure seal oil supply at rated speed and drives the MTOT Eductor. The eductor supplies generator lube oil requirements and provides a backup low pressure seal oil supply at rated speed.

Objective # 8 & 19

A Sixty (60) Toothed Wheel mounted on the stub shaft provides turbine RPM, Zero Speed indication, 103% and 111% overspeed protection signals via speed sensors. Speed is sensed by five proximity probes adjacent to the wheel. Passing gear teeth generate a signal whose frequency is proportional to turbine speed. Three signals go to the DEH system. The remaining two probes are used to supply Control Room meters, the OAC and local panel indication.

Objective # 8

The Mechanical Overspeed Trip Device trips the turbine at 110% rated speed to prevent damage due to excessive centrifugal force. The mechanism consists of an eccentric weight mounted in a transverse hole in the turbine shaft. The weight is offset from the center so centrifugal force tends to move it outward against spring force. When the turbine overspeeds, the weight moves out to strike a trigger mechanism which trips the overspeed trip valve and releases auto-stop oil and high pressure EH fluid to drain.

From Lesson Plan OP-MC-MT-MT page 63:

Turbine Trips	Setpoints	
Low Vacuum	20 - 23 inches of mercury	
Thrust Bearing Wear	> 75 - 80 psig; 45 mils	
Low Bearing Oil Pressure	5 - 7 psig at #1 journal bearing	
Overspeed	Mechanical - 110% Electrical - 111%	
S/G Hi Hi Level	83% Narrow range level on 2 of 3 detectors	
Loss of both FWPT's	2 of 2 FWPT's Tripped Manual or Automatic	
Reactor Trip	Any reactor trip signal Manual or Automatic	
Turbine Oil Fire Lockout	Breakglass station in the Control Room on MC9 or Manual actuation	
Safety Injection	Any Safety Injection signal Manual or Automatic	
Turbine Load Rejection	Channel 2 Turbine Impulse Pressure >360# and the Main Generator Separated from the Grid	

QuestionBank #	KA_system	KA_number
1835	SYS055	K1.06

KA_desc
Knowledge of the physical connections and/or cause-effect relationships between the CARS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)□PRM system ....

The following conditions exist on Unit 2:

- 2A S/G has developed a 200 GPD tube leak
- 2EMF-33 (CSAE Discharge) Trip 2 light is illuminated

Which ONE (1) of the following describes the discharge flowpath for the Condenser Steam Jet Air Ejectors (CSAE) AND what occurs as a result 2EMF-33 counts reaching Trip 2?

A. The CSAEs discharge to the Unit Vent.
Annunciator ONLY.

B. The CSAEs discharge to the Unit Vent.
Annunciator AND CSAE discharge flowpath isolates.

C. The CSAEs discharge to the Turbine Building roof.
Annunciator ONLY.

D. The CSAEs discharge to the Turbine Building roof.
Annunciator AND CSAE discharge flowpath isolates.

General Discussion

The CSAEs discharge to the Unit Vent. In the past, the CSAEs discharged to the Turbine Building roof and the discharge swapped to the Unit Vent on a 1EMF-33 Trip 2 condition. However, that automatic action has been defeated and the CSAEs now continuously discharge to the Unit Vent. 1EMF-33 now only performs a monitoring function with no automatic actions.

The K/A is met because the candiate must be understand the discharge flowpath of the CARS (Physical connection) and the effect of an alarm associated with the PRM which monitors this system.

Answer A Discussion

CORRECT

Answer B Discussion

.Incorrect. Correct discharge path. The PRM control function is plausible because it used to work this way and this is true of all of the other PRR's that monitor a flowpath which discharges directly to the environment.

Answer C Discussion

Incorrect. Discharge flow path is plausible since the discharge at one time did go to the turbine building roof. The second part of the question is correct.

Answer D Discussion

Incorrect. Discharge flow path is plausible as explained above. The PRM control function is plausible because it used to work this way and this is true of all of the other PRR's that monitor a flowpath which discharges directly to the environment.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-MT-ZM Objective 4 Section 2.2	

QuestionBank #	KA_system	KA_number
1835	SYS055	K1.06

KA_desc

Knowledge of the physical connections and/or cause-effect relationships between the CARS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)□PRM system ....

401-9 Comments:

401-9 Comments RESPONSE

Question 35 References:

From Lesson Plan OP-MC-MT-ZM Section 2.2:

Objective # 2

Steam exhausting from the LP Turbines is channeled down around tube bundles from all directions. Non-condensable gasses enter the air cooling section. The CSAE's and Main Vacuum Pumps take a suction on this section to remove these gasses. The major portion of the vacuum is created by steam condensing to water around the tube bundles.

2.0 COMPONENT DESCRIPTION

2.1. Rubber Belt Expansion Joint (Boot Seal) (See Drawing 7.3)

Objective # 3

The boot seals allow for expansion and contraction of the turbine during load changes. They are located between each low pressure turbine and its associated condenser. They are physically attached to the condenser neck and low pressure turbine. There is a seal trough that runs around the perimeter of the boot seals. Water can be supplied to the seal troughs from the YM or the CM System. It was once believed that this practice would help mitigate the consequences of any small leaks that may develop in the seal.

Engineering began researching the merit of this practice in 1997. They discovered that the boot seal material actually degrades faster when it is covered in water. The vendor said the seal was designed to run dry and recommended that we discontinue our current practice. It is postulated that a pinhole leak in the seal would propagate quickly due to the differential pressures involved. Therefore, it was determined that the water would probably not be very effective in slowing down a seal leak. Also, we were using roughly 50,000 gallons of water per day to provide seal trough water to both units. After all of these factors were considered, the decision was made in 1998 to isolate the boot seal water supplies.

The procedures, valves and piping necessary to supply the seal troughs still exist however, in case such an alignment is desired in the future. The YM System (≈100 psig) would be the preferred source of water. The CM System (≈200 psig) is the backup supply and comes from the discharge of the Hotwell Pumps. Swapping between YM and CM is manually performed by procedure whenever necessary. Due to the large pressure differential between supply sources, manual valves must be adjusted when changing supply sources. This is done to ensure adequate overflow from the seals. When in this alignment, water overflows to a floor drain via seal trough overflow lines.

2.2. Condenser Steam Air Ejector (CSAE) (See Drawing 7.2)

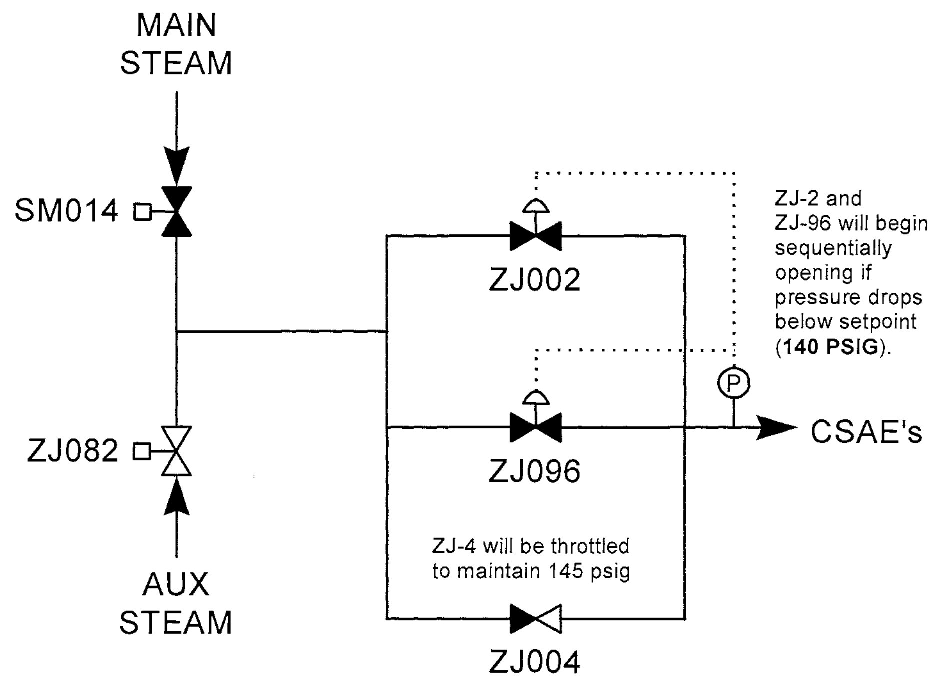
Objective # 4

Each CSAE draws the non-condensable gases and water vapor mixture from a condenser shell to the first air ejector stage. The mixture then flows to the inter-condenser where it is cooled to condense and remove the water vapor and motive steam. The second air ejector stage draws the uncondensed portion of the cooled mixture from the inter-condenser and compresses it further. The compressed mixture then passes through the after-condenser where it is cooled and more water vapor and motive steam are condensed. The condensed water vapor and motive steam from the first stage drain to the main "C" condenser. The second stage drains are normally aligned to the Turbine Building ditch in order to aid in removal of residual ammonia from the water system. The remaining non-condensable gases and water vapor are released to the atmosphere through the unit vent.

There are three CSAE's per unit, each one connected to a header that is normally aligned to all three of the main condenser shells and the CF pump condensers. Each CSAE has two sets of primary and secondary jets. The procedure directs having one set in service with the spare set in standby. The second set of primary and secondary jets may be placed in service if desired. This alignment is typically used during Unit startup or when off-gas readings are high.

Objective # 5

Steam to the air ejector jets is supplied from the AS (aux steam) header. There is a connection from Main steam to supply the air ejectors, but it's not used. There is no procedural guidance to allow Main steam to be aligned to the CSAE's.



MD-100361/200362 changed the way steam pressure to the Unit 1/2 CSAE's is controlled. **ZJ004 will be throttled by procedure to maintain steam pressure at 145 psig. Both control valves will normally be closed. A dual acting controller controls both ZJ002 and ZJ096. As pressure decreases below the setpoint of 140 PSIG, ZJ002 opens in an attempt to maintain pressure. If ZJ002 reaches the full open position and pressure remains below setpoint, ZJ096 will begin opening and continue opening as long as pressure is below setpoint.** The throat size of the two control valves combined is less than that of ZJ-004 and they would not be able to maintain 140 psig without flow from the bypass valve.

Stage steam admission is via manual valves. There are two sets of first and second stage valves per CSAE. The second stage is placed in service before first stage. Each first stage jet has a supply connection from each main and FWPT condenser. These manually operated isolation valves are used to separate all supply headers from the associated first stage jet.

Air discharge flow monitors (one high flow 0-50 SCFM and one low flow 0-15 SCFM), on the discharge of each CSAE, can be valved in to check off gas flow rate. Typically we run with one set of primary and secondary jets in service (set number two) on all three CSAE's.

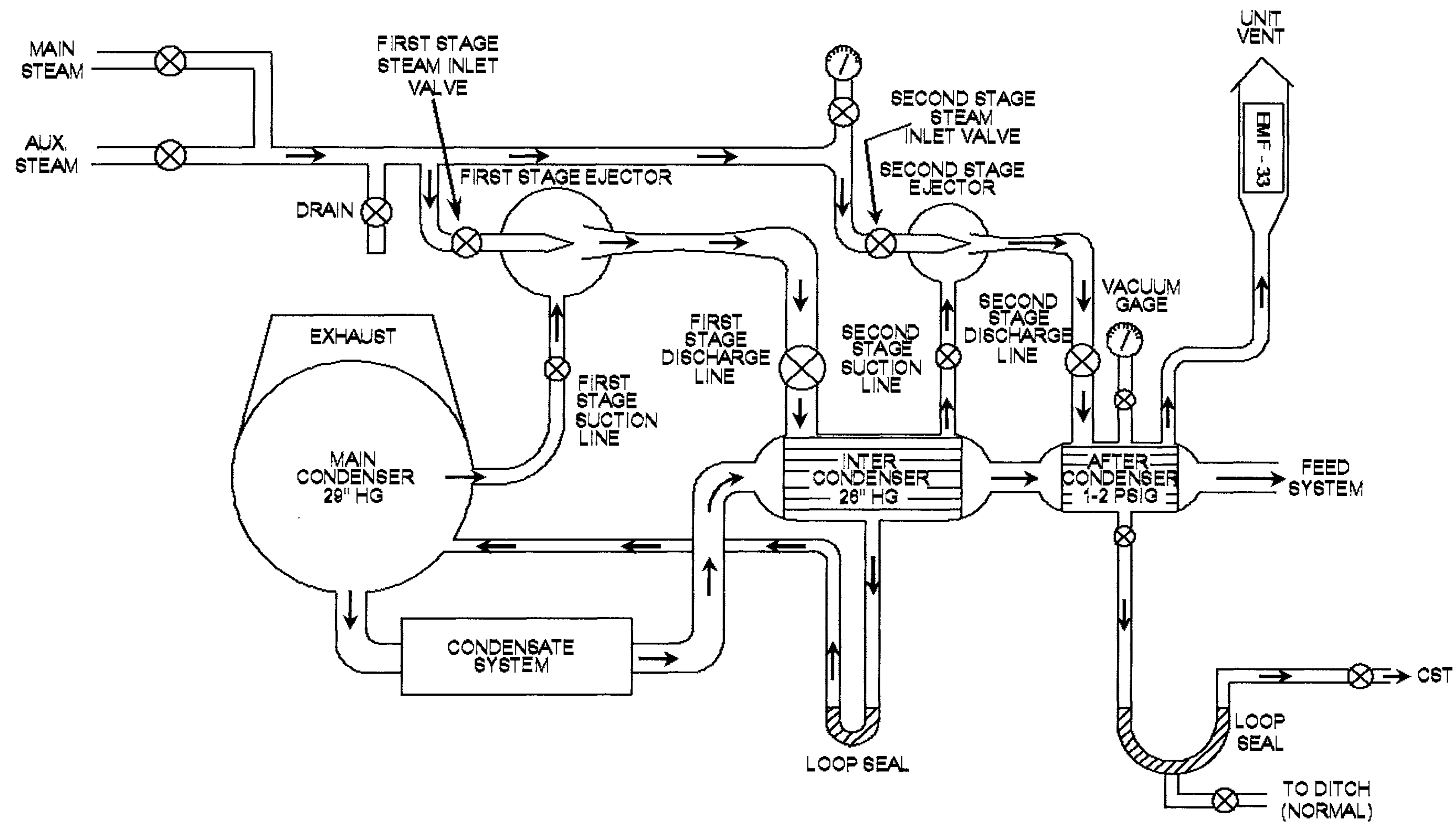
The air stream to the unit vent is monitored by EMF-33 (CSAE Discharge). An EMF Trip II alarm, signals the Control Room of a high off gas activity level. The detectors associated with 1/2EMF-33 were changed per MG-12549 and 22549. The new type of detector is mounted in-line of the exhaust header piping. It uses a gamma sensitive scintillation detector and does not require any type of sample pump. This MOD was implemented due to recurring problems with maintaining sample flow.

The gland steam condenser air discharge combines with the condenser off-gas discharge and flows to the unit vent. This connection is located downstream of the EMF-33 sample connection. The gland seal discharge is not monitored for activity.

Cooling water is supplied to the CSAE inter and after-condensers from the Condensate (CM) System. CM flow must be established prior to ejector startup.

CSAE main header and FWPT condenser vacuum gauges are located on a panel on the main turbine floor. These gauges indicate vacuum at the inlet of the jets.

FIGURE 7.2 Condenser Steam Vacuum System (03/11/04)



QuestionBank #	KA_system	KA_number
1836	SYS068	2.4.50

.A_desc
SYS068 GENERIC□Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)

Units 1 and 2 were operating at 100% RTP with a WMT release is in progress. Given the following:

- Annunciator 1RAD1 C5 (EMF 49 Liquid Waste Disch Hi Rad) is in alarm.
- 1WP-37 (Liquid Waste to RC Cntrl) indicates <u>OPEN</u>.
- 1WP-35 (WMT & VUCDT to RC Cntrl) indicates <u>OPEN</u>.
- 1WM-46 (0EMF-49 Outlet Hi Rad Shutoff Isol) indicates <u>CLOSED</u>.

Concerning the 0EMF-49 RP86A Digital Module, which ONE (1) of the following statements correctly describes the status of the associated indicator lights and the required operator actions?

A. Amber Light <u>ONLY</u> - LIT
Ensure 1WP-35 and 1WM-46 are closed on 1MC-11.

B. Amber Light <u>AND</u> Red Light - LIT
Ensure 1WP-35 and 1WM-46 are closed on 1MC-11..

C. Amber Light <u>ONLY</u> - LIT
Ensure 1WP-37 and 1WP-35 are closed on 1MC- 11

D. Amber Light <u>AND</u> Red Light - LIT
Ensure 1WP-37 and 1WP-35 are closed on 1MC- 11

General Discussion

Alarm given in the stem of this question is caused by a Trip 2 associated 0EMF-49. The EMF digital module has a red led with would be illuminated if the Trip 2 setpoint were to be reached. The yellow LED is for a Trip 1. ARP for this annunciator directs the operator to ensure 1WP-35 and 1WM-46 are closed.

KA is matched because candidate must know how to verify from the a liquid rad waste alarm is valid and then determine the required controls which need to be operated in order to respond to the alarm per the associated Alarm Response Procedure.

Answer A Discussion

Plausible if the candidate believes that the amber light indicates Trip 2, second part of the question is correct.

Answer B Discussion

CORRECT

Answer C Discussion

Plausible: first part as described above, second because one of the valves is correct, the other is closed by a different EMF for a similar liquid waste release.

Answer D Discussion

Plausible: First part is correct, second is plausible as described above.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

☑ Developed

☑ OPT Approved

☑ OPS Approved

☐ NRC Approved

Development References

Technical Reference(s): OP-MC-MC-EMF, Rev 19 pages 111 & 113
OP/1/A/6100/010 Q Pg 28

Learning Objective: OP-MC-MC-EMF, Obj. 3

Student References Provided

QuestionBank #	KA_system	KA_number
1836	SYS068	2.4.50

KA_desc

SYS068 GENERIC□Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)

401-9 Comments:

401-9 Comments RESPONSE

Question 36 References:

From Lesson Plan OP-MC-WE-EMF page 113:

DETECTOR NUMBER	PROCESS MONITORED	FUNCTION	LOCATION
1&2 EMF 46A &B	COMPONENT COOLING WATER	CLOSES SURGE TANK VENT (KC122)	SOUTH END OF KC HX
0EMF 47	BORON RECYCLE	DIVERTS NB EVAP. DISTILLATE FLOW BACK TO RHT BY DIVERTING NB 219	NORTH END OF 733 LEVEL OF AUX BLDG
1&2 EMF 48A&B	REACTOR COOLANT WATER	MONITORS NC SAMPLE FROM "A" & "D" HOT LEGS	716 LEVEL OUTSIDE HOT LAB
0EMF 49	LIQUID WASTE	TERMINATES LIQUID WASTE RELEASE (CLOSES WM46) (NORMALLY ISOLATED) AND CLOSES WP35.	NEAR WMT
0EMF 50	GASEOUS WASTE	TERMINATES GASEOUS WASTE RELEASE (CLOSES WG160)	716 LEVEL NORTH END

SEQ	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
1	State the purpose of the Process and Area Radiation Monitoring System. WEEMF001	X	X	X	X	
2	List the process monitored by each EMF and why it is monitored. WEEMF002	X	X	X	X	X
3	Describe the automatic actions that occur as a result of a Trip alarm for each of the following EMFs • 0EMF 49(L) Liquid Waste Discharge	X	X	X	X	X

QuestionBank #	KA_system	KA_number
1837	SYS071	A4.14

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□WDGS status alarms ....

Given the following:

- Unit 1 is operating at 100% RTP
- Unit 2 is refueling
- Unit 1 is releasing a minimally decayed Waste Gas Decay Tank
- A significant packing leak starts on isolation valve 1WG-160, (WG Decay Tank Outlet to Unit Vent Control)

Which ONE (1) of the following correctly describes the automatic actions which will ensure that the leak is contained and filtered?

A. 1EMF-35 (Unit Vent Part Hi Rad) automatically stops the Auxiliary Building ventilation unfiltered exhaust fans AND 1EMF-41 (Aux Bldg Vent Hi Rad) automatically aligns the Auxiliary Building ventilation filter trains.

B. 1EMF-41 (Aux Bldg Vent Hi Rad) automatically stops the Auxiliary Building ventilation unfiltered exhaust fans AND 1EMF-36 (Unit Vent Gas Hi Rad) automatically closes 1WG-160.

C. 1EMF-36 (Unit Vent Gas Hi Rad) automatically closes 1WG-160 AND 1EMF-35 (Unit Vent Part Hi Rad) automatically aligns the Auxiliary Building ventilation filter trains.

D. 0EMF-50 (Waste Gas Disch Hi Rad) automatically closes 1WG-160 AND 1EMF-41 (Aux Bldg Vent Hi Rad) automatically stops the Auxiliary Building ventilation unfiltered exhaust fans.

General Discussion

The release of radioactive gas into the Auxiliary Building will be picked up by the Auxiliary Building Ventilation System which discharges to the plant vent. The Unit 1 Low Range Particulate Vent Monitor (EMF 35) should alarm which will automatically stop the Auxiliary Building Unfiltered Exhaust Fans. The Auxiliary Building Ventilation Monitor (EMF 41) should also alarm which will place the Auxiliary Building Ventilation Filter system in service.

There are no specific WGDS status alarms in the Main Control Room. Therefore, an exact match for this KA is difficult. The closest match possible is to test applicant's ability to evaluate conditions related to the WGDS and determine how the status of the WGDS will change based on radiation monitor alarms (in the Main Control Room) and automatic actions associated with those alarms.

This is a higher cognitive level because the candidate must comprehend the physical location of the leak and based on that location analyze the given answers to determine which automatic actions will mitigate the consequences of the leak.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect: EMF 41 does not automatically stop these fans. Plausible if the candidates do not recognize that this is not an automatic action for EMF 41 but for EMF 35/37.

Answer C Discussion

Incorrect: EMF 35 does not realign ventilation filters. Plausible if applicant does not recognize this. Also, EMF 36 can close 1WG-160. But, since it's setpoint is high enough to allow the release to occur, EMF 36 will not alarm.

Answer D Discussion

Incorrect. EMF 50 will not get to Trip 2 because it is set for the activity being released, and EMF 41 does not automatically stop these fans. Plausible as these are automatic actions for the EMF monitors.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS NRC Bank 771 / 2009 NRC Question 49

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-WE-EMF, rev. 29, page 29 Objective 3	

QuestionBank #	KA_system	KA_number
1837	SYS071	A4.14

KA_desc
Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8)□WDGS status alarms ....

401-9 Comments:

401-9 Comments RESPONSE

Question 37 References:

From OP-MC-WE-EMF page 29:

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, utilize a sample probe located within the Unit Vent to monitor, record, and alarm the gaseous, iodine and air particulate activity levels released to the atmosphere from the combined ventilation systems within the station.

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.**

2.1.6 Auxiliary Building Ventilation Monitor

The Auxiliary Building is monitored by OEMF 41 - Aux Building Ventilation.

Objective # 2, 5

EMF-41 uses a scanner capable of monitoring 12 points within the Auxiliary Building ventilation ducts. These points are located to provide maximum coverage of Auxiliary Building rooms. (refer to Drawing 7.2 and 7.3)

NOTE: Sample point 6 has been deleted, so only 11 points are currently monitored.

A timed sample system is used to control the solenoid valves (refer to Drawing 7.4). **Each sample point takes about 2.5 minutes, 1.5 minutes to purge and 1 minute to sample. Thus, each point will be sampled twice per hour.** The flow rate for each sample line is 1 scfm. This 1 scfm from the sampled line is routed through the detector. A SCAN/STOP switch is provided to control EMF 41 operation mode: (refer to Drawing 7.4)

- **Scan Mode - provides automatic sequential sampling of 11 Aux. Bldg areas. PT/1/A/4600/03B requires the toggle switch to be in the scan position.**
- **Stop - provides continuous sampling of one area.**

A ready light - illuminates while EMF is sampling and off while purging. A STEP switch allows manual selection of desired sample point. This option is available in the SCAN mode only. A point window provides an LED readout that displays selected sample point. When the scanner is selected to a single point, remote readout to the OAC and Pi database is disabled. Only the local Control Room module readout is available.

Objective # 2, 3

On a Trip 2 high radiation alarm, Aux. Building Ventilation will be passed through filter units ABFU-1 and ABFU-2 (filter bypass will be terminated). The following dampers will open:

- 1ABF-D-4A 2ABF-D-4A
- 1ABF-D-4B 2ABF-D-4B
- 1ABF-D-5A 2ABF-D-5A
- 1ABF-D-5B 2ABF-D-5B

The following dampers will close:

- 1ABF-D-3
- 2ABF-D-3
- 1ABF-D-6
- 2ABF-D-6

MNS NRC Exam Bank Question 771:

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1 Pt(s) Unit 1 is operating at full power and Unit 2 is refueling. Unit 1 is releasing a minimally decayed waste gas decay tank when a significant packing leak starts on isolation valve 1WG-160, (*WG Decay Tank Outlet to Unit Vent Control).*

Which one of the following statements correctly describes the automatic actions required to assure that the leak is contained and filtered?

A. **1EMF-50 *(WASTE GAS DISCH HI RAD)* automatically closes 1WG-160, and 1EMF-41 *(AUX BLDG VENT HI RAD)* automatically stops the auxiliary building ventilation unfiltered exhaust fans.**

B. **1EMF-41 automatically stops the auxiliary building ventilation unfiltered exhaust fans, and 1EMF-36 *(UNIT VENT HI RAD)* automatically closes 1WG-160.**

C. **1EMF-36 automatically closes 1WG-160, and 1EMF-35 *(UNIT VENT PART HI RAD)* automatically aligns the auxiliary building ventilation filter trains.**

D. **1EMF-35 automatically stops the auxiliary building ventilation unfiltered exhaust fans, and 1EMF-41 automatically aligns the auxiliary building ventilation filter trains.**

Answer: D

QuestionBank #	KA_system	KA_number
1838	SYS075	K2.03

KA_desc
Knowledge of bus power supplies to the following: (CFR: 41.7)□Emergency/essential SWS pumps ....

Which ONE (1) of the following is the power supply to 1B Nuclear Service Water Pump?

A. 1ETB

B. 1ELXB

C. 1TB

D. 1EMXB

General Discussion

The 1B Nuclear Service Water Pump is powered from emergency bus 1ETB.

The K/A is matched because the applicant must know the power supply for the Nuclear Service Water pumps.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Plausible because it is the correct unit and correct train and 1ETB is supplied from 1TD which is supplied by 1ATB.

Answer C Discussion

Incorrect. Plausible because it is the correct unit and 1ETB can be supplied from 1TB.

Answer D Discussion

Incorrect. Plausible because it is the correct unit and correct train and 1EMXB is a safety-related load center which is supplied from 1ETB.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank Question PSSRN006

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

OP-MC-PSS-RN Objective 3
Page 21

Student References Provided

QuestionBank #	KA_system	KA_number
1838	SYS075	K2.03

KA_desc

Knowledge of bus power supplies to the following: (CFR: 41.7)□Emergency/essential SWS pumps ....

401-9 Comments:

401-9 Comments RESPONSE

Question 38 References:

From Lesson Plan OP-MC-PSS-RN page 21:

2.2 RN Pumps, Strainers and Mini-flow

Objective # 3

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.

The automatic start signals for the RN pumps have interlocks within the trip circuitry to prevent the pumps from being manually stopped as long as the automatic start signal is present.

RN Pump discharge throttle valve (RN-29 "RN Pump A Disch Isol" and RN 31 "RN Pump B Disch Isol") is used to throttle flow in the RN System during the start of the first pump. This valve is normally full open during operation.

Objective #5

The RN pump has a **base plate drain** which is a stainless steel basin which collects primarily mechanical seal leakage from RN pump inboard and outboard bearings. Two sump pumps are provided for the catch basin. They are powered from a local electrical socket with an on/off switch. The switch should be in the "on" position if the RN pump is running. A float switch is used to start and stop the sump pump. The sump pumps discharge to "A" Groundwater Sump.

MNS Exam Bank Question PSSRN006:

PSSRN006

1 Pt Which of the following is the power supply to 1B Nuclear Service Water Pump?

A. 1ETB

B. 1ATB

C. 1TB

D. 1EMXB

Answer 100

A

QuestionBank #	KA_system	KA_number
1839	EPE007	2.4.2

KA_desc
EPE007 GENERIC□Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)

Given the following:

- Unit 1 was operating at 100% RTP
- A Reactor Trip occurs due to the loss of Bus 1TA
- NC system temperature is 569°F

Which ONE (1) of the following describes the CURRENT plant status based on the conditions above?

A. Main Feed Pump turbines are tripped
Bank 1 Condenser Dump valves are modulated open

B. Main Feed Pump turbines are in MANUAL at 2800 RPM
Bank 1 Condenser Dump valves are tripped open

C. Main Feed Pump turbines are tripped
Bank 1 Condenser Dump valves are tripped open

D. Main Feed Pump turbines are in MANUAL at 2800 RPM
Bank 1 Condenser Dump valves are modulated open

General Discussion

On a reactor trip, the Main Feed Pump turbines will go to Manual Speed control with a setting of 2800 rpm (rollback hold). With NC system temperature at 569°F, this is 12°F above no-load Tave. The turbine trip controller portion of the Steam Dump control system will modulate the Bank 1 Condenser Dump valves open until NC system T-ave is 14.4°F above no-load T-ave (557°F) at which point the Bank 2 dump valves will receive a trip open signal.

There is no direct correlation for automatic actions, interlocks, or setpoints associated with EOP entry conditions. Closest match to this K/A is to ask automatic actions that should have occurred on EOP entry (in this case a Reactor Trip) given a specific set of plant conditions.

This is an analysis level question as it required the applicant to associate multiple pieces of information both calculated and recalled from memory to correctly answer the question. The applicant must first determine that the CF pumps should be in rollback hold and not tripped based on the difference between their response on a reactor trip and SI (or other CF pump trip scenarios). The applicant must then determine that there is a 12:°F delta-T between T-ave and no-load T-ave and recall from memory that on the Plant Trip Controller, with less than a 14.4°F delta-T the Bank 1 Steam Dump valves will be modulated open and not tripped open. The applicant must recall the difference in setpoints betweent the Load Rejection Controller and Plant Trip Controller as the setpoint for Bank 1 trip open on the Load Rejection Controller is 8.1°F.

Answer A Discussion

Incorrect. Main Feed Pump turbine trip is plausible as the turbines will trip on an SI, S/G Hi-Hi level, Hi Hi Doghouse level or a trip of all three CBPs. Second part of answer is correct.

Answer B Discussion

Incorrect. Plausible because first part is correct and with the current delta-T, the Bank 1 Condenser Dump valves would be tripped open if control was on the Load Rejection Controller.

Answer C Discussion

Incorrect. Plausible if the applicant confuses CF pump status on a Reactor Trip with SI, Hi-Hi S/G level, Hi-Hi Doghouse level or trip of all CBPs. Bank 1 Condenser Dumps would be tripped open if control was on the Load Rejection Controller.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-STM-IDE pages 25, 29, and 31 Lesson Plan OP-MC-CF-CF pages 19 Lesson Plan OP-MC-CF-IWE page 29	

QuestionBank #	KA_system	KA_number
1839	EPE007	2.4.2

KA_desc
EPE007 GENERIC□Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)

401-9 Comments:

401-9 Comments RESPONSE

Question 39 References:

From Lesson Plan CF-CF page 19:

Objective # 4

The conditions which will result in both main feed pumps tripping:

- if all three CBPs trip
- on a Safety Injection actuation
- on S/G Hi-Hi-level (P-14)(83%)
- on Hi Hi Dog House level in either inner or outer Dog House (12 inches)

The conditions which will result in tripping the associated main feed pump:

- two out of three of its suction pressure switches are low (230 psig)
- two out of three of its discharge pressure switches are high (1435 psig)
- manual trip
- two out of three low bearing oil pressure (7 psig)
- two out of three low vacuum (14 inches Hg)
- overspeed
- fire lockout
- thrust bearing wear (0.01 inch axial movement)

The status of the suction and discharge pressure switches can be determined from the "Condensate 2 of 3 Logic Panel" located in the Turbine Building basement near the BB demineralizer room across for Column 1F24 (refer to Drawing 7.3).

When A(B) CF pump is tripped, solenoid valve 1CFSV0010 (1CFSV0040) is energized which closes A(B) CF Pump piston operated discharge check valve CF1 (CF4). This will prevent flow reversals through the idle pump and prevent damage to the pump and piping due to waterhammer.

The CF pump suction (CM266 and CM272) and discharge (CF2 and CF4) valves are motor operated valves which can be controlled using OPEN/CLOSE pushbuttons from MC-10 (refer to Drawing 7.4). **The A(B) CF pump turbine high and low pressure stop valves can not be raised (opened) until its suction valve CM266 (CM272) and its discharge valve CF2(CF5) are open, as well as the CM Booster Pump recirc valve CM250 and CF System Flush Valve CF124 are closed. In addition CF124 can not be opened unless A CFP suction valve (CM266) and discharge valve (CF 2) are open OR B CFP suction valve (CM272) and discharge valve (CF 5) are open, and both CF pump turbines are tripped.**

From Lesson Plan OP-MC-CF-IWE page 29:

3.2 Abnormal and Emergency Operation

When a reactor trip occurs, the feedpumps go to Man Speed control with a setting of 2800 rpm.

All abnormal and emergency operations of the Feedwater Pumps are covered in the appropriate AP and EP lesson plans.

4.0 TECHNICAL SPECIFICATIONS

There are no Technical Specifications associated with Feedwater Pump Speed Control.

5.0 INDUSTRY EVENTS

5.1 Nuclear Network/OEP No: OE 7137, Main Feedwater Pump Tripped Due To Failure Of Speed Controller

On January 25, 1995, Arkansas Nuclear One (ANO) Unit 2 was holding at 20% power when the "A" main feedwater (MFW) pump tripped due to a failure of the pump speed controller. At the time of the failure, the "B" MFW pump was idling at its low speed stop. Feedwater was restored by raising the "B" MFW pump speed until it began feeding the steam generators. Feedwater flow to the steam generators was lost for about one minute and the levels dropped a significant amount before they began to increase. If the "B" pump had not been idling on-line, the plant would have tripped.

Cause:

The blown fuse was caused by an age related power supply failure.

Significance:

Operators trained on the event to reinforce good operating techniques.

5.2 PIP M-01-00986 - McGuire Unit 1 significant cooldown

On March 10, 2001 McGuire Unit 1 operators were reducing reactor power in preparation for 1EOC14. When reactor power was about 15% rated thermal power

(RTP), letdown flow was increased to 120 gpm. Following this activity, regular monitoring and adjustment of charging flow was required to maintain proper pressurizer level. Steam dump control was placed in "Steam Pressure Mode" and adjusted to maintain T-Cold at 557 degrees. Following this action, some manual adjustments of the demand setpoint were required to maintain proper primary system temperature.

From Lesson Plan OP-MC-STM-IDE page 25:

The load rejection controller output signal (Steam Dump Demand) is derived from $T_{avg} - T_{ref}$. Refer to Figure 3 below. Notice that the controller does not develop an output until the $T_{avg} - T_{ref}$ reaches 3°F. The 3°F deadband allows the Reactor Control System to restore T_{avg} to T_{ref} following small transients without Steam Dump operation. At ($T_{avg} - T_{ref}$) of 8.1°F the Steam Dump Demand will be 25% which is the value required to modulate Bank 1 fully open. At ($T_{avg} - T_{ref}$) of 13°F the Steam Dump Demand will be 45% which is the value required to modulate Bank 2 fully open.

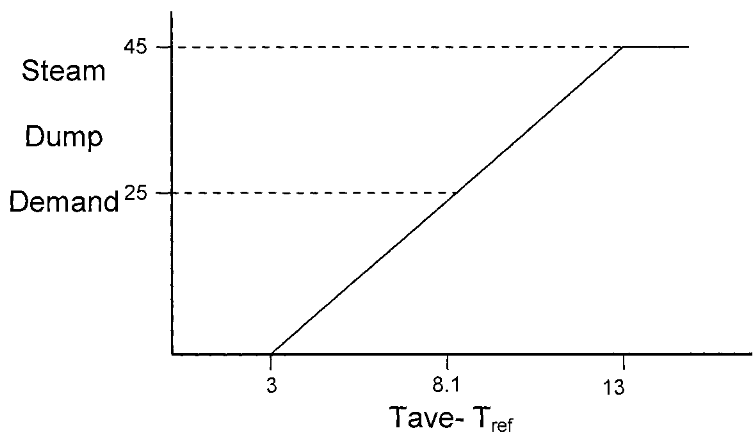


Figure 3, Load Rejection Steam Dump Demand on Tave – Tref Mismatch (9/14/04)

NOTE: Figure 3 is available on the OAC (SB Graphic)

2.3.4 The load rejection trip bistables are used to provide a separate dump valve trip open signal by energizing the trip solenoid valves for its associated bank when the (T_{avg}-T_{ref}) signal reaches the value where the bank should be fully open. This provides faster response on rapidly increasing demand signals. The setpoints are:

Bank	T_{avg} - T_{ref} (°F)
1	8.1
2	13

Trip bistables and valves are energized to actuate; thus, a signal failure will prevent tripping (modulation 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 MODULATION will illuminate.

From Lesson Plan OP-MC-STM-IDE page 29 and 31:

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.

2.4.2 The Plant Trip Controller will be in effect when both of the following conditions exist:

Objective #6,7

* STEAM DUMP SELECT switch is in the 'T_{AVG}' position
* The reactor has tripped (P-4 signal from Train B SSPS)

Objective #5

2.4.3 The Plant Trip Controller output signal (Steam Dump Demand) is derived from a comparison of Auctioneered Hi T_{avg} to $T_{no\text{-}load.}$ Auctioneered Hi T_{avg} was discussed in section 2.3.3.

$T_{no\text{-}load}$ is a fixed setpoint which is set for the no load reactor coolant temperature (557°F).

The plant trip steam dump demand signal is equivalent to T_{avg} - $T_{no\text{-}load}$. There is no deadband. Refer to Figure 4 below.

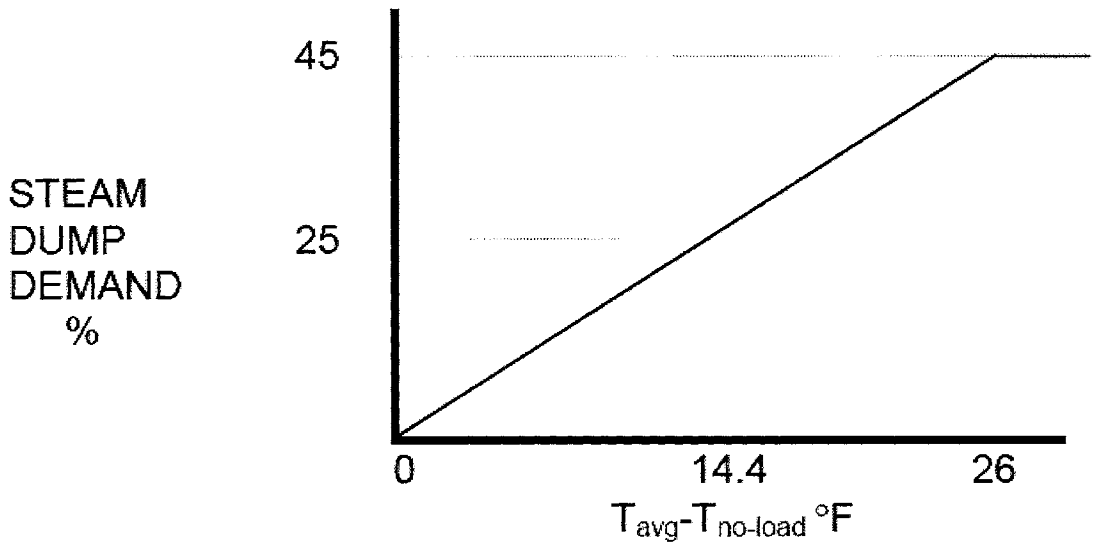


Figure 4, Plant Trip Steam Dump Demand on T_{avg} -$T_{no\text{-}load}$ Mismatch (9/14/04)

NOTE: Figure 4 is available on the OAC (SB graphic)

Following a reactor (plant) trip, steam dump capacity requirement is only that necessary to maintain steam pressure below the steam generator safety valve setpoint. This is met by the 40% condenser dump capacity.

2.4.4 Arming the steam dumps in the plant trip mode.

Following a reactor trip Auctioneered Hi T_{avg} will be greater than $T_{no\text{-}load}$ and a steam dump demand signal proportional to the error will be generated. The electrical demand signal will be converted to a control air signal in the E/P converter which will drive the valve positioner. The resultant air supply will reach the valve actuator provided the valve is 'armed' (arming solenoid valve energized).

The two condenser dump banks are armed in the plant trip mode. To do this, the condenser available interlock (C-9) has to be satisfied, and Train 'A' P-4 reactor trip signal needs to be present.

2.4.5 Valve trip bistables

The trip bistables are used to provide a separate dump valve trip open signal by energizing the trip solenoid valves for its associated bank when the (T_{avg}-$T_{No\ Load}$) signal reaches the value where the bank should be fully open. This provides faster response on rapidly increasing demand signals. The setpoints are:

Bank	T_{AVG} - T_{NoLoad}
1	14.4°
2	26°

Any of the bank trip signals are indicated by the single status panel window, COND STM DUMP TRIP OPEN.

QuestionBank #	KA_system	KA_number
1840	APE008	AK1.01

KA_desc
Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident: (CFR 41.8 / 41.10 / 45.3)□Thermodynamics and flow characteristics of open or leaking valves ....

Unit 1 is in Mode 3 at full temperature and pressure. The crew has entered AP/1/A/5500/011 (Pressurizer Pressure Anomalies) due to Pressurizer pressure decreasing very slowly.

- Pressurizer pressure is 2150 PSIG
- PRT pressure is 2 PSIG

Given the above conditions, determine which ONE (1) of the following would indicate a leaking PORV and the state of the fluid in the PORV discharge?

REFERENCE PROVIDED

	PORV Discharge Temperature	State of the Effluent
A.	200-240°F	Wet Vapor
B.	200-240°F	Saturated Vapor
C.	240-280°F	Wet Vapor
D.	240-280°F	Saturated Vapor

General Discussion

Required Reference is steam table.
This question is associated with TMI. Per the TMI lesson plan:
It was clear from the operator's understanding of the PZR PORV discharge temperature and the indications of saturation/superheated fluid in the hot leg, that operator knowledge of thermodynamics needed to be drastically improved.
At 0520 the operators obtain a printout of PZR Safety and PORV discharge temperatures showing 232°F and 283°F respectively, but the operators still believe the PORV to be closed. For some time the PORV had been leaking prior to this day. The PORV leakage had been accepted as a normal part of operation (i.e. workaround). The temperature on the discharge of the PZR PORV had indicated what would be seen for PORV open or leaking since the PORV had started leaking. The operators believed the discharge temperature would increase to PZR temperature if the PORV actually opened.

A Pressurizer pressure of 2150 psig (2165 psia) corresponds to a Saturated Vapor Enthalpy of 1125 BTU/lbm. This Enthalpy undergoing a throttling process discharging to a PRT at a pressure of 2 psig (17 psia)

This KA is matched since the applicant must know how to use the Mollier diagram to determine the thermodynamic characteristics of the fluid entering the PRT.

This is an analysis level because the applicant must evaluate the given conditions using the Mollier diagram to determine the correct temperature and state of the fluid.

Answer A Discussion

Correct: This pressure results in an enthalpy of ~1135. The intersection of the PRT pressure results in a saturation temperature of 200-240

Answer B Discussion

Incorrect. Plausible as this temperature would be obtained if the student followed the entropy line from the PRT pressure to the saturation curve.

Answer C Discussion

Incorrect. Plausible if the applicant follows the entropy line from the PRT press to the saturation curve.

\nswer D Discussion

Incorrect. Plausible as this temperature would be obtained if they follow the entropy line from the PRT press to the saturation curve.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 NRC Q2 (Bank 608)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References
THFFLO07 OP-CN-II-TMI

Student References Provided
Steam Tables (Q40)

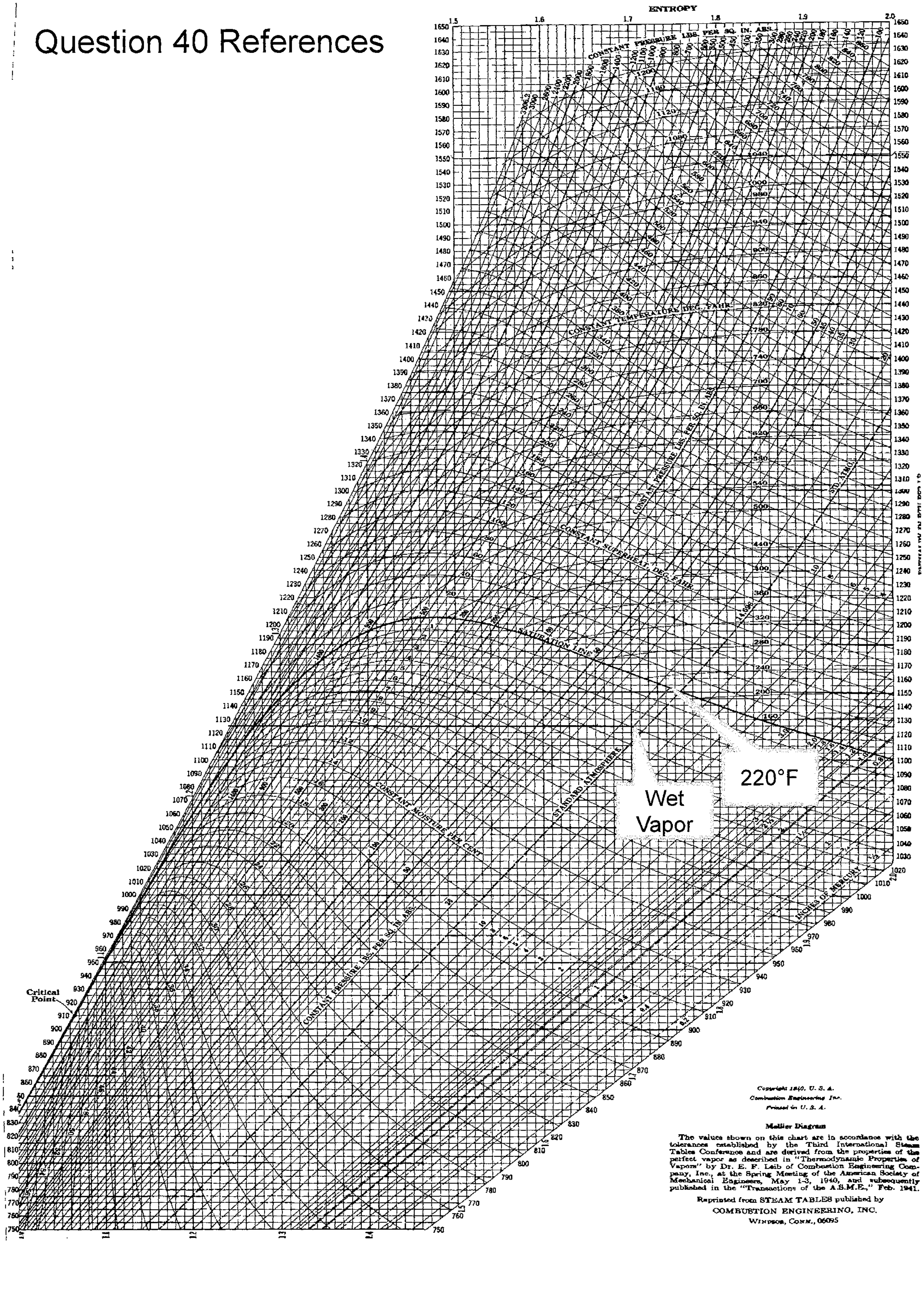
QuestionBank #	KA_system	KA_number
1840	APE008	AK1.01

KA_desc
Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident: (CFR 41.8 / 41.10 / 45.3)□Thermodynamics and flow characteristics of open or leaking valves ....

401-9 Comments:

401-9 Comments RESPONSE

Question 40 References



Mollier Diagram

The values shown on this chart are in accordance with the tolerances established by the Third International Steam Tables Conference and are derived from the properties of the perfect vapor as described in "Thermodynamic Properties of Vapors" by Dr. E. F. Leib of Combustion Engineering Company, Inc., at the Spring Meeting of the American Society of Mechanical Engineers, May 1-3, 1940, and subsequently published in the "Transactions of the A.S.M.E.," Feb. 1941.

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Windsor, Conn., 06095

D

QuestionBank #	KA_system	KA_number
1841	APE015/017	AK2.08

KA_desc
Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the following: (CFR 41.7 / 45.7)□CCWS ....

Which ONE (1) of the following describes the OPERATIONAL CONCERN associated with a Loss of Seal Injection Flow coincident with a Loss of Thermal Barrier Heat Exchanger KC Flow?

A. An increase in pump lower bearing temperature, seal temperatures, and No.1 seal leakoff flow is expected. However, prompt closure (within five minutes) of a Seal Return Containment Isolation Valve should allow continued NCP operation.

B. NCP operation in this condition is limited to 30 minutes, due to the affect of borated NCS fluid on the pump seals. Seal Injection flow must be recovered or a pump trip will be required.

C. No temperature increase of the pump or motor bearings is expected but No.1 seal operation can not continue without fluid between the non-rubbing seal faces. Therefore, the No.2 seal must be placed in operation immediately or No.1 seal failure will occur.

D. An increase in pump lower bearing temperature, seal temperatures, and No.1 seal leakoff flow is expected. Exceeding one of the pump operational limitations is expected unless seal injection or thermal barrier cooling is recovered.

General Discussion

The conditions presented in this question represent complete loss of seal cooling to the NCP seals and the NCP lower pump bearing. This would result in the water at NC system temperature reaching the pump seal package within approximately 10 minutes and would result in the pump parameter reaching trip criteria for both seal leakoff temperature and lower bearing temperature.

KA is matched because the candidate must demonstrate and understand interrelations between a loss of KC cooling to the thermal barrier coincident with a loss of seal injection. Additionally the conditions presented will result in a loss of the pump.

This is a higher cognitive level question because the candidate must interpret multiple symptoms of a failure, evaluate the impact to continued pump operation and evaluate alternate actions to mitigate the consequences of the loss of cooling.

Answer A Discussion

Incorrect. Plausible: Increase in seal flow and temps is correct, the closure of the Seal return isolation would raise the pressure in the seal leakoff line which would help prevent flashing in this line.

Answer B Discussion

Incorrect. Plausible: There are multiple references to 30 min time limits in the limits and precautions associated with the NCP's. Candidate may believe that flashing in the seals could result in boron precipitation affecting seal function.

Answer C Discussion

Incorrect. Plausible: There are multiple references to 30 min time limits in the limits and precautions associated with the NCP's. He may believe that flashing in the seals could result in boron precipitation affecting seal function.

Answer D Discussion

CORRECT :See explanation above

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	Bank #PSNCP043

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s): Lesson Plan OP-MC-PS-NCP Rev. 25, page 25 Learning Objective: OP-MC-PS-NCP, Obj. 4	

QuestionBank #	KA_system	KA_number
1841	APE015/017	AK2.08

KA_desc

Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the following: (CFR 41.7 / 45.7)□CCWS ....

401-9 Comments:

401-9 Comments RESPONSE

Question 41 References:

From Lesson Plan OP-MC-PS-NCP page 25:

Objective # 4

A **loss of thermal barrier heat exchanger flow while maintaining seal injection** would result in a slight increase in pump lower bearing and seal temperatures, but these temperatures would be expected to remain below any pump operational limitations.

A **loss of seal injection while maintaining thermal barrier heat exchanger flow** would result in reversed flow through the thermal barrier. The thermal barrier heat exchanger cools the hot NCS water as it flows between the pump shaft and labyrinth seal prior to entering the radial bearing and the seal area of the pump. An increase in pump lower bearing temperature, seal temperatures and No. 1 seal leakoff flow would be expected, however, the thermal barrier heat exchanger is designed to maintain these parameters within operating limitations (assuming KC inlet temperature $\leq$ 105°F). The main concern here is the unfiltered reactor coolant flowing to the seals, which may cause degradation of the seal surfaces and possible seal failure.

A **simultaneous loss of seal injection and thermal barrier heat exchanger flow** would result in rapidly increasing pump lower bearing and seal temperatures with increased seal leakoff flow. Temperatures would increase until NCP parameters require the pump to be stopped by the operator. The No. 1 seal leakoff will increase rapidly to about 15 gpm if seal injection is not restored within 10 minutes. The pump has a purge volume of 32 gallons. At an initial seal leakoff flow of 3 gpm, hot water would begin affecting the No. 1 seal at 10.6 minutes causing rapid seal temperature transients and high leak rates. The No.1 seal is sensitive to seal inlet water temperature and the effects can be seen during periodic VCT dilutions (due to the colder makeup water affecting seal injection temperature). The No.1 seal, with qualified high temperature o-rings installed, will not fail from loss of all seal cooling alone. Thermally caused transients may cause flashing at the seal discharge, which will cause seal instability. The #2 Seal also becomes unstable under 2 phase flow.

Objective # 9

The **Pump Radial Bearing** is a water lubricated journal-type pump bearing (radial bearing), mounted above the thermal barrier heat exchanger. It has a self-aligning spherical seat and maintains radial alignment of the pump. It is normally cooled and lubricated by seal injection water. Bearing temperature is indicated on the Main Control Board. A high bearing temperature alarm is provided in the Control Room.

Under very low NCS pressures, it may be necessary to open NCP No. 1 seal bypass valve (under certain conditions) to ensure adequate flow through this bearing.

MNS Exam Bank Question PSNCP043:

PSNCP043

1 Pt Which ONE (1) of the following describes the OPERATIONAL CONCERN associated with a Loss of Seal Injection Flow with a Loss of Thermal Barrier Heat Exchanger KC Flow?

A. An increase in pump lower bearing temperature, seal temperatures, and No.1 seal leakoff flow is expected. However, prompt closure (within five minutes) of a Seal Return Containment Isolation Valve should allow continued NCP operation.

B. NCP operation in this condition is limited to 30 minutes, due to the affect of borated NCS fluid on the pump seals. Seal Injection flow must be recovered or a pump trip will be required.

C. No temperature increase of the pump or motor bearings is expected but No.1 seal operation can not continue without fluid between the non-rubbing seal faces. Therefore, the No.2 seal must be placed in operation immediately or No.1 seal failure will occur.

D. Without seal cooling an increase in pump lower bearing temperature, seal temperatures, and No.1 seal leakoff flow is expected. Exceeding one of the pump operational limitations is expected unless seal injection or thermal barrier cooling is recovered.

Answer 731

D

PS-NCP, section 2.2, pg 23

C

QuestionBank #	KA_system	KA_number
1842	APE022	AK1.02

KA_desc
Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Makeup: (CFR 41.8 / 41.10 / 45.3)□Relationship of charging flow to pressure differential between charging and RCS . . . .

Which ONE (1) of the following describes why NC system pressure is checked less than 2335 PSIG immediately after initiating emergency boration in FR-S.1, Response to Nuclear Generation / ATWS?

A. To reduce NC pressure to allow closing of NV pump recirc valves to maximize emergency boration flow.

B. To maintain positive control of NC pressure to prevent lifting a code safety relief valve.

C. To ensure that the boration flow rate is sufficient for emergency boration.

D. To maintain pressure below the PORV setpoint to prevent cycling the PORVs.

C

General Discussion

NC system pressure is checked after initiation of emergency boration in FR-S.1 to ensure that pressure is low enough to provide adequate boration flow to the NC system. If NC system pressure is elevated, it would impede charging flow (and hence boration flow) to the NC system.

The higher level portion of this KA related to Loss of Rector Coolant Makeup could not be directly matched. The MNS Abnormal Procedure for associated with Loss of Reactor Coolant Makeup (AP-12, Loss of Letdown, Charging, or Seal Injection) does not address checking NC system pressure to determine if an elevated NC system pressure is impeding charging flow to the system. The closest possible match was to relate the question to a potential for insufficient boration flow as a result of the differential pressure between the NV and NC systems when emergency boration is required.

Answer A Discussion

Incorrect. Plausible as there is Foldout criteria which has the operator check NC system pressure to determine if the NV pump recirc valves should be open.

Answer B Discussion

Incorrect. Plausible as this is below the lift setpoint for the Pressurizer safety valves.

Answer C Discussion

CORRECT

Answer D Discussion

Incorrect. Plausible as this is below the lift setpoints for the PZR PORVs.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank EPFRSN07

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-EP-FRS page	

QuestionBank #	KA_system	KA_number
1842	APE022	AK1.02

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Makeup: (CFR 41.8 / 41.10 / 45.3)□Relationship of charging flow to pressure differential between charging and RCS ....

401-9 Comments:

APE022AK102
No comment at this time
RFA 10/09/09

401-9 Comments RESPONSE

Question 42 References:

From Lesson Plan OP-MC-EP-FRS page 27:

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.

The check on Pzr pressure is intended to alert the operator to a condition which would reduce charging or S/I pump injection into the NC system, and therefore, boration. The Pzr PORV lift setpoint is chosen as that pressure at which flow into the NC system is insufficient. The contingency action is a rapid depressurization to a pressure which would allow a rise in injection flow. When primary pressure drops to 200 PSI below the PORV lift setpoint, the PORVs should be closed.

Because the depressurization uses pressurizer PORVs which discharge to the PRT, it is possible for the rupture disc to burst. Isolation of the Containment Air Addition and Release valves (VQ) is an expedient action to verify a barrier to radiation release.

STEP 6Close the following VQ valves:

PURPOSE: To ensure non-essential containment ventilation penetrations (VQ) are Isolated.

BASIS: The non-essential containment ventilation penetrations are isolated to prevent potential release of radioactive materials from containment. The only containment ventilation penetration which may be open in modes 1-4 are the VQ valves.

From FR-S.1 pages 3 and 4:

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/1/A/5000/G-1 (Generic Enclosures), Enclosure 17 (PD Pump Startup).
b. Align boration flowpath as follows:	
__ 1) Open 1NV-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 1NV-221A (NV Pumps Suct From FWST). __ b) Open 1NV-222B (NV Pumps Suct From FWST). __ c) Close 1NV-141A (VCT Outlet Isol). __ d) Close 1NV-142B (VCT Outlet Isol).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. (Continued)	
c. Check if NV flowpath aligned to NC System: __ • 1NV-244A (Charging Line Cont Outside Isol) - OPEN __ • 1NV-245B (Charging Line Cont Outside Isol) - OPEN.	c. Perform the following: 1) **IF** NV pump suction is aligned to VCT, **THEN** align to FWST as follows: __ a) Open 1NV-221A (NV Pumps Suct From FWST). __ b) Open 1NV-222B (NV Pumps Suct From FWST). __ c) Close 1NV-141A (VCT Outlet Isol). __ d) Close 1NV-142B (VCT Outlet Isol). 2) Open the following valves: __ • 1NI-9A (NC Cold Leg Inj From NV) __ • 1NI-10B (NC Cold Leg Inj From NV). __ 3) **GO TO** Step 5.e.
__ d. Ensure charging flow is greater than emergency boration flow.	
__ e. Check Pzr pressure - LESS THAN 2335 PSIG.	e. Perform the following: __ 1) **IF** all Pzr PORVs and isolation valves open, **THEN GO TO** Step 6. __ 2) **IF** Pzr PORV(s) **OR** isolation valves closed, **THEN** open Pzr PORV(s) and isolation valves as required to reduce Pzr pressure less than 2135 PSIG (200 PSIG less than PORV auto open setpoint).

MNS Exam Bank Question EPFRSN07:

EPFRSN07

1 Pt Step 5e of FR-S.1 requires the operators to check Pzr pressure less than 2335 psig immediately after initiating emergency boration flow to the reactor. If pressure exceeds 2335 psig, the contingency action is to open a PORV and rapidly depressurize to 2135 psig. What is the basis for this step?

A. To maintain pressure below the PORV setpoint to prevent cycling the PORVs.

B. To ensure that the boration flow rate is sufficient for emergency boration.

C. To maintain positive control of NC pressure to prevent lifting a code safety relief valve.

D. To reduce NC pressure to allow closing of NV pump recirc valves to maximize emergency boration flow.

Answer 920

Answer: B

MISCINFO: RO&SRO SOURCE: NEW

REFERENCES: OP-MC-EP-FRS page 25, 27

FR-S.1 pages 2, 3, 4, 5

LESSON: OP-MC-EP-FRS TASK:

OBJECTIVE: FR-S.1 Obj: 6 TIME:

KA:000024EK302(4.2/4.4) DATE: 5/28/97

QuestionBank #	KA_system	KA_number
1843	APE026	AA2.04

.A_desc
Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: (CFR: 43.5 / 45.13)□The normal values and upper limits for the temperatures of the components cooled by CCW ....

Given the following current conditions on Unit 1:

- Unit is operating at 100% RTP
- A malfunction of the Letdown Hx Outlet temperature controller has caused 1KC-132 (Letdown Hx Cooling Water Control) valve to slowly drift closed
- Letdown Heat Exchanger Outlet temperature has increased from 106°F to 115°F

Based on current conditions, NC system temperature will __(1)__ AND if Letdown Hx Outlet temperature continues to increase, 1NV-127A, LD Hx Outlet 3-Way Cntrl will divert to the VCT at __(2)__.

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

A. (1) decrease
(2) 120°F

B. (1) decrease
(2) 138°F

C. (1) increase
(2) 120°F

D. (1) increase
(2) 138°F

General Discussion

The increase in Letdown Heat Exchanger Outlet temperature causes an increase in mixed bed demineralizer resin temperature. This temperature increase results in thermal regeneration of the resin and the release of boron from the demineralizer resin to the letdown. This results in an increase in the boron concentration of the charging water going back to the NC system which causes NC system temperature to decrease. If Letdown temperature increases to 138°F, letdown will divert to the VCT to protect the demineralizer resin from damage.

This KA is matched because the applicant must determine the effect that increase in letdown line temperature will have on NC system temperature and the upper limit for letdown temperature before NV-127A diverts.

This is a comprehension level question because the applicant must process and evaluate multiple pieces of information to determine the correct answer. First, the applicant must determine the increase in letdown temperature will result in a release of boron from the demineralizers and then determine that the increase in boron concentration in the NV charging will result in a temperature decrease. The applicant must then recall from memory the temperature setpoint for the diversion of letdown flow.

Answer A Discussion

Incorrect. NC system temperature decreasing is correct. The temperature of 120°F is plausible because that is the setpoint for the Letdown Hx Oulet Hi Temperature Annunciator.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Plausible if the applicant does not recall the effect of letdown line temperature on the affinity of demineralizer resin for boron. 120°F is plausible because it is the setpoint for the Letdown Hx Outlet Temperature Hi Annunciator.

Answer D Discussion

Incorrect. Plausible if the applicant does not recall the effect of letdown line temperature on the affinity of demineralizer resin for boron. The temperature setpoint is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

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

Development References	Student References Provided
Annunciator Response Procedure for Panel 1AD-7 / H2 BNT-CH05R3, Ion Exchange Objective 23 page 23	

QuestionBank #	KA_system	KA_number
1843	APE026	AA2.04

KA_desc

Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: (CFR: 43.5 / 45.13)□The normal values and upper limits for the temperatures of the components cooled by CCW ....

401-9 Comments:

401-9 Comments RESPONSE

Question 43 References:

From OP/1/A/6100/010 H page 37:

Nomenclature: **LETDN HX OUTLET HI TEMP**

Window: **H2**

Setpoint: 120°F

Origin: Temperature sensor monitoring Letdown HX outlet temperature (1NVTT-5590)

Probable Cause:

- Letdown flow too high
- 1KC-132 (L/D Outlet Temp Control) malfunction (valve controlled by 1NVSS-5590)

Automatic Action: IF letdown temperature continues to rise to 138°F, 1NV-127A (LD HX Outlet 3-Way Temp Cntrl) will divert Letdown to VCT.

Immediate Action: None

Supplementary Action:

1. Check orifice block valve to ensure desired lineup.
2. Ensure letdown flow does NOT exceed 120 gpm.
3. Check 1NV-124 (Letdown Press Control) is maintaining proper back pressure at 350 psig.
4. Check 1KC-132 (L/D HX Outlet Temp Control) is functioning properly.
5. IF necessary, manually control 1KC-132 (L/D HX Outlet Temp Control) to restore temperature to normal.
6. IF controller malfunction, notify WCC SRO.
7. IF 1NV-127A has diverted to VCT, perform the following:
   A. Notify Primary Chemistry that the demineralizer is bypassed.
   B. Ensure condition corrected and return 1NV-127A to "DEMIN".
   C. Notify Primary Chemistry that the demineralizer is back in service.

References:

- MCFD-1554-2.0
- MCEE-157-00.26

End Of Response

Unit 1

From Lesson Plan BNT-CH05R3 page 23:

boron saturated resin, the ability of the resin to exchange unwanted impurities is severely reduced. One of the primary reasons for this demineralizer is to control the trace amounts of chloride (also an anion) present in the reactor coolant. When a chloride ion enters a boron saturated resin bed only some of the chloride ions will be exchanged due to the large number of borate ions present which compete for the exchange sites on the resin. The amount of chloride which can be retained is dependent on the concentration of the "competing" ion, borate. For this reason, early in core life when the concentration of boron in the reactor coolant is high, the demineralizer is not able to remove all the chloride from the reactor coolant. As the core ages and the concentration of boron is reduced, the concentration of chloride in the reactor coolant decreases as the amount of competing borate ions decreases.

Boron affinity of a resin bed is also affected by the temperature of the coolant as it passes through the bed. At lower temperatures, the borate ion bonding to exchange site contains three boron atoms. At higher temperatures, the borate ion contains only one boron atom. The results of this characteristic are that at lower temperatures, resins are more efficient at removing boron from coolant than at higher temperatures. A boron saturated resin bed will actually release boron as the temperature is increased.

The second chemical added to the reactor coolant is lithium hydroxide. Lithium is a cation with a single "+" charge. During normal operation the cation portion of the mixed bed demineralizer is "saturated" with lithium. In a similar fashion to the borate / chloride competition, the relatively large amount of lithium present in the reactor coolant reduces the capacity of the mixed bed demineralizer for other unwanted cations which are present in only trace amounts (such as cesium). One reason for the chemical and volume control system cation bed demineralizer is to remove cesium as the unit is shutdown for refueling (to prevent radioactive cesium isotopes from presenting dose problems to workers). The cation bed demineralizer is NOT lithium saturated and can effectively remove lithium, cesium, and other trace cation impurities from the coolant.

In the discussion of the **Effects of Ion Exchange,** the effect of passing a sodium chloride solution through various types of resin beds was discussed. Based on that discussion it follows that a demineralizer can be used to alter the pH of the process fluid. This is commonly done as a means to control the pH of the reactor coolant.

The reactor coolant is a solution of boric acid with lithium hydroxide added to increase the pH. Lithium hydroxide is produced in the coolant via a boron – neutron reaction. This production of lithium causes the pH of the reactor coolant to increase. One way to reduce the concentration of lithium (and the pH) in the reactor coolant is to process the coolant through a hydrogen form cation demineralizer. The lithium ions are removed and replaced with hydrogen ions (which then form water), effectively reducing the pH.

In systems where it is possible to subject the demineralizer resin to high temperatures, demineralizers have automatic features to protect against temperature damage. This is usually accomplished by automatic closure of the demineralizer inlet valves to isolate the demineralizer from high temperature liquid when high temperature at the inlet to the demineralizer is sensed. These systems are typically equipped with bypass valves that can divert flow around the demineralizer until normal system temperature is restored.

Objective 26

Oconee has reactor coolant demineralizers which are loaded with only anion resin. These demineralizers are used primarily to remove boron from the reactor coolant late in the core cycle. The amount of feed and bleed of the reactor coolant necessary to lower the boron concentration

QuestionBank #	KA_system	KA_number
1844	APE027	AK3.04

KA_desc
Knowledge of the reasons for the following responses as they apply to the Pressurizer Pressure Control Malfunctions: (CFR 41.5,41.10 / 45.6 / 45.13)□Why, if PZR level is lost and then restored, that pressure recovers much more slowly ....

Given the following events and conditions on Unit 1:

- A Reactor Trip and SI has occurred due to a stuck open PZR Safety valve
- The affected Safety valve has now reseated and is no longer leaking
- The transient resulted in PZR level indicating off scale low for a period of time but is now 70% and stable
- Safety injection has been terminated and normal letdown and charging have been restored.
- The Pressurizer Pressure Master has been placed in MANUAL with a 50% output and all backup heaters have just been energized.
- NC system pressure is 2000 PSIG and increasing.

Which ONE (1) of the following describes the resulting behavior of PZR pressure AND the automatic action that will occur to protect the NC system if an overpressure condition develops?

A. PZR pressure will recover slowly because the water in the PZR is subcooled: Pressurizer PORVs 1NC-32 & 36 will open at 2335 PSIG.

B. PZR pressure will recover slowly because the water in the PZR is subcooled: Pressurizer PORV 1NC-34 will open at 2335 PSIG.

C. PZR pressure will recover rapidly because of the elevated level and smaller steam space volume:
Pressurizer PORVs 1NC-32 & 36 will open at 2335 PSIG.

D. PZR pressure will recover rapidly because of the elevated level and smaller steam space volume:
Pressurizer PORV 1NC-34 will open at 2335 PSIG.

General Discussion

The first part of the question applies anytime the PZR is emptied and subsequently refills. This results in subcooled liquid in the majority of the PZR liquid space which has to be heated to saturated temperature before normal pressure response is recovered. There is no specific objective that covers this phenomena but in all the EP steps which the plant is recovering from a loss of inventory such as step 17 of ES 1.1 (SI Termination), the basis references restoring the PZR to saturated conditions. In the scenario given in the question, pressure response from backup heater operation would be extremely slow. Second part of the question concerns the effect of placing he pressure master in manual at a 50% output. As long as it remains in manual, the output would be unaffected by actual NC system pressure therefore the components controlled by this instrument would be unaffected as well. One of the PZR PORVs, 1NC-34A is controlled strictly by the output of the pressure master (Opens at 81.2%), the other two (NC 32 &36) are controlled by the second selected pressure channel and would function independent of the pressure master output.

K/A is matched because the candidate must understand how a scenario involving a loss and subsequent recovery of PZR level would affect pressure control. Additionally he must evaluate the effect of an off normal alignment of the pressure control system.

Analysis level because the candidate must evaluate a given scenario and predict an outcome based on selected switch positions and evaluation of a transient associated with PZR level.

Answer A Discussion

Correct: See explanation above

Answer B Discussion

Plausible: First answer is correct, Second answer is plausible because if the PZR pressure master is selected to auto, 1NC-34 would open before the other two due to the build in of the integral function of the controller.

Answer C Discussion

Plausible: if the candidate believes that the elevated PZR level would have a significant impact to pressure control, this condition would have a very limited effect but in the scenario given it would be insignificant. 2nd part is correct.

Answer D Discussion

Plausible: Fist part is plausible as explained above, second. Second answer is plausible because if the PZR pressure master is selected to auto, 1NC-34 would open before the other two due to the build in of the integral function of the controller

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s): OP-MC-PS-IPE Rev 28 Page 21 Learning Objective: OP-MC-PS-IPE, Obj 4 & 9	

QuestionBank #	KA_system	KA_number
1844	APE027	AK3.04

KA_desc
Knowledge of the reasons for the following responses as they apply to the Pressurizer Pressure Control Malfunctions: (CFR 41.5,41.10 / 45.6 / 45.13)□ Why, if PZR level is lost and then restored, that pressure recovers much more slowly ....

401-9 Comments:

401-9 Comments RESPONSE

Question 44 References:

From Lesson Plan OP-MC-PS-IPE page 21:

reduced. A 70 psig increase in pressure could cause the PORV to lift. This is why the PORV could lift before 2335 psig.

Another effect the integral function can have on the controller can be seen after a large transient, like a steam break. With Pzr pressure significantly below the controlling setpoint for a period of time, a large negative integral builds in. Later, when pressure recovers to 2235, the controller output would be at 50% **if** only a proportional controller. However, because of the large negative integral built in, the controller output would still be very low (backup heaters ON), resulting in pressure overshoot. Some of these transients could be severe enough so that the PORVs not controlled by the master controller could open prior to the spray valves opening.

2.3.2 Controller Outputs

Objective #4

The master pressure controller output is sent to:

- C Bank Pzr Heater Control
- Spray Valve Controllers
- PORV 34 actuation
- Low Pressure Deviation Control (Annun. and Backup Heaters)
- High Pressure Deviation Control (just an Annun.)
- Output meter indication on the MCB Manual/Auto Control station.

These components controlled by the master controller are not affected what-so-ever by Pzr pressure. They operate strictly off the different % outputs. Refer to Drawing 7.5, Pressure Master Controller Output Vs Function.

2.3.3 Controller Operation

Objective #9

Automatic operation of the controller is as described as above. With actual pressure **equal** to the reference setpoint, this controller is setup to have a **50**% output, if no integral function has built in. As actual pressure goes high, the controller output will go up, and this will cause the control system to try to decrease pressure. So it follows that, in manual, depressing the raise pushbutton will cause pressure to go down, and vice versa.

Objective #8

In automatic, the controller output will vary if the pot setting is changed. Assume the pot setting at 6.69. Then with Pzr pressure at 2235 psig, the controller output would be 50%. If under these conditions the pot setting was rapidly spun lower to 5.69 (80 psig worth), then it would try to control at 2155, and the controller would see actual pressure as 80 psig too high, with a corresponding controller output of 73.4%, calling for sprays to be full open. Eventually, the pressure master controller would be controlling pressure at 2155 psig, with a controller output back at approximately 50%.

QuestionBank #	KA_system	KA_number
1845	EPE029	2.4.2

KA_desc
EPE029 GENERIC□Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)

Which ONE (1) of the following lists the indications which are checked in E-0, (Reactor Trip or Safety Injection) prior to implementing monitoring of Critical Safety Function Status Trees to determine if entry into FR-S.1, Response to Nuclear Generation / ATWS is required?

1. I/R Amps – GOING DOWN
2. All Rod Bottom Lights – LIT
3. Reactor Trip and Bypass Breakers – OPEN
4. I/R SUR – ZERO OR NEGATIVE
5. All Power Channels – LESS THAN 5%

A. 2, 3, and 5 ONLY

B. 3, 4, and 5 ONLY

C. 1, 2, and 3 ONLY

D. 2, 3, and 4 ONLY

General Discussion

Immediate actions from E-0.

When checking the Reactor Tripped:
1) All Rod Bottom lights - LIT
2) Reactor Trip and Bypass Breakers - Open
3) IR AMPs - Going Down

This KA is matched because the question requires the applicant to know what indications (i.e. entry conditions for E-O) are checked as part of the immediate actions for E-0.

Answer A Discussion

Incorrect. Plausible because 2 & 3 are correct and Power Range Channels less than 5% is an entry condition for FR-S.1.

Answer B Discussion

Incorrect. Plausible because 3 is correct, 4 is associated with IR indication which is checked (except zero or negative is an entry condition for FR-S.1), and Power Range Channels less than 5% is an entry condition for FR-S.1.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible since 2 and 3 are correct and 4 is associated with IR indication which is checked (except zero or negative is an entry condition for FR-S.1).

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
E-0, Reactor Trip or Safety Injection page 3	

QuestionBank #	KA_system	KA_number
1845	EPE029	2.4.2

KA_desc

EPE029 GENERIC□Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)

401-9 Comments:

401-9 Comments RESPONSE

Question 45 References:

From E-0 page 3:

MNS EP/1/A/5000/E-0 UNIT 1	REACTOR TRIP OR SAFETY INJECTION	PAGE NO. 3 of 37 Rev. 29

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor the Foldout page.**	
2. **Check Reactor Trip:** __ • All rod bottom lights - LIT __ • Reactor trip and bypass breakers - OPEN __ • I/R amps - GOING DOWN.	**Perform the following:** __ a. Trip reactor. b. **IF** reactor will not trip, **THEN** perform the following: __ • 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:** __ • All throttle valves - CLOSED.	**Perform the following:** __ 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: __ • All MSIVs __ • All MSIV bypass valves.

QuestionBank #	KA_system	KA_number
1846	EPE038	EA1.10

KA_desc
Ability to operate and monitor the following as they apply to a SGTR: (CFR 41.7 / 45.5 / 45.6)□Control room radiation monitoring indicators and alarms ....

Unit 1 is operating at 100% RTP. Given the following conditions:

- 1EMF-33 *(Condenser Air Ejector Exhaust)* alarms in Trip 2

Which ONE (1) of the following provides the best indication per NSD-513 (Primary-to-Secondary Leak Monitoring Program) that a S/G tube leak has occurred?

A. S/G feed flow to steam flow mismatch

B. 1EMF-24, 25, 26 and 27 (STEAMLINE HI RAD- Doghouse)

C. 1EMF-34 (S/G SAMPLE)

D. 1EMF-71, 72, 73, and 74 (STEAMLINE N-16 LEAKAGE)

General Discussion

In accordance with NSD-513, the primary method for detecting primary-to-secondary leakage while on line is the condenser off-gas (EMF-33) radiation monitor. The secondary method for detecting tube leakage on line is the N-16 (EMF-71, 72, 73, & 74) radiation monitors.

This KA is matched because the applicant must know which methods (radiation monitors) are valid or accurate indications of S/G tube leakage under various plant conditions. The "operate" part of this KA is not applicable to MNS as there is nothing to operate related to the radiation monitors associated with detection of SG tube leakage.

Answer A Discussion

Incorrect. Not sensitive enough to detect leakage of this magnitude. Plausible because it can be used to detect a SGTR.

Answer B Discussion

Incorrect. Can be used. However, it is not the best indication for detecting tube leakage as they are not as sensitive as the N-16 monitors. Plausible because they would be the most accurate verification of tube leakage if the unit was shut down.

Answer C Discussion

Incorrect. SG sample line isolates on an EMF-33 trip 2. Plausible because it would be a good answer if the automatic actions did not occur.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank WEEMFN04

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
NSD-513, Primary-to-Secondary Leakage Monitoring Program	

QuestionBank #	KA_system	KA_number
1846	EPE038	EA1.10

KA_desc

Ability to operate and monitor the following as they apply to a SGTR: (CFR 41.7 / 45.5 / 45.6)□Control room radiation monitoring indicators and alarms ....

401-9 Comments:

401-9 Comments RESPONSE

Question 46 References:

From NSD 513 page :

513.4.4 DENSITY CORRECTION

Primary-to-secondary leak rate measurement (monitoring) is performed at room temperature (typically 77°F). However, station leak rate limits, which are based on off-site dose considerations, may have been developed at a different temperature. For example, technical specification leak rate limits or station administrative limits are often established based on the average reactor coolant temperature at full power operation. Under such situations, the measured leak rate using radiation monitors or condenser off-gas grab samples may be non-conservative relative to station leak rate limits. In such cases, a density correction shall be applied to the measured leak rate to ensure the measured value is comparable to the limit. It should be noted that the limits described in Sections 513.4.1.1 through 513.4.1.6 of this directive are based on a temperature of 77°F. These limits may be adjusted (density corrected) to the same temperature that measured leak rates are corrected to. Table 513-2 includes applicable density corrected limits for each station.

513.4.5 DATA REPORTING

Measured leak rates, whether determined from radiation monitor readings or manually calculated from grab samples, shall have a density correction applied if needed per Section 513.4.4, if needed. Measured leak rates shall be reported as X gallons per day at X°F, if density corrected, to avoid confusion as to whether the leak rate has been density corrected. If the results are not density corrected, measured leak rates shall be reported as X gallons per day. From an implementation standpoint, measured leak rates shall be reported at the same temperature as the basis for the station's leak rate limit(s).

513.4.6 SURVEILLANCE METHODS

Monitoring for primary-to-secondary leakage shall normally be conducted with online monitors. These include the condenser off-gas radiation monitor and main steam line N-16 monitors. Operational decisions shall normally be made based on online monitor readings. Operational decisions based on condenser off-gas grab samples shall be minimized due to the time-consuming nature of this analysis. If the condenser off-gas radiation monitor and one (1) N-16 monitor (if installed) are out of service, or if there is significant disagreement in the trend of online monitors such that the monitor results are called into question, then condenser off-gas grab sampling shall be used for operational decision-making until a valid online monitor reading can be established. Re-establishing a valid online monitor reading shall receive the highest station priority. Although online radiation monitors and grab sampling have been established as the primary and secondary methods of leak rate monitoring, respectively, other plant indications can be indicative of primary-to-secondary leakage. Appropriate action should be taken to address possible primary-to-secondary leakage if other indications exist. This is particularly important during periods when all online monitors are out of service.

513.4.6.1 Condenser Off-Gas Radiation Monitor

The primary method of monitoring the primary-to-secondary leak rate during power operation shall be the condenser off-gas radiation monitor. Alarm set points shall be established to provide the appropriate sensitivity to an increasing leak rate (see Section 513.4.8 on alarm set points). The leak rate in gallons per day shall be calculated from the radiation monitor reading in counts per minute, the condenser off-gas flow rate, the correlation factor for converting counts per minute to µCi/ml, the Xe-133 equivalence factor as determined from a recent, valid reactor coolant sample, and, if used, any factors for correlating radiation monitor response with grab samples results. Normally, this calculation should be performed on the station's Operational Aid Computer (OAC) for trending purposes (and for alarm purposes if desired). The Xe-133 equivalence factor is a calculated equivalence factor that converts all of the radioactive gases in the sample to a beta equivalence for Xe-133. This equivalence factor shall also include the isotope Carbon-11.

513.4.6.2 N-16 Radiation Monitors

The secondary method for monitoring the primary-to-secondary leak rate during power operation shall be the main steam line N-16 monitors. Alarm set points shall be established to provide the appropriate sensitivity to an increasing leak rate (see Section 513.4.8 on alarm set points). The calculated leak rate from these monitors (in gallons per day) should normally be routed to the OAC for trending purposes (and for alarm purposes if desired). In the event of an increase in the leak rate as determined by the condenser off-gas radiation monitor, the N-16 monitors serve as a verification of the increase in leak rate. The calculated leak rate between the condenser off-gas radiation monitor and the N-16 monitor does not have to agree, but the monitors should display the same trend to validate the leak rate as determined by the condenser off-gas radiation monitor. The main steam line N-16 monitors will also help to identify the leaking steam generator. In the event the condenser off-gas radiation monitor is out of service, the N-16 monitors shall be the primary method for monitoring the primary-to-secondary leak rate. In this case, there will not be another online method to validate the leak rate. If the condenser off-gas radiation monitor and any of the N-16 monitors are out of service at the same time, then grab sampling shall be used as the primary means of surveillance (see Section 513.4.6).

513.4.6.3 Condenser Off-Gas Grab Samples

During power operation, routine grab samples of condenser air ejector off-gas shall be obtained for radiochemical analysis. A manual calculation shall be performed using these radiochemical results to determine the primary-to-secondary leak rate. The equation for this calculation is as follows:

$$\text{Leak Rate, gallons per day} = \frac{(F_g)(A_g)(1.08 \times 10^4)}{A_{RCS}}$$

Where: F_g = Flow rate of condenser off-gas (SCFM)

A_g = Activity in condenser off-gas sample (μCi/ml)

A_{RCS} = Activity in reactor coolant sample (μCi/ml)

1.08×10^4 = conversion factor to obtain gallon per day units

The same gaseous radionuclide shall be used for both the reactor coolant and condenser off-gas samples. Normally, this will be Xe-133, Xe-135 or Ar-41, but any gas that is present in each sample can be used for the calculation. Calculations based on different radionuclides may provide additional confidence in the result. The condenser off-gas grab sample and the reactor coolant sample should be taken within a reasonable time frame, except for power transients during which sample collection should be coordinated to occur at approximately the same time.

Grab sampling frequency shall be increased during periods when online monitors are unavailable or during periods of increased leak rates (see Section 513.4.7).

513.4.6.4 Tritium Analysis

During Modes 2, 3, and 4, a calculation based on tritium analysis shall be used to determine the primary-to-secondary leak rate. Samples for tritium analysis shall be taken from each steam generator (if samples can be obtained), condensate, and reactor coolant to calculate the primary-to-secondary leak rate. Tritium is used to determine primary-to-secondary leak rates during these periods because other readily usable isotopes are typically not present in sufficient concentration after longer shutdowns. The tritium-based calculation will not detect a rapidly propagating leak and is not intended to do so. Rather, the calculation will help detect whether a relatively large steam generator tube leak is present during startup, thus preventing startup with a leak rate near or exceeding administrative or technical specification limits.

If a leak rate is calculated using the tritium-based approach that appears to be increasing and approaching an administrative leak rate limit or 80 gallons per day (whichever is less), the plant shall cease start up activities until

MNS Exam Bank Question WEEMFN04:

WEEMFN04

1 Pt Unit 1 was operating at 100% power. Given the following conditions:

- EMF-33 *(Condenser Air Ejector Exhaust)* alarms in trip 2

If all the automatic features operate as designed (without operator intervention), which one of the following indications will provide the best indication per NSD-513, Primary-to-Secondary Leak Monitoring Program, to confirm that a S/G tube leak has occurred?

A. Comparing S/G feed flow to steam flow mismatch

B. Observing EMF-24, 25, 26 and 27 *(STEAMLINE HI RAD)*

C. Observing EMF-34 *(S/G SAMPLE)*

D. Observing EMF-71, 72, 73, 74 *(N16 LEAKAGE)*

Answer 1896

D

Distracter Analysis:

A. Incorrect: Not a sensitive method of comparison

Plausible: This method will show gross SGTRs

B. Incorrect: Not as sensitive as using EMF 71-74

Plausible: This was the correct answer for the 1997 NRC exam - did not have EMF-71-74 operable

C. Incorrect: S/G sample line will isolate at EMF-33 trip 2

Plausible: This would be a good answer if the automatic isolation did not occur

D. Correct answer: most sensitive method as it detects N16 γ radiation

KA: SYS 039 A1.09 (2.5/2.7)

QuestionBank #	KA_system	KA_number
1847	APE040	AK1.01

KA_desc
Knowledge of the operational implications of the following concepts as they apply to Steam Line Rupture: (CFR 41.8 / 41.10 / 45.3)□Consequences of PTS ....

Unit 1 is responding to a Steam Break inside Containment from 100% RTP.

Given the following events and conditions:

- Narrow Range S/G level is 15% for each intact S/G
- The NCPs were tripped
- FR-P.1 (*Response to Imminent Pressurized Thermal Shock Condition)* has been implemented
- NCS temperature is now stable
- NCS pressure is stable
- Letdown has been restored

The crew has determined that a 1 hour soak is required. Which ONE (1) of the following evolutions could be performed by the crew in the next hour while continuing on through the EP procedures?

A. Start 1D NCP

B. Place Auxiliary Spray in service

C. Increase CA flow to one intact S/G to raise NR level to 50%

D. Commence a 25-degree/hour cooldown to Mode 5

B

General Discussion

During the NC system soak, evolutions may be performed from other procedures which do not increase NC system pressure or decrease NC system temperature

K/A is matched because the candidate is presented with a steam line rupture scenario and must understand what components can be manipulated during the soak (operational Implications) which will not violate the requirement to not increase pressure or decrease temperature. These limitations are part of the consequences of the PTS conditions which exist as a result of the rupture.

Analysis level because the candidate must analyze each answer and determine the effect of manipulating that component on NC system temperature and pressure.

Answer A Discussion

Plausible because earlier in FR-P.1, if SI termination criteria is not met, an NC pump is started to mix incoming SI water with NC system water to raise the temperature of the water entering the reactor vessel downcomer

Answer B Discussion

CORRECT: See explanation above

Answer C Discussion

Plausible if the candidate believes that raising S/G level to a normal level is appropriate and does not consider the consequences of adding cold water to the S/Gs.

Answer D Discussion

Plausible if the candidate does not comprehend that the cooldown which is described in the same step as the soak is not allowed to commence until the soak is complete.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	Bank #EPFRPN01

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Technical Reference(s): FR-P.1, Response to Imminent Pressurized Thermal Shock Condition, rev. 10, page 28
Learning Objective: OP-MC-EP-FRP, Objective 6

Student References Provided

QuestionBank #	KA_system	KA_number
1847	APE040	AK1.01

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Steam Line Rupture: (CFR 41.8 / 41.10 / 45.3)□Consequences of PTS ....

401-9 Comments:

401-9 Comments RESPONSE

Question 47 References:

From Lesson Plan OP-MC-EP-FRP page 43:

STEP 26 Check adequate NC System depressurization as follows:

PURPOSE: To determine if subcooling has been reduced to a minimum in order to minimize NC system pressure.

BASIS: Establishing NC system pressure as low as possible minimizes the pressure stress on the reactor pressure vessel. If minimum subcooling is not already established, this step instructs the operator to return to the depressurization in Step 17. Since letdown has been established, the operator should use auxiliary spray for further depressurization if normal Pzr spray is not available. The specified subcooling value does not represent a minimum limit since an operating margin of 10^0 F above the minimum is provided to allow sufficient time for stopping the depressurization. Should the minimum subcooling value be reached, the S/I pumps should be operated to maintain the minimum subcooling (as directed by the actions of Step 13.

STEP 27 Determine if NC System soak is required.

PURPOSE: To see if a "soak" period is required prior to further cooldown.

BASIS: If cold leg temperature has gone down more than 100° F in any one hour period, then a "soak" period is required to allow the thermal stresses imposed on the reactor vessel wall to decrease before further cooldown is allowed. The "soak" is a period of steady state operation during which any temperature drop or pressure rise are to be avoided. This time period allows thermal gradients in the reactor vessel wall to be reduced, thus reducing corresponding stresses. Any actions that will not cause either a cooldown or a pressure rise and are specified by any other procedure in effect are permitted during this "soak" period.

Following the "soak", a cooldown may be implemented with the following additional cooldown restrictions required in order to not challenge vessel integrity.

1. Maintain NC system pressure and T-Colds within the limits of Enclosure 3 (Post-Soak Cooldown Limit).
2. Maintain cooldown rate in cold legs less than 50^0 F in any 60 minute period.

STEP 28 Return to procedure and step in effect.

PURPOSE: To direct the operator to the proper procedure following successful completion of the steps in this procedure.

BASIS: Now that the pressure/temperature stabilization guidance presented in FR-P.1 has been completed, the operator should continue plant recovery operations by returning to the procedure and step that was in effect at the time FR-P.1 was entered.

From FR-P.1 page 28:

MNS EP/1/A/5000/FR-P.1 **UNIT 1**	RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITION	PAGE NO. 28 of 40 Rev. 10

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
26. **Check adequate NC System depressurization as follows:**	___ **RETURN TO Step 18.**
___ • NC subcooling based on core exit T/Cs - LESS THAN 10°F	
OR	
___ • NC System pressure - LESS THAN 112 PSIG.	
27. **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. **GO TO** Step 28.
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) **WHEN** NC System 60 minutes soak is complete, **THEN** 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.	

MNS Exam Bank Question EPFRPN01:

EPFRPN01

1 Pt

Unit 1 is responding to a steam break inside containment from full power. Given the following events and conditions:

- All systems operate as designed.
- Narrow range S/G level is 15% for each intact S/G
- CA flow is 100 GPM to each intact S/G.
- The NCPs were tripped.
- The crew entered FR-P.1 (*Response to Imminent Pressurized Thermal Shock Condition)* due to low temperature.
- NCS temperature is now stable.
- NCS pressure is stable with only the control group of pressurizer heaters energized.
- Letdown has been restored

If the crew has determined that a 1 hour soak is required, which of the following evolutions could be performed by the crew in the next hour while continuing on through the EP procedures?

A. Start 1D NCP

B. Place auxiliary spray in service

C. Increase CA flow to one intact S/G to raise NR level to 50%

D. Commence a 25-degree/hour cooldown to Mode 5

Answer 880

Answer: B

Distracter Analysis:

A. Incorrect: Starting a NCP will cause a pressure transient and could cause further cooldown.

Plausible: If the candidate does not understand the limitations during the soak or the effects of NCP start.

B. Correct: Any actions that will not cause either a cooldown or a pressure rise and are specified by any other procedure in effect are permitted during this "soak" period.

C. Incorrect: Increases cooldown stressing the vessel.

Plausible: The candidate may not link raising S/G level with a cooldown.

D. Incorrect: Cooldown is not allowed.

Plausible: The candidate may recall that a cooldown at less than 50/hr is directed after the soak.

D

QuestionBank #	KA_system	KA_number
1848	APE054	AA2.08

KA_desc
Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): (CFR: 43.5 / 45.13)□Steam flow-feed trend recorder ....

Given the following conditions on Unit 1:

- The unit is operating at 100% RTP
- The steam pressure input for S/G 'B' controlling channel fails LOW

The S/G 'B' trend recorder will indicate which ONE (1) of the following?

A. - Steam Flow increased
- Feed Flow decreased
- S/G Narrow Range level decreasing

B. - Steam Flow increased
- Feed Flow increased
- S/G Narrow Range level increasing

C. - Steam Flow decreased
- Feed Flow increased
- S/G Narrow Range level increasing

D. - Steam Flow decreased
- Feed Flow decreased
- S/G Narrow Range level decreasing

D

General Discussion

The steam pressure channel failing low causes a loss of density compensation to the controlling S/G B steam flow channel which causes the steam flow channel to decrease. In response the S/G water level control system with see a steam-flow feed flow mismatch and will close the Feed Control valve in an attempt to match feed flow to steam flow. The decrease in feedwater flow will cause S/G narrow range level to decrease.

The K/A is match because the applicant must diagnose a instrument failure which results in a loss of feedwater flow and determine what the indications on the steam flow - feed flow trend recorder would be.

This is an analysis level question because the applicant must analyze the effect of the failed intrument on the steam flow input to the S/G water level control program and how the change in the input affects the response of the system and the associated recorder trends which indicate that response.

Answer A Discussion

Incorrect. Plausible if the applicant does not understand the effect of the loss of density compensation on the indicated steam flow. The feed flow and S/G level response are correct.

Answer B Discussion

Incorrect. Plausible if the applicant does not understand the effect of the loss of density compensation on steam flow. And if steam flow increases it follows that feed flow would increase to match steam flow and level would increase.

Answer C Discussion

Incorrect. Steam flow decreasing is correct. Feed flow increasing is plausible if the applicant does not understand the effect of the steam flow decrease on Feed Control valve response. If the Feed flow increases the S/G level will increase.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS CFIFEN01

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s): OP-MC-CF-IFE, rev. 21, page 33,	

QuestionBank #	KA_system	KA_number
1848	APE054	AA2.08

KA_desc

Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): (CFR: 43.5 / 45.13)□Steam flow-feed trend recorder ....

401-9 Comments:

401-9 Comments RESPONSE

Question 48 References:

From Lesson Plan OP-MC-CF-IFE page 31 and 33:

Objective #8

0.1. Abnormal and Emergency Operation

Objective #11

0.1.1. Power Range Channel Failures

Power Range Channel "Low" Failure

A low channel failure will not require immediate operator response since the high select feature will ensure that the other channel will provide control input.

Power Range Channel "High" Failure

A NIS channel "High" failure will affect feedwater control since the failed High channel will always be selected to provide the controlling signal input. High channel failure will result in S/G level increasing to the 100% power value (65%) if power level at the time of failure was less than 100%, if no operator action was taken. This failure will require operators to take manual control until the affected channel can be defeated. No reactor trip or other actuations should occur due to high failure.

Objective #11

0.1.2. Feedwater Flow ,Steam Flow or Level Channel Failure

During normal full power operation, and without Operator action, the following is the response of SGWLC, assuming all Channel 1 inputs are selected for control and channel 1 is the one with the failure.

CF Flow transmitter fails low : Due to CF Flow indicating less than SM flow the Flow Error causes the CF Control Valves to open . S/G level will increase toward the (P14) setpoint where a Turbine/Reactor trip occurs.

CF Flow transmitter fails high: Due to CF Flow indicating greater than SM flow the Flow Error causes the CF Control Valves to throttle closed. S/G level will decrease and approach the Lo Lo Level Reactor Trip setpoint .

Steam Flow transmitter fails low : Due to SM flow indicating less than CF flow, the resulting flow error will close the CF Control valve. S/G Level will decrease toward the Lo Lo Level Reactor trip Setpoint

Steam Flow transmitter fails high : Due to SM flow indicating greater than CF flow, the Flow Error causes the CF Control Valves to open . S/G level will increase toward the (P14) setpoint where a Turbine/Reactor trip occurs.

Steam Pressure transmitter fails low: Since the SM Pressure signal is used to density compensate the SM Flow, the effect will be the same as a Steam Flow transmitter failing low.

Steam Pressure transmitter fails high: the effect will be the same as a Steam Flow transmitter failing high.

S/G N/R Level transmitter fails low: Due to indicated level less than program , the Level Error causes the CF Control Valve to open . S/G level will increase toward the (P14) setpoint where a Turbine/Reactor trip occurs.

S/G N/R Level transmitter fails high: Due to indicated level greater than Program , the resulting Level Error will close the CF Control Valve. S/G Level will decrease toward the Lo Lo Level Reactor trip Setpoint .

For a faulty input channel, select MAN on the Valve controller and maintain level. Swap faulty channels using the '1A (B,C,D) S/G STM FLOW RECORDER CHANNEL SELECT' switch the '1A (B,C,D) S/G CF FLOW RECORDER SELECT' switch or the "1A (BCD) S/G N/R LEVEL RECORDER SELECT" switch, as appropriate. After verifying the recorder for the affected instrument returns to the value of the selected channel, return the S/G CF Control Valve controller to AUTO and verify proper operation.

3.2.3. Controller Malfunction:

A malfunction of the redundant portion of the controller such as a driver card or E/P converter would cause the CF Control valve to open or close without a change in the level or flow error. The operator response would be to place the affected controller in manual and attempt to control level. If manual control was not effective the redundant channel would be selected by placing the CONTROL VALVE SELECTOR Switch to ALT.

MNS Exam Bank Question CFIFEN01:

CFIFEN01

1 Pt Unit 1 was operating at 100% power when a loss of main feedwater occurred due to the failure of a feedwater flow instrument.

Which one of the following statements correctly describes the valid main control board indications of this failure?

A. Rapidly decreasing S/G level and a high main steam pressure indication on the steam pressure recorder.

B. Rapidly decreasing S/G level and a low feedwater flow indication on the steam/feed flow recorder.

C. Rapidly decreasing S/G level and a high feedwater flow indication on the steam/feed flow recorder.

D. Rapidly decreasing S/G level and a low main steam pressure indication on the steam pressure recorder.

Answer 1131

Answer: C

Distracter Analysis:

A. Incorrect: Feedwater flow is not density compensated.
Plausible: If the candidate thinks feed flow is density compensated.

B. Incorrect: Feed flow failing low will not cause a loss of feedwater.
Plausible: If the candidate reads the question to be a feed controller failure.

C. Correct:

D. Incorrect: Feedwater flow is not density compensated.
Plausible: If the candidate thinks feed flow is density compensated and memorized the steam flow transmitter failure response.

D

QuestionBank #	KA_system	KA_number
1849	EPE055	EK3.02

KA_desc
Knowledge of the reasons for the following responses as the apply to the Station Blackout : (CFR 41.5 / 41.10 / 45.6 / 45.13)□Actions contained in EOP for loss of offsite and onsite power ....

Given the following conditions:

- A loss of All AC power has occurred on Unit 1
- Crew has implemented ECA-0.0 (Loss of All AC Power)
- Attempts to place the Unit 1 Standby Make Up pump in service have failed
- The crew is performing actions to depressurize the S/G's to 290 PSIG

Which ONE (1) of the following describes the reason for this action?

A. Initiate Cold Leg Accumulator injection to re-establish NC system subcooling.

B. Initiate Cold Leg Accumulator injection and establish Natural Circulation conditions.

C. Reduce NC system temperature and pressure to establish Natural Circulation conditions.

D. Reduce NC system temperature and pressure to reduce NC pump seal leakage and minimize NC system inventory loss.

General Discussion

The S/Gs are depressuized to 290 psig to reduce NC system temperature and pressure. This will reduce the amount of leakage from the NC pump seals which will minimize the NC system inventory loss until AC power can be restored.

If SGs are depressurized to less than 190 psig, the CLA accumulators will inject into the NC System. While this is desirable in some EOP mitigating schemes to depressuize the SGs to cause the CLAs to inject (i.e. ECA-1.1, Loss of Emergency Coolant Recirculation), in ECA-0.0 it is undesirable to have the CLAs inject as any nitrogen which enters the NC system could disrupt Natural Circulation flow.

K/A is matched since the applicant must know the basis for actions taken in the EPs during a Station Blackout.

Answer A Discussion

Incorrect. Plausible because the injection of the cool water in the CLA's would impact positivetly impact subcooling but this is not the reason the S/G's are depressurized.

Answer B Discussion

Incorrect. Plausible because in some EPs it is desirable to have the CLAs inject and establishing and maintaining natural circulation is important until forced flow can be restored in ECA-0.0.

Answer C Discussion

Incorrect. While reducing NC pump seal leakage is correct and establishing Natural Circulation conditions is desirable, reducing SG pressures to 290 psig is not required to establish Natural Circulation conditions.

Answer D Discussion

CORRECT

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	CNS NRC Exam Bank Question 126

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

ECA-0.0 page 22
Lesson Plan OP-MC-EP-ECA-0 pages 19 and 49

Student References Provided

QuestionBank #	KA_system	KA_number
1849	EPE055	EK3.02

KA_desc

Knowledge of the reasons for the following responses as the apply to the Station Blackout : (CFR 41.5 / 41.10 / 45.6 / 45.13)□Actions contained in EOP for loss of offsite and onsite power ....

401-9 Comments:

401-9 Comments RESPONSE

Question 49 References:

From ECA-0.0 page 22:

MNS EP/1/A/5000/ECA-0.0 **UNIT 1**	LOSS OF ALL AC POWER	PAGE NO. 22 of 168 Rev. 25

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

CAUTION **Lowering S/G pressures to less than 190 PSIG will cause injection of CLA N_2 into the NC System.**

NOTE
- **The S/Gs should be depressurized at a rate sufficient to maintain a cooldown rate in the NC System cold legs near 100°F/hr. This will minimize NC System inventory loss while cooling the NC pump seals in a controlled manner.**
- **Control room operation of 1SV-7ABC (1C Main Steam Line PORV) is not available due to swap to SSF.**
- **Pzr level may be lost and reactor vessel head voiding may occur due to depressurization of S/Gs. Depressurization should not be stopped to prevent these occurrences.**

28. **Depressurize intact S/Gs to 290 PSIG as follows:**

__ a. Check S/G N/R level in any intact S/G - GREATER THAN 11% (32% ACC).

a. Perform the following:

__ 1) Maintain maximum CA flow until N/R level greater than 11% (32% ACC) in at least one S/G.

__ 2) **WHEN** N/R level greater than 11% (32% ACC) in at least one S/G, **THEN** perform Steps 28.b through 28.h.

__ 3) **GO TO** Step 29.

__ b. **Ensure operator monitors Enclosure 16 (S/G Depressurization Limits) throughout the S/G depressurization.**

__ c. **WHEN** "P-11 PRESSURIZER S/I BLOCK PERMISSIVE" status light (1SI-18) lit, **THEN** depress "BLOCK" on Low Pressure Steamline Isolation block switches.

From Lesson Plan OP-MC-EP-ECA-0 page 19:

3.3.3 Maintain Plant Conditions for Optimal Recovery

This major action category consists of actions to mitigate deterioration of NC system conditions and establish plant conditions amenable to optimal recovery following AC power restoration. The operator is limited in actions available to mitigate deteriorating NC system conditions. By minimizing NC system inventory loss and maintaining a secondary heat sink, the operator can extend the time to core uncovery.

NC system inventory loss is minimized by depressurizing the secondary system, thereby resulting in the following.

1. Reducing NC system temperature to minimize NC pump seal degradation.

2. Reducing NC system pressure to reduce NC pump seal leakage and to permit injection of S/I accumulator water to partially replace the NC system inventory lost through the NC pump seals.

Secondary heat sink is maintained by controlling the turbine driven CA pump and the rate of S/G steam release to maintain narrow range (N/R) level in at least one intact S/G.

Plant conditions amenable to optimal recovery are established through operator actions that anticipate the restoration of AC power and establish required systems and equipment alignments prior to AC power restoration.

Defeating automatic loading of the energized AC emergency bus provides bus overload protection by permitting the operator to evaluate the status of the restored bus and to manually load equipment onto the bus consistent with bus status and plant conditions.

Actions to isolate NC pump seal cooling and to check the status of auxiliary boration systems permit the NC system inventory makeup systems to be quickly started and minimize the potential for equipment damage following AC power restoration.

From Lesson Plan OP-MC-EP-ECA-0 page 49:

STEP 28 Depressurize intact S/Gs to 290 PSIG as follows:

PURPOSE: To depressurize the intact S/Gs.

It is important to maintain at least one intact S/G N/R level above the top of the U-tubes during depressurization.

BASIS: During the rapid depressurization performed in Step 28, S/G level could drop out of the N/R, resulting in a loss of adequate heat sink. If this situation occurs, the depressurization should be stopped and CA flow reestablished until S/G N/R level is raised to greater than 11% (32% ACC).

Step 28 depressurizes the intact S/Gs, thereby reducing NC temperature and pressure to reduce NC pump seal leakage and minimize NC inventory loss.

Once intact S/G pressure is reduced to 290 PSIG, the S/G PORVs and CA flow should be controlled to maintain S/G pressure at that level until AC power is restored.

STEP 29 Check reactor subcritical:

PURPOSE: To ensure the reactor does not return to a critical condition during S/G depressurization.

BASIS: Step 29 checks for a zero or negative startup rate on the intermediate and source range channels. If a positive startup rate is detected, the RNO action requires secondary depressurization be terminated and NC temperature be allowed to go up to shut down the reactor. This step addresses the core criticality concern associated with S/G depressurization and NC cooldown.

STEP 30 Check S/I signal status:

PURPOSE: To check if an S/I signal exists.

BASIS: The secondary depressurization initiated in Step 28 will result in S/I actuation, if not already actuated, on low Pzr pressure. The operator should check S/I actuation status and reset S/I as soon as the reset delay time has expired. This reset action is consistent with the philosophy of defeating automatic loading of the emergency bus upon AC power restoration. Resetting S/I will open the individual output relays from the solid state protection cabinets, thus permitting the operator to manually load S/I equipment as instructed in the recovery procedures.

QuestionBank #	KA_system	KA_number
126	EPE055	EK3.02

KA_desc
Knowledge of the reasons for the following responses as the apply to the Station Blackout : (CFR 41.5 / 41.10 / 45.6 / 45.13)□Actions contained in EOP for loss of offsite and onsite power ....

Which one of the following describes the reason for depressurizing the S/Gs to 165 psig in accordance with EP/1/A/5000/ECA-0.0 (Loss of All AC Power)?

A. Initiate Cold Leg Accumulator injection to re-establish NC System inventory.

B. Initiate Cold Leg Accumulator injection and establish Natural Circulation conditions.

C. Minimize secondary heat sink requirements if CA inventory is limited, and establish Natural Circulation conditions.

D. Minimize secondary heat sink requirements if CA inventory is limited, and minimize NC Pump seal leakage.

General Discussion

Answer A Discussion

Answer B Discussion

B is incorrect. NC system depressurization will assist natural circulation, but is not reason for depressurization to 165 psig.

Answer C Discussion

C is incorrect. Natural Circ will be set up as a byproduct of rapid depressurization; rapid cooldown and depressurization due to limited CA is an action that could be taken in E-3 series procedures.

Answer D Discussion

D is incorrect. In other E-3 series procedures, rapid secondary depressurizations may be performed when there is limited makeup availability.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References	Student References Provided
ECA-0.0 EPEP507	

QuestionBank #	KA_system	KA_number
126	EPE055	EK3.02

KA_desc

Knowledge of the reasons for the following responses as the apply to the Station Blackout : (CFR 41.5 / 41.10 / 45.6 / 45.13)□Actions contained in EOP for loss of offsite and onsite power ....

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1850	APE056	AA2.37

KA_desc
Ability to determine and interpret the following as they apply to the Loss of Offsite Power: (CFR: 43.5 / 45.13)□ED/G indicators for the following: voltage, frequency, load, load-status, and closure of bus tie breakers ....

A Loss of Off-Site Power (LOOP) has occurred.

D/G '1B' is supplying bus 1ETB, loaded as follows:

- Voltage - 4120 volts.
- Frequency - 59.4 Hz.
- Load - 1800 KW.

Which one of the following describes the response of D/G '1B' when the Governor Control RAISE pushbutton is depressed?

A. Frequency increases; load and voltage remain the same.

B. Frequency and voltage remain the same; load increases.

C. Frequency increases; load remains the same; voltage increases.

D. Frequency remains the same; load and voltage increase.

General Discussion

Generator running disconnected from grid - No VAR loading or load sharing. Generator in isochronous mode means governor is speed = frequency. Voltage is excitation=volts. When frequency is raised, other parameters may change slightly depending on the value of those parameters.

K/A is matched as the applicant must understand how EDG indications are affected when the diesel generator is operated in isochronous mode (i.e. during a Loss of Offsite Power).

This is an analysis type question as the applicant must relate several pieces of information both given and recalled from memory. The given information is the initial condition where the EDG is operating supplying the bus in isochronous mode. The applicant must then recall from memory the effect of depressing the Geneerator Control RAISE pushbutton with the generator operating in isochronous mode.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Partially correct if DG was paralleled

Answer C Discussion

Incorrect. In isochronous, raising frequency would not increase voltage

Answer D Discussion

Incorrect. Voltage remains the same.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 CNS NRC Q50 (Bank 127)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Lesson Plan OP-MC-DG-DG Objectives 14 and 15 page 31

Student References Provided

QuestionBank #	KA_system	KA_number
1850	APE056	AA2.37

KA_desc

Ability to determine and interpret the following as they apply to the Loss of Offsite Power: (CFR: 43.5 / 45.13)□ED/G indicators for the following: voltage, frequency, load, load-status, and closure of bus tie breakers ....

401-9 Comments:

401-9 Comments RESPONSE

Question 50 References:

From Lesson Plan OP-MC-DG-DG page 31:

The Diesel Governor

Each diesel unit at McGuire will be operated in either the **speed droop** or the **isochronous** modes. Selection of the droop or Isochronous modes will be determined by the normal and/or standby breaker positions on the 4160V bus.

Two OAC points provide a droop permissive indication and a droop mode indication. The droop permissive provides operations with indication that the droop contact on the normal or standby breaker is closed before the diesel is started. The droop mode indication will provide indication that the diesel engine is in the droop mode which indicates that the droop permissive is available and the droop contact on the diesel generator feeder breaker is closed.

Objective # 14, 15

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 <u>KW</u> (load), but does <u>NOT</u> affect <u>FREQUENCY</u> (D/G speed). Adjusting the ""Volt Adjust" switch changes <u>Power Factor</u> and <u>KVars</u>, but does <u>NOT</u> affect <u>VOLTAGE</u>.

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 <u>FREQUENCY</u> (D/G speed), but does <u>NOT</u> affect load (<u>KW</u>). Adjusting the ""Volt Adjust" switch changes <u>VOLTAGE</u>, but does <u>NOT</u> affect <u>Power Factor</u> or <u>KVars</u>.

The Diesel governor performs as follows:

- For an automatic start the governor brings the engine up to speed and as the sequencer assigns loads it adjusts the input to the engine to maintain 60 HZ.
- For a manual start during testing the governor brings the engine up to speed. Further speed changes are performed manually for paralleling.
- For a control room emergency start at the local panel, the same would hold true as that of a manual start.

QuestionBank #	KA_system	KA_number
127	APE056	AA1.04

KA_desc
Ability to operate and / or monitor the following as they apply to the Loss of Offsite Power: (CFR 41.7 / 45.5 / 45.6)□Adjustment of speed of ED/G to maintain frequency and voltage levels ...

A Loss of Off-Site Power has occurred.

D/G '1B' is supplying bus 1ETB, loaded as follows:

- Voltage - 4120 volts.
- Frequency - 59.4 Hz.
- Load - 1800 KW.

Which one of the following describes the response of D/G '1B' when the Governor Control Switch is taken to RAISE?

A. Frequency increases; load and voltage remain the same.

B. Frequency and voltage remain the same; load increases.

C. Frequency increases; load remains the same; voltage increases.

D. Frequency remains the same; load and voltage increase.

General Discussion

Generator running disconnected from grid - No VAR loading or load sharing. Generator in isochronous mode means governor is speed = frequency. Voltage is excitation=volts. When frequency is raised, other parameters may change slightly depending on the value of those parameters

Answer A Discussion

Answer B Discussion

B is incorrect. Partially correct if DG was paralleled

Answer C Discussion

C is incorrect. In isochronous, raising frequency would not increase voltage

Answer D Discussion

D is incorrect. Voltage remains the same.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [x] NRC Approved

Development References	Student References Provided
DGDG312	

QuestionBank #	KA_system	KA_number
127	APE056	AA1.04

KA_desc

Ability to operate and / or monitor the following as they apply to the Loss of Offsite Power: (CFR 41.7 / 45.5 / 45.6)□Adjustment of speed of ED/G to maintain frequency and voltage levels ...

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1851	APE057	AA1.06

KA_desc
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) Manual control of components for which automatic control is lost ....

Reactor power is at 45% RTP with all systems in automatic when you notice the following:

- 120 VAC ESS PWR CHANNEL A TROUBLE alarm
- CH 1 Impulse pressure indicates 0 PSIG
- All 4 S/G CH 1 Feed Flow, Stm Flow and Levels indicate 0 %
- CH 1 PZR pressure indicates 1700 PSIG

Which ONE (1) of the following lists the IMMEDIATE ACTIONS which must be taken based on these indications?

A. Manually trip the reactor and go to E-0 (Reactor Trip or Safety Injection).

B. Place Control Rods and Feedwater Reg valves in Manual and restore Tave to Tref.

C. Place Control Rods and Feedwater Reg valves in Manual, and manually restore S/Gs to programmed level.

D. Place Pressurizer Pressure Master in Manual, adjust to 50%, and then place "PZR PRESS CNTRL SELECT" switch to backup channel.

General Discussion

The Immediate Actions of AP-15, Loss of Vital or Aux Control Power require the operator to check the status of instrument channels 1 and 2. If those channels are lost the operator must place the control rods in manual and place the CF control valves in manual and restore S/G levels to program level.

The K/A is matched because the applicant is required to the manual actions which must be taken to control the plant on a loss of a vital instrument bus.

Answer A Discussion

Incorrect. Plausible if the applicant believes that MSIVs have closed or control of the plant has been lost and that tripping the reactor is necessary to place the plant in a safe condition.

Answer B Discussion

Incorrect. Plausible because these are actions that will be taken to restore plant conditions to normal. However, these are done later in AP-15 and are NOT immediate actions.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible as there are actions later in AP-15 regarding the Pressurizer Pressure channel failure. However, they are not immediate actions.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank Question AP15002

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
AP-15, Loss of Vital or Aux Control Power page 3, 6, 8, and 22	

QuestionBank #	KA_system	KA_number
1851	APE057	AA1.06

KA_desc

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)□Manual control of components for which automatic control is lost ....

401-9 Comments:

401-9 Comments RESPONSE

Question 51 References:

AP-15 page 3:

MNS AP/1/A/5500/15 UNIT 1	LOSS OF VITAL OR AUX CONTROL POWER	PAGE NO. 3 of 268 Rev. 20

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Procedure Steps	
__ 1. **Check Channel 1 and Channel 2 status lights - NORMAL.**	**Perform the following:** __ a. IF Channel 1 failed, THEN place control rods in manual. b. IF S/G controlling channel failed, THEN perform the following: __ 1) Place affected CF control valves in manual. __ 2) Restore S/G levels to program. __ 3) GO TO Step 3.
__ 2. **GO TO Step 4.**	
3. **Ensure the following switches are selected to operable channel on each S/G:** __ • Feed flow __ • Steam flow __ • S/G level.	
__ 4. **Check ND - IN RHR MODE.**	__ **GO TO Step 7.**

From AP-15 page 6:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 7. **Check all Pzr pressure channels - INDICATING THE SAME.**	**IF either controlling channel is malfunctioning, THEN perform the following:** __ a. **Place "PZR PRESS MASTER" in "MANUAL".** __ b. **Adjust "PZR PRESS MASTER" output TO 50%.** __ c. **Place "PZR PRESS CNTRL SELECT" switch to backup channel.** __ d. Place "PZR PRESS MASTER" in "AUTO" as desired.

From AP-15 page 8:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 9. **Check position of all MSIVs (using control board indications or status lights) - OPEN.**	**IF any MSIV is closed, THEN perform the following:** __ • IF reactor is tripped, THEN GO TO Step 10. OR • IF reactor is not tripped AND in Mode 1 or 2, THEN perform the following: __ a. Trip reactor. __ b. Continue with this procedure as time allows. __ c. GO TO EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
__ 10. **Check all CF control valves - IN AUTO.**	__ **WHEN S/Gs at programmed level AND auto control desired, THEN place CF control valve(s) in auto.**

From AP-15 page 22:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 39. **Check "TURB IMP PRESS CH 1" - NORMAL.**	**Maintain proper T-Avg as follows:** a. **IF** unit coastdown in progress **AND** T-Ref has been reduced per OP/1/A/6100/003 (Controlling Procedure For Unit Operation), **THEN** perform the following: __ 1) Determine T-Ref for current power level from OP. __ 2) **GO TO** Step 40. __ b. Maintain T-Colds 555°F to 557°F with control rods in manual. __ c. **GO TO** Step 41.
__ 40. **Adjust control rods in manual to maintain T-Avg at T-Ref.**	
41. **Defeat the affected T-AVG channel using the following switches:** __ • "D/T DEFEAT" __ • "T-AVG DEFEAT".	

MNS Exam Bank Question AP15002:

AP15002

1 Pt

Reactor power is at 45% with all systems in automatic when you notice the following:

1. 120 VAC ESS PWR CHANNEL A TROUBLE Alarm
2. Ch 1 Impulse Pressure indicates 0 psig
3. All 4 S/G CH 1 Feed Flow, Stm Flow And Levels indicate 0 %
4. Ch 1 Pzr Pressure indicates 1700 psig

What action(s) should you take? (Select One)

A. Manually trip the reactor and go to EP-E0 immediately.

B. Place Control Rods and Feedwater Reg Valves in Manual and restore Tave to Tref.

C. Place Control Rods and Feedwater Reg Valves in Manual, and manually restore S/Gs to programmed level.

D. Check actual Pzr pressure has gone down and check all Pzr pressure channels indicating the same. Then place "PZR PRESS CNTRL SELECT" switch to backup channel. Check Pzr PORVs and Pzr spray valves CLOSED.

Answer 668

C

B

QuestionBank #	KA_system	KA_number
1852	APE058	AK3.02

KA_desc

Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: (CFR 41.5,41.10 / 45.6 / 45.1)□Actions contained in EOP for loss of dc power ....

Given the following:

- A loss of ALL AC power has occurred on Unit 1
- Crew has implemented ECA 0.0 (Loss of All AC Power)
- The crew is performing Enc 7 (DC Bus Alignment) of AP-07 (Loss of Electrical Power)

Power must be restored to the battery chargers within __(1)__.

The <u>MAXIMUM DESIGN</u> loads that the 125v DC Vital Batteries are designed to carry under emergency conditions with no Essential AC available to the Vital Chargers is __(2)__.

A. (1) ONE hour
(2) One (1) 125v DC Distribution Center, Two(2) 125v DC Panel Boards, Two (2) 120v AC Static Inverters

B. (1) ONE hour
(2) Two(2) 125v DC Distribution Centers, Four (4) 125v DC Panel Boards, Four (4) 120v AC Static Inverters

C. (1) 30 minutes
(2) Two(2) 125v DC Distribution Centers, Four(4) 125v DC Panel Boards, Four(4) 120v AC Static Inverters

D. (1) 30 minutes
(2) One (1) 125v DC Distribution Center, Two(2) 125v DC Panel Boards, Two (2) 120v AC Static Inverters

General Discussion

Step 24 of ECA 0.0 directs the crew to :align DC buses per AP-07. Enc 7 (DC bus Alignment). This step is preceded with a caution stating that it is time critical action. In a loss of all AC scenario, the station batteries are the only source of electrical power. The vital batteries are sized to supply (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.

KA is matched because the candidate must understand why the action directed in ECA 0.0 (Loss of all AC) Step 24 is time critical and what components are potentially affected should this actions not be taken. This action is taken in order to preserve the DC power sources, our EOPs contain no actions that deal directly with a loss of DC power. Loss of DC power sources are addressed with AOP's so the best match for this K/A is to test the actions to prevent a loss of DC power sources and reasons for those actions.

Answer A Discussion

Plausible: Answer 1 is correct,
Answer 2 is plausible because the loads listed are the normal loads for a vital battery.

Answer B Discussion

CORRECT

Answer C Discussion

Plausible: 30 minutes duty cycle would be correct for some of our other batteries such as those supplying the D/Gs. Answer 2 is plausible as explained above.

Answer D Discussion

Plausible: Answer 1 is plausible as explained above and answer 2 is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

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

Development References	Student References Provided
Technical Reference(s): Lesson Plan OP-MC-EL-EPL, Rev. 23 Pg 25 Learning Objective: OP-MC-EL-EPL, Obj 12	

QuestionBank #	KA_system	KA_number
1852	APE058	AK3.02

KA_desc

Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: (CFR 41.5,41.10 / 45.6 / 45.1)□Actions contained in EOP for loss of dc power ....

401-9 Comments:

401-9 Comments RESPONSE

Question 52 References:

From Lesson Plan OP-MC-EL-EPL page 25:

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.

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 Annunciator Alarm Panel 1AD-11 (Electrical), 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, comparable to the original design standards for safe operation. However, a loss of any two of these channel sources will result in a reactor trip or forced reactor shutdown (Technical Specifications) of both units (Unit 1 and 2).

QuestionBank #	KA_system	KA_number
1853	APE062	AA1.05

KA_desc
Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water (SWS): (CFR 41.7 / 45.5 / 45.6)□The CCWS surge tank, including level control and level alarms, and radiation alarm ....

Given the following:

- Due to air entrainment, both Unit 1 RN pumps were tripped
- The Unit 1 Reactor was tripped along with all NC pumps
- As a result of this transient, a leak developed associated with the 1A NC pump thermal barrier
- 1EMF-46A (Unit 1Component Cooling A) is in Trip 2
- KC Surge tank levels are increasing

1KC-364B (A NC PUMP THERM BAR OTLT) will Auto Close at __(1)__.

1KC-122 (U-1 KC Surge Tank Vent Valve) __(2)__.

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

A. (1) 60 GPM
(2) must be re-opened at the Local Control Station

B. (1) 60 GPM
(2) will re-open when the EMF signal clears

C. (1) 70 GPM
(2) must be re-opened at the Local Control Station

D. (1) 70 GPM
(2) will re-open when the EMF signal clears

B

General Discussion

With the scenario described in the stem of this question a 50 GPM imbalance has been established between what is leaking from the system and what is leaking out. KC Surge tank abnormal level lo comes into alarm at 4.0 Feet.
The KC surge tank consists of 2 compartments which are separated by a divider plate but since the trains are normally cross connected, in the situation described both compartments would track together until the train cross connect valves are closed. This would not be directed by the procedure until a level of 2.0 feet was reached.
The tank curve (Curve 7.31) provided as a reference denotes individual compartment level so the volume calculated to provide a 1.25 ft level change (5.25 minus 4.0) would have to be doubled to obtain the correct time.
Using the curve, a level change of 1.25 feet in BOTH compartments represent a volume loss of 1400 gallons which with a 50 gpm miss-match would take 28 minutes. The following values were obtained using the KC Surge tank curve:

Volume at 5.25 Feet--- 2400 Gal (Single compartment)
Volume at 4.0 Feet--- 1700 Gal (Single compartment)
Change required --- 700 Gallons x 2 = 1400 gal

KA is matched because the situation described in the stem represents a loss of Nuclear Service Water concerning the CCWS (KC) system. The candidate must demonstrate knowledge of associated KC system level alarms and then demonstrate the ability to monitor a level change by the use of the associated tank curve.

This is a comprehension level question because the candidate must demonstrate the ability to use a tank curve in solving a problem whose parameters are set up in the stem of the question. He must also understand that the associated tank curve only represents one of the two compartment levels and therefore must double the results to obtain the correct answer.

Answer A Discussion

Plausible if the candidate neglects to double the volume derived when he determines the volume change required to effect a 1.25 level change in one compartment per the tank curve.

Answer B Discussion

CORRECT. As explained above

Answer C Discussion

Plausible If the candidate believes the low level alarm comes into alarm at 2.0 feet and fails to double the volume derived from the tank curve. This is actually the OAC Lo Lo level alarm setpoint.

Answer D Discussion

Plausible the time would be correct if the candidate believes the low level alarm comes into alarm at 2.0 feet. This is actually the OAC Lo Lo level alarm setpoint.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s): OP-MC-PSS-KC Rev 25 Pg 21 and 23 23 Learning Objective: OP-MC-PSS-KC Obj. 5	

QuestionBank #	KA_system	KA_number
1853	APE062	AA1.05

KA_desc

Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water (SWS): (CFR 41.7 / 45.5 / 45.6)□The CCWS surge tank, including level control and level alarms, and radiation alarm ....

401-9 Comments:

401-9 Comments RESPONSE

Question 53 References:

From Lesson Plan OP-MC-PSS-KC page 23:

2.6.12 Air Operated Containment Isolation Valves (KC-320, 332 & 333).

These valves are physically located in the KC lines for NCDT Heat Exchanger and are Isolated on a Phase "A" isolation (S_t) or manually.

These valves are controlled from Control Room MC-11 by its own two position pushbutton switch.

2.6.13 Excess Letdown Containment Isolation Valves (KC-305 & 315).

These valves are physically located in the KC line for the Excess Letdown Heat Exchanger and isolates on S_t signal or manual. They are controlled from Control Room MC-10 using two position pushbuttons.

2.6.14 NCP and Reactor Vessel Coolers Iso Valves (KC-338, 424 & 425).

Containment isolation valves serving NCP coolers and Reactor vessel support coolers. Controlled from Control Room MC-11 using a two position pushbutton, OPEN/CLOSE. Isolates on S_p signal or manual. The Reactor vessel support coolers are normally isolated by manual isolation valves.
Does not isolate on S_s due to supplying NCP cooling.

2.6.15 KC Drain Header Containment Isolation Valves (KC-429 & 430).

Containment isolation valves on the KC drain header from Reactor Building. These valves are controlled from Control Room MC-11 using a two position pushbutton. Isolates on S_t or manual.

2.6.16 NCP Thermal Barrier Isolation Valves (KC-345, 364, 394 & 413). These valves are controlled from Control Room MC-11 using two position pushbuttons. These valves would often close on high flow conditions during KC pump starts or train swaps. In order to keep this from occurring, the KC procedure has been changed 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.

Objective #5

These valves automatically close to isolate the thermal barrier on high flow (60 gpm) which is indicative of a ruptured thermal barrier.

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.

2.6.18KC 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.

From Lesson Plan OP-MC-PSS-KC page 21:

2.6.6 ND Heat Exchanger Cooling Water Isolation Valves (KC-56 & 81).

These valves are located on the inlet of the ND Heat Exchanger and are controlled from Control Room MC-11. The operator must hold the open pushbutton until the valve fully opens because there is no seal-in associated with the open circuit. They are normally closed and open on a S_s signal.

2.6.7 ND Heat Exchanger Cooling Water Control Valves (KC-57 & 82).

These valves are located in the discharge lines of the ND Heat Exchangers. It is normally controlled by flow instrumentation to maintain KC flow through the heat exchanger at ≈5000 gpm. They fail open on a S_s signal. To regain automatic control, the S_s and the "Modulating Valves Reset" must be reset. The purpose of the "Modulating Valves Reset" is to ensure two actions are taken prior to removing a component from its safety alignment. These valves fail in open position.

Objective #10

2.6.8 KC Surge Tank Vent Valve (KC-122)

Located in the surge tank vent line and vents the tank to atmosphere. It is controlled from a local station at the surge tank by a two position, OPEN/CLOSE, pushbutton. It is normally open and receives a close signal on EMF-46A & B alarm. The "OPEN" position latches in so when the EMF signal clears, the valve will re-open.

2.6.9 KC Surge Tank Pressure Relief (KC-972)

Designed to relieve maximum water flow as a result of a ruptured NCP Thermal Barrier Heat Exchanger. Relief setpoint is 15 psig and discharges to Liquid Waste Recycle System, via Floor Drain System

2.6.10 KC Surge Tank Vacuum Relief (KC-123).

Vacuum breaker protects the tank from collapsing in the event of a KC leak when the KC Surge Tank vent is closed.

2.6.11 Letdown Heat Exchanger Cooling Water Control Valve (KC-132).

These valves are physically located in the Letdown Heat Exchanger line and regulate component cooling flow to maintain Letdown temperature at 115 °F. Valve is designed to fail open. Operation of this valve can cause changes in the NV System Demineralizers' temperatures. A change in demineralizer temperature can affect the boron concentration out of the demeralizer. Decrease in temperature can cause a dilution of the NC System (cooler resin holds more boron). An increase in temperature will have the opposite effect. See OE item 5.2

C

QuestionBank #	KA_system	KA_number
1854	WE04	EK2.2

KA_desc

Knowledge of the interrelations between the (LOCA Outside Containment) 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.

Unit 1 was operating at 100%. Given the following events and conditions:

- 0210 – reactor tripped due to a LOCA outside containment
- 0220 – crew enters ECA-1.2, (LOCA Outside Containment)
- 0230 – crew enters ECA-1.1, (Loss of Emergency Coolant Recirc)
- 0250 – The crew is at step 21.b of ECA-1.1
- Current conditions:
  - 1B NC pump running, all other NC pumps secured
  - 1 NI pump running, indicating 220 GPM
  - 1 NV pump running, indicating 385 GPM
  - Both ND pumps off
  - Subcooling is 35°F

Which ONE (1) of the following describes the <u>MINIMUM</u> SI flow required and the required actions (if any)?

<u>REFERENCE PROVIDED</u>

A. Minimum flow required is 408 GPM, stop the running NI pump.

B. Minimum flow required is 380 GPM, stop the running NI pump.

C. Minimum flow required is 408 GPM, neither pump may be secured at this time.

D. Minimum flow required is 380 GPM, neither pump may be secured at this time.

General Discussion

Time after trip is 40 minutes, graph starts at 10 minutes, flow required is 408 gpm

Since the minimum flow required is 408 gpm and the flow from the running NI pump will not meet the minimum required flow, neither pump can be stopped.

It is a difficult K/A match to relate ECA-1.2 (LOCA Outside Containment) to the facility's heat removal systems. To match this K/A initial conditions were given which placed the plant in ECA-1.2 and then a transition to ECA-1.1 (Loss of Emergency Coolant Recirc) was made. A transition to ECA-1.1 from ECA-1.2 is a possible flow path based on plant conditions.

This is an analysis question as the applicant must interpret the graph from Enclosure 9 and then determine if an NI pump can be stopped.

Answer A Discussion

Incorrect. Plausible if candidate uses the "4" after the 100 minute mark on the graph instead of the "4" after the 10 minute mark.

Answer B Discussion

Incorrect: Plausible if the candidate realizes the increments on the graph are 10 minutes apart and goes to the fourth mark on the graph not realizing that the graph starts at 10 minutes instead of 0 minutes.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible if the candidate uses the time since entering ECA-1.1 to determine the required flow instead the time since the trip. Plausible since the top of Enclosure 9 contains the title of the procedure (Loss of Emergency Coolant Recirc).

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	CNS NRC Exam Bank Question 521

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan Objective: EP-EP2 SEQ 29 References: 1. ECA-1.1 step 21 and Encl 9 - PROVIDED	EP/1/A/5000/ECA-1.1 (Step 21) EP/1/A/5000/ECA-1.1 (Enclosure 9) (Q54)

QuestionBank #	KA_system	KA_number
1854	WE04	EK2.2

KA_desc

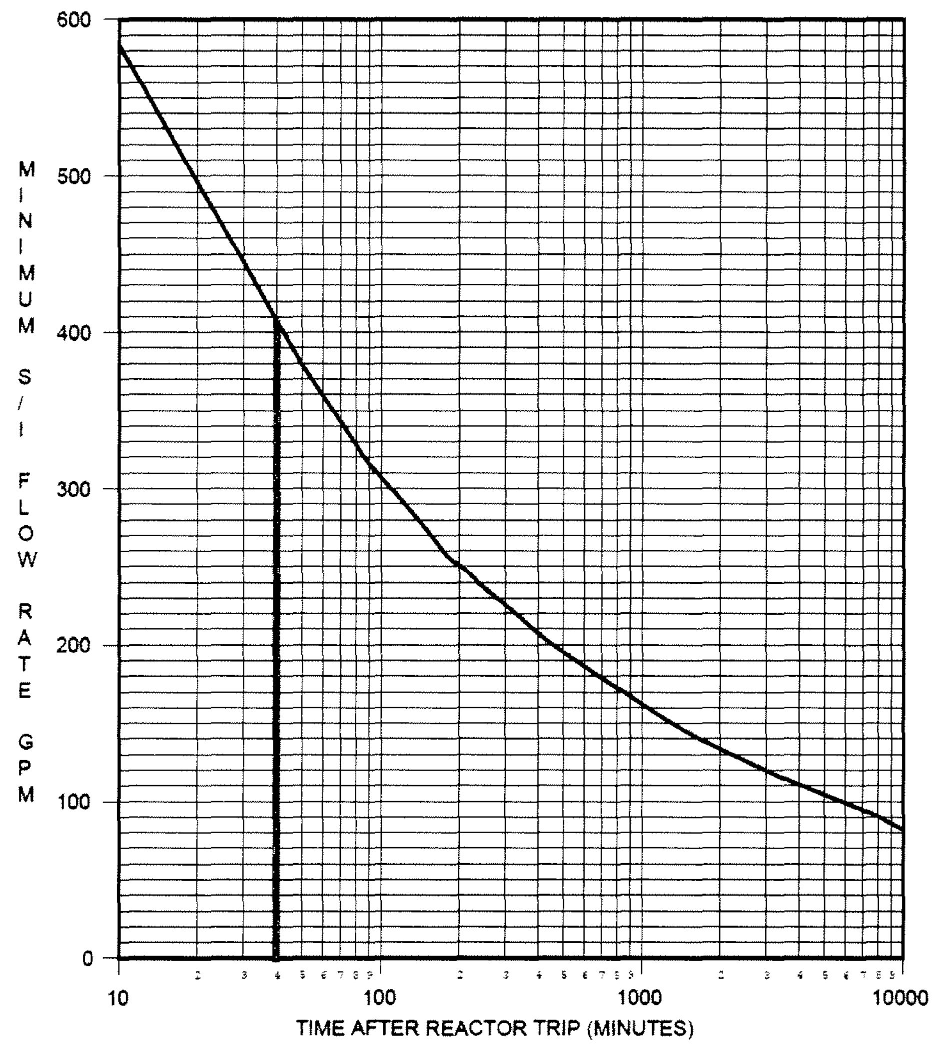
Knowledge of the interrelations between the (LOCA Outside Containment) and the following:
(CFR: 41.7 / 45.7)□Facility*s heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.

401-9 Comments:

401-9 Comments RESPONSE

Question 54 References:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
21. **Check if S/I can be terminated:**	
a. Check RVLIS indication:	__ a. **GO TO** Step 27.
__ • **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).	
__ 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) **GO TO** Step 27.
22. **Reset the following:**	
__ • Phase A Isolation	
__ • Phase B Isolation.	


600
500
400
300
200
100
0
MINIMUM S/I FLOW RATE GPM
10
100
1000
10000
TIME AFTER REACTOR TRIP (MINUTES)

QuestionBank #	KA_system	KA_number
521	WE04	EK2.2

KA_desc
Knowledge of the interrelations between the (LOCA Outside Containment) 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.

Unit 1 was operating at 100%. Given the following events and conditions:

- 0200 – reactor tripped due to a LOCA outside containment
- 0210 – crew enters ECA-1.2, (LOCA Outside Containment)
- 0220 – crew enters ECA-1.1, (Loss of Emergency Coolant Recirc)
- 0240 – The crew is at the step in ECA-1.1 to determine NC subcooling
- Current conditions:
  - NCS pressure is 1100 psig
  - 1B NC pump running
  - 1A, 1C, and 1D NC pumps secured
  - Reactor Vessel D/P is 20%
  - 1 NI pump running, indicating 220 gpm
  - 1 NV pump running, indicating 385 gpm
  - Both ND pumps off
  - No NS pumps running
  - Subcooling is 35°F

Which one of the following statements correctly describes the minimum required flow and which pump can be secured?

Reference provided

A. 210 gpm, stop the running NV pump.

B. 210 gpm, stop the running NI pump.

C. 410 gpm, stop the running NI pump.

D. 410 gpm, neither pump may be secured at this time.

General Discussion

Bank Question: 912.1
Time after trip is 40 minutes, graph starts at 10 minutes, flow required is 408 gpm

Answer A Discussion

Incorrect: required flow is 408 gpm
Plausible: candidate misses the fact that the graph starts at 10 minutes; this is the 50 minute number

Answer B Discussion

Incorrect: required flow is 408 gpm, the NV pump is providing 385 gpm, and the NI pump may not be stopped.

Answer C Discussion

Incorrect: required flow is 408 gpm
Plausible: candidate uses 30 minutes to determine required flow (time since diagnosis of LOCA outside containment)

Answer D Discussion

Correct: required flow is 408 gpm Both pumps are required to meet this flow.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2004 NRC Q26 (Bank 326)

- [x] Developed
- [ ] OPT Approved
- [ ] OPS Approved
- [x] NRC Approved

Development References

Lesson Plan Objective: EP-EP2 SEQ 29
References:
1. ECA-1.1 step 19 and Encl 5 - PROVIDED

Student References Provided

EP/1/A/5000/ECA-1.1 (Step 19)
EP/1/A/5000/ECA-1.1 (Enclosure 5)

QuestionBank #	KA_system	KA_number
521	WE04	EK2.2

KA_desc

Knowledge of the interrelations between the (LOCA Outside Containment) 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:

W/E04EK2.2 Question appears to match K/A. Modified from 2004 NRC exam. SAT
Modified.

401-9 Comments RESPONSE

Underlined minimum in the stem.

QuestionBank #	KA_system	KA_number
1855	WE05	EK2.1

KA_desc

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 conditions on Unit 1:

- A Reactor Trip and Safety Injection have occurred due to a Small Break LOCA
- Both MD CA pumps and the TD CA pump failed to start and attempts to restore them have been unsuccessful
- FR-H.1 (Response to Loss of Secondary Heat Sink) has been implemented
- I&E has been dispatched to block the Feedwater Isolation in accordance with FR-H.1, Enclosure 6 (Feedwater Isolation Override)

In addition to blocking the Feedwater Isolation, to regain control of the CF pumps the Operators must also ____.

A. Reset SI

B. Reset Phase A

C. Reset the Sequencers

D. Override CA Auto Start Defeat

General Discussion

To regain control of CF components after an SI, the SI must be reset and NORMALLY the reactor trip breakers would be closed. The sequencers are reset by procedure but not required to restore control to the CF components. During performance of FR-H.1, the reactor trip breakers are NOT closed. Instead the Feedwater Isolation signal is overridden.

This KA is match because the applicant must have knowledge of the interlocks which must be met to restore CF flow during a Loss of Secondary Heat Sink scenario.

Question is comprehensive because the candidate must evaluate a given plant scenario and apply that assessment to determine what must be done (How) to reset a safety signal. These actions could be different depending on plant conditions so this is above just straight recall for system knowledge.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Plausible because Phase A is normally reset when SI is reset. However, it is not required to regain control of the CF pumps

Answer C Discussion

Incorrect. Plausible because the sequencers are reset in FR-H.1 when performing actions to regain control of CF components. However, it is not required to regain control of the CF pumps.

Answer D Discussion

Incorrect. Plausible because and CA Auto Start Defeat signal can prevent the CA pumps from running. However, in this case there should be no CA Auto Start Defeat signal present.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-CF-CF Objective 12 pages 35 and 37 FR-H.1 pages 9 & 10	

QuestionBank #	KA_system	KA_number
1855	WE05	EK2.1

KA_desc

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:

401-9 Comments RESPONSE

Question 55 References:

From Lesson Plan OP-MC-CF-CF pages 35 and 37:

A Feedwater isolation will occur if any one of the following conditions occur (refer to Drawing 7.9 and 7.10):

- S_S - Safety Injection actuation
- P14 - Hi Hi S/G level (83% on 2 / 3 channels on 1 / 4 S/Gs)
- Reactor trip with low T_{ave} (P-4 and 553°F on 2 / 4 loops)
- Manual Feedwater Isolation actuation (1 / 2 pushbuttons)

Objective #13

When Feedwater isolation actuates, the following valves will close (refer to Drawing 7.2):

- S/G CF Control Valves (CF-32, 23, 20, 17)
- S/G CF Control Bypass Valves (CF-104, 105, 106, 107)
- S/G CF Containment Isolation Valves (CF-35, 30, 28, 26)
- S/G CF to CA Nozzle Isolation Valves (CF-126, 127, 128, 129)

Status lights "S/G A(B)(C)(D) FDW ISOLATED" on 1SI-4, A-2(B-2)(C-2)(D-2) will light when all four valve on its associated S/G CF flow path are closed.

Objective #14

The P14 (Hi Hi S/G Level) actuation signal is designed to terminate the main feedwater contribution to a S/G(s) overfill event. An overfill event could occur from conditions such as a S/G tube rupture or a CF control system misoperation/failure (manual/auto) which results in overfeeding. A P14 actuation will initiate the following:

- FWI (Feedwater isolation)
- Both main CF pump turbines trip
- Main turbine trips

Note: The tripping of both main feedwater pumps will result in an auto start of the Motor Driven CA pumps. The operator will have to manually control CA flow to prevent feeding the steam generator(s) that initiated the P14.

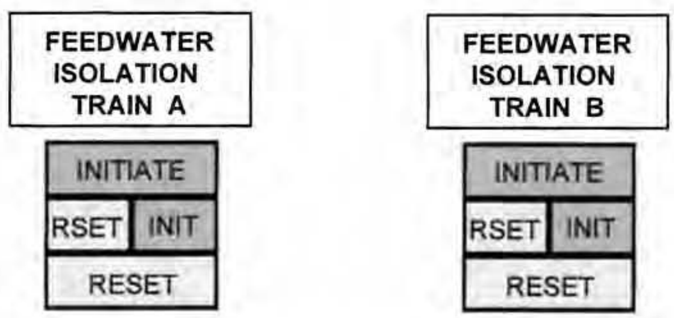
Objective #12

Operator action is required to restore control to FWI components: (refer to Drawing 7.10 and 7.11)

- If FWI was due to S_S; control of FWI components is regained by having S_S "Reset" and closing the reactor trip breakers. (The FWI "Reset" PB does not need to be depressed.)

- If FWI was due to P-14 with a Reactor trip; control of FWI components is regained by clearing the P-14 and closing the reactor trip breakers. (The FWI "Reset" PB does not need to be depressed.)
- If FWI was due to P-14 without a Reactor trip; control of FWI components is regained by clearing the P-14 (the reactor trip breakers will already be closed). (The FWI "Reset" PB does not need to be depressed.)
- If FWI was due to P-4/Low T-avg, control of FWI components may be regained by depressing the FWI "Resets", even with the initiating signal present (i.e., Rx trip breakers can be open and temp can be less than 553^{0}F degrees).
- If FWI was due to "Manual initiation"; control of FWI components is regained by depressing the FWI "Resets" (i.e., Rx trip breakers can be open).

During a normal controlled plant shutdown, it is undesirable to have automatic feedwater isolation. The reset pushbuttons on the FWI control switches (Train A & B) (provided on MC2) allows the operator to manually block the Reactor Trip-Lo Tave FWI (by procedure).



The block is accomplished, prior to opening the reactor trip breakers, by depressing and holding both train RESETS pushbuttons while the reactor trip breakers are opened. When depressing CF isolation RESETS during operations of the Rx Trip breakers, practice STAR individually on EACH pushbutton. That is, STAR the first pushbutton to be depressed and then depress the pushbutton. While continuing to hold the first pushbutton fully depressed, STAR the second pushbutton and then depress it. Continue to hold both pushbuttons fully depressed until the reactor trip breakers are open.. This will instate the memory and block feedwater isolation. Cooldown below 553^{o}F may be accomplished without further action. (PIP 1-M96-0326 and LER 369/96-02 document a situation where an operator accidentally depressed the FWI initiate pushbutton instead of the reset pushbutton).

From FR-H.1 pages 9 and 10:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. **Reset Feedwater Isolation as follows:**	
a. **Check the following alarms - DARK:** __ • **1AD-5, G-6 (Inner Doghouse Level Hi)** __ • **1AD-5, H-6 (Outer Doghouse Level Hi).**	a. Perform the following: 1) Check the position of the following valves: __ • 1CF-2 (1A CF Pump Discharge Isol) __ • 1CF-5 (1B CF Pump Discharge Isol). __ 2) **IF** both valves are open, **THEN GO TO** Step 10.b. __ 3) Dispatch operator to block Feedwater Isolation signal **PER** Enclosure 6 (Feedwater Isolation Override). __ 4) Have IAE obtain Key 172 from key locker in the Work Control Center. 5) Dispatch IAE (with Key 172) to remove the following fuses to defeat high-high doghouse level signal: • In 1ATC2A (750, GG-54) (MCEE 145-99.02) (Connection Drawing MC-1717-03.02-03): __ • FB 7-8 __ • FA 7-8. • In 1ATC3 (716, GG-54) (MCEE 145-99.02-01) (Connection Drawing MC-1717-04.01-03): __ • GE 1-2 __ • GE 3-4. __ 6) Do not continue until fuses removed. 7) Open the following valves: __ • 1CF-2 (1A CF Pump Discharge Isol) __ • 1CF-5 (1B CF Pump Discharge Isol). __ 8) **GO TO** Step 10.c.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. (Continued)	
__ b. **Dispatch operator to block Feedwater Isolation signal PER Enclosure 6 (Feedwater Isolation Override).**	
__ c. **Check S/I - HAS BEEN ACTUATED.**	c. Perform the following: __ 1) **IF** any S/G N/R level has exceeded 83% (P-14) during this event, **THEN GO TO** Step 10.f. __ 2) **GO TO** Step 11.
d. **Reset the following:**	
__ 1) **S/I.**	__ 1) Reset S/I **PER** EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 23 (Local Reset of S/I Signal).
__ 2) **Sequencers.**	2) Dispatch operator to open affected sequencer control power breaker: __ • A Train - 1EVDA Breaker 6 __ • B Train - 1EVDD Breaker 8.
__ e. **IF AT ANY TIME** a B/O signal occurs, **THEN** restart S/I equipment previously on.	
__ f. **Do not continue until Enclosure 6 (Feedwater Isolation Override) is completed.**	

QuestionBank #	KA_system	KA_number
1856	WE11	2.4.8

KA_desc
WE11 GENERIC□Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)

Given the following conditions on Unit 1:

- A Reactor Trip and Safety Injection have occurred due to a Small Break LOCA
- The crew was performing E-1 (Loss of Reactor or Secondary Coolant) and have implemented ECA-1.1 (Loss of Emergency Coolant Recirc)
- Annunciator 1AD-12 C1 (VI/VS LO PRESS) is in alarm

Which ONE (1) of the following describes the requirements for implementing AP-22 (Loss of VI) in conjunction with ECA-1.1?

A. AP-22 may be implemented concurrently with ECA-1.1. However, it must be suspended if transition is made to a Functional Restoration Procedure (FRP).

B. AP-22 may not be implemented since no other procedures may be implemented while an ECA procedure is in effect.

C. AP-22 may be implemented concurrently with ECA-1.1. However, the operators must use caution since an S/I has occurred.

D. AP-22 may not be implemented since an SI has occurred. The APs are written assuming the S/I had not occurred and shall not be used if S/I has actuated.

General Discussion

OMP 4-3, Use of Abnormal and Emergency Procedure allows APs to be implemented in conjunction with EPs. However, it cautions that APs are written assuming that an SI has occurred and that steps in APs that are performed after an SI has occurred must be evaluated to ensure that they do not conflict with guidance in the EPs.

This KA is matched because the applicant must understand the administrative requirments for implementing APs in conjunction with EPs.

Question is comprehensive because the candidate must evaluate a given plant scenario which includes multiple pieces of information. Based on this evaluation, he must then come to a conclusion as to how a selected procedure may or may not be implemented.

Answer A Discussion

Incorrect. Plausible because some EP procedures specifically state that no other procedures should be implemented while that procedure is in effect.

Answer B Discussion

Incorrect. Plausible as OMP 4-3 states that the use of APs in conjunction with EPs should be avoided.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible since it is true that APs are written assuming that an SI has not occurred. However, OMP 4-3 does not prohibit implementation of APs in conjuction with EPs. It does caution the Operators to evaluate AP steps performed after an SI.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OMP 4-3, Use of Abnormal and Emergency Procedures page 22	

QuestionBank #	KA_system	KA_number
1856	WE11	2.4.8

KA_desc

WE11 GENERIC□Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:

401-9 Comments RESPONSE

Question 56 References:

From OMP 4-3 page 22:

7.18 Multiple Use of EPs and APs.

The Control Room Supervisor will determine how many procedures can be implemented at a time and their priority based on manpower availability and the particular event in progress. More than one EP shall NOT be run concurrently unless directed by the procedure. Generally the use of APs in conjunction with EPs should be avoided. In some instances it would be proper to use an AP concurrently during a major accident which is being addressed by the EPs. An example of this is upon loss of all Nuclear Service Water in the middle of an accident, the operators would need to utilize the AP for Loss of RN also. IF an AP is used during an S/I event, USE CAUTION. APs are generally written assuming an S/I has NOT occurred (exception - AP/35, ECCS Actuation During Plant Shutdown). Evaluate any AP steps in post S/I events to ensure the steps do NOT conflict with any EP in effect. NOT all AP actions would be appropriate if an S/I occurred. (Enclosures in EP/G-1 (Generic Enclosures) may be used when reference by EPs or APs.)

Use of most APs that have foldouts will likely be terminated when a reactor trip or S/I occurs. There are a few APs with foldouts that could potentially be implemented concurrently with an EP though (Loss of VI or Loss of KC for example). Rules of foldout page use as specified in Section 7.12 should be applied in this situation also. Although unlikely, it is possible that the crew may have one EP foldout in effect at the same time as one of the AP foldouts. Implementation and priority of the AP foldouts will be evaluated as discussed in paragraph above.

OATC or BOP may be given procedure responsibilities when APs and EPs or multiple APs are in effect at the same time.

OSM or CRS with OSM approval can choose to supplement the Control Room core crew, (core defined as the OSM, STA, CRS, OATC and BOP for the unit in question) with additional licensed resources to assist with implementation of an AP during EP implementation or implementation of multiple APs. Before allowing the supplemental resources to be used the OSM must ensure command and control of the crew is NOT comprised and the CRS can maintain oversight and control of the RO resources performing main control board manipulations. Additionally, the OSM must hold a focus brief to define the communication and status reporting expectations for the supplemental resources. The OSM and CRS are the only supervisors who can direct main control board manipulations in accordance with this OMP. {PIP M-08-3873 CA#9} Note that for a dual unit event, another SRO may be used in the CRS function for the other unit. The OSM must maintain command and control for both units.

QuestionBank #	KA_system	KA_number
1857	APE003	AK1.07

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Dropped Control Rod: (CFR 41.8 / 41.10 / 45.3) Effect of dropped rod on insertion limits and SDM ....

Given the following:

- Unit 1 is operating at 100% RTP with Rod Control in AUTO
- A rod in Control Bank C drops into the core
- Tave dropped to 584°F and was restored to 585°F by the Rod Control system before Rod Control was placed in MANUAL
- NC system pressure has stabilized at 2235 PSIG

Based on the conditions above, shutdown margin __(1)__ and rod insertion limits __(2)__.

(ASSUME XENON CONCENTRATION HAS NOT CHANGED)

A. 1) decreases
 2) decrease

B. 1) remains the same
 2) decreases

C. 1) remains the same
 2) remain the same

D. 1) decreases
 2) remain the same

C

General Discussion

Shutdown margin is defined as the amount of reactivity by which the reactor is shutdown OR could be made instantaneously shutdown. With the dropped control rod, the control rods withdraw slightly to compensate for the decrease in Tave caused by the dropped rod. Since Reactor Power, Boron Concentration, and Tave are at the same value as they were prior to the dropped rod SDM does not change. Since power is the same Rod Insertion Limits remain the same.

This KA is matched because the applicant must know the effect of a dropped rod on SDM and RILs to correctly answer the question.

Question is comprehensive because the candidate must evaluate the effects of a rod drop scenario on SDM and rod insertion limits. This represents a multi part mental process and a prediction of an outcome.

Answer A Discussion

Incorrect. Part 1 is incorrect but plausible if the applicant believes that the temperature decrease reduces shutdown margin. Part 2 is plausible if the applicant does not understand the RILs are determined by reactor power.

Answer B Discussion

Incorrect. Part 1 is correct. Part 2 is plausible if the applicant does not understand the RILs are determined by reactor power.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Part 1 is incorrect but plausible if the applicant believes that the temperature decrease reduces shutdown margin. Part 2 is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-RT-RB Objective 9 page 45 Lesson Plan OP-BNT-RT03 Objective 8 pages 19 and 20	

QuestionBank #	KA_system	KA_number
1857	APE003	AK1.07

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Dropped Control Rod: (CFR 41.8 / 41.10 / 45.3)□Effect of dropped rod on insertion limits and SDM ....

401-9 Comments:

401-9 Comments RESPONSE

Question 57 References:

From Lesson Plan OP-MC-RT-RB page 45:

2.1 Shutdown Margin Calculations

2.3.1 Shutdown Margin (SDM) Definition

Objective # 9

Definition: Shutdown margin shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

- **All rod cluster control assemblies (RCCAs) are fully inserted except for the single RCCA of highest reactivity worth, which is assumed to be fully withdrawn. With any RCCA not capable of being fully inserted, the reactivity worth of the RCCA must be accounted for in the determination of SDM;**

AND

- **In MODES 1 and 2, the fuel and moderator temperatures are changed to the nominal zero power design level.**

SDM must be verified under various plant conditions and during several operating procedures. Many of these are specified by Technical Specifications.

Certain procedures (OPs, EPs, and APs) will require SDM verification based on requirements by Technical Specifications. Most of these verifications are required when possible dilution could occur or if a cooldown is expected.

2.3.2 SDM - Unit at Power, Modes 1 and 2 With No Inoperable Rods

In Mode 1 and Mode 2 with Keff $\geq$ 1.0 with all RCCAs operable, shutdown margin is satisfied provided that:

- Control banks are positioned above the control bank insertion limits with proper sequence and overlap (Technical Specification 3.1.6).

  AND

- Shutdown banks are positioned above the shutdown bank insertion limits (Technical Specification 3.1.5).

If these conditions are satisfied, no calculation required. These conditions are verified in PT/1,2/A/4600/003A, Semi Daily Surveillance Items.

From Lesson Plan OP-BNT-RT03 pages 19 and 20:

The method of determining SDM will be specified in facility operating procedures. The procedure typically involves solving a general reactivity balance equation using the actual and assumed conditions of plant parameters.

Objective 8

Several "common" conditions (parameters) affect the SDM whether the plant is operating at power or shut down.

- Xenon concentration – An increase would add negative reactivity, increasing the shutdown margin.
- Samarium concentration – An increase would add negative reactivity, increasing the shutdown margin.
- Boron concentration – An increase would add negative reactivity, increasing the shutdown margin.
- Stuck Control Rod – A stuck control rod (not the highest worth rod) will reduce the amount of reactivity by which the reactor can be shutdown, therefore reducing the shutdown margin.

Conditions that have an effect on SDM while shutdown are the "common" conditions listed above as well as:

- Moderator Temperature – An increase would insert negative reactivity, increasing the shutdown margin.
- Number of fuel assemblies in the core – An increase would add positive reactivity, decreasing the shutdown margin.
- Fuel temperature – An increase (caused by a decrease in heat removal rate or an increase in moderator temperature) would insert negative reactivity, increasing the shutdown margin.

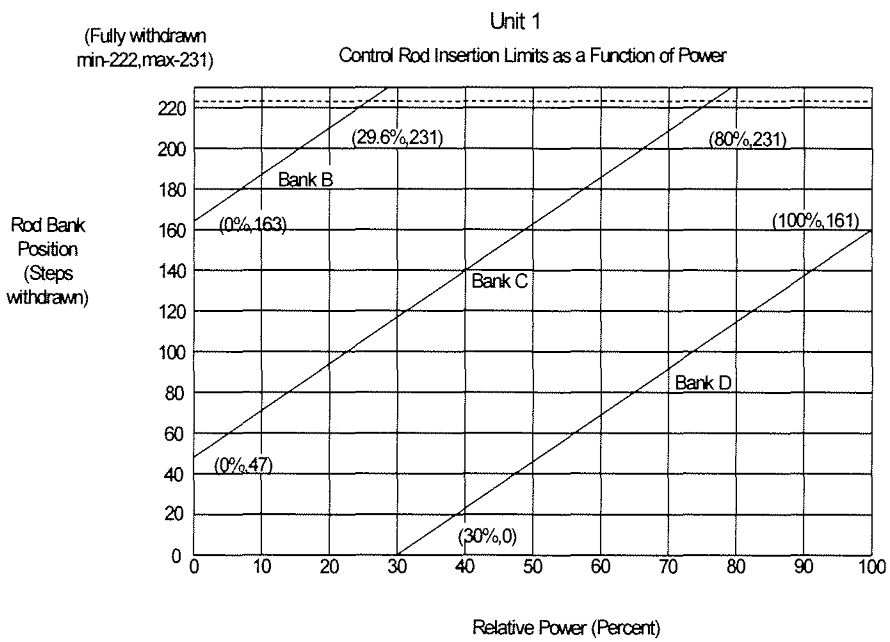
Conditions that have an effect on SDM while operating at power are the "common" conditions listed above as well as:

- Exposure/burnup of fuel assemblies in the core – An increase would add negative reactivity, increasing the shutdown margin

From Lesson Plan OP-MC-RT-RP page 47:

Objective # 11

2.3.4 Control Rod Insertion Limit Curves



This curve is provided in the McGuire Data Book.

Notice how the required rod height increases as power level increases. This is necessary to compensate for power defect and still be able to ensure that an adequate Shutdown Margin *(1.3% ΔK/K)* will be maintained after a Reactor Trip.

Objective # 12

Use the Rod Insertion Limit Curve located in the McGuire Data Book as Enclosure 4.3 – Graph 1.2 *(This curve is also illustrated as Training Drawing 7.5, Control Rod Insertion Limits)* to determine the specific Rod Insertion Limit for each of the following plant conditions:

- **Unit 1 Reactor Startup**

  Answer: *47 steps on Bank C (163 steps on Bank B)*

- **OTΔT Turbine Runback to 84% Reactor Power**

  Answer: *125 steps on Bank D*

- **Control Rod Bank Lo-Lo Limit Alarm (1AD2 - B-9) while performing 50% Power Calorimetric**

  Answer: *46 steps on Bank D (162 steps on Bank C)*

QuestionBank #	KA_system	KA_number
1858	APE005	AK2.02

KA_desc
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 ....

Given the following conditions on Unit 1:

- Control Rod M-4 (Control Bank D, Group 2) indicates 186 steps on DRPI
- Bank D Group Step Counters indicate 195 steps on both banks
- I&E has determined that Control Rod M-4 is immovable due to a failure of its Lift Coil Disconnect switch
- There has been no indication that the rod is mechanically bound.
- It will take approximately 3 hours to replace the failed disconnect switch

Which ONE (1) of the following describes the OPERABILITY of Control Rod M-4 as described by Technical Specification 3.1.4 (Rod Group Alignment Limits)?

A. The control rod does not meet alignment limits but remains OPERABLE because it can be tripped.

B. The control rod can be tripped but is INOPERABLE because it is not within alignment limits.

C. The control rod is OPERABLE because it is can be tripped and it is within alignment limits.

D. The control rod is within alignment limits but is INOPERABLE because it can not be moved.

C

General Discussion

The control rod is operable because it is still trippable (no indications otherwise). Since the control rod is within 12 steps of the group step counter position, the rod is not out of alignment as required by TS 3.1.4

The K/A is matched because the applicant must understand the relationship between the lift coil disconnect switches for the control rod and the Tech Spec operability of the rod.

This is an analysis level question because the applicant must apply multiple given indications to information recalled from memory (control rod alignment TS limits) and must comprehend that the control rod is still trippable (and therefore still operable) with the lift coild disconnect switch failed.

Answer A Discussion

Incorrect. The control rod is operable. Verifying SDM within limits is plausible if the applicant believes that the control rod is misaligned by comparison to other rods in the bank instead of Group Demand Counters.

Answer B Discussion

Incorrect. Control rod being inoperable is plausible if the applicant believes it is not trippable with the lift coil disconnect switch failed. Verified SDM would be the appropriate action of the control rod was inoperable.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Control rod being inoperable is plausible if the applicant believes it is not trippable with the lift coil disconnect switch failed. No additional actions is correct.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Specification 3.1.4 Rod Group Alignment Limits	

QuestionBank #	KA_system	KA_number
1858	APE005	AK2.02

KA_desc
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 ....

401-9 Comments: **401-9 Comments RESPONSE**

Question 58 References:

From Tech Spec 3.1.4:

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)

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)

QuestionBank #	KA_system	KA_number
1859	APE024	AK1.04

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Emergency Boration: (CFR 41.8 / 41.10 / 45.3) Low temperature limits for born concentration ....

Given the following conditions on Unit 1:

- An Operator in the plant reports that the FWST Heater Overtemperature light on the FWST Heater Control panel is LIT

Which ONE (1) of the following describes the operational implications of the FWST Heater overtemperature condition?

A. All FWST heater groups are tripped. The FWST will remain OPERABLE until FWST temperature decreases to less than 70°F.

B. Only the FWST heater group with the overtemperature condition has tripped. The FWST will remain OPERABLE until FWST temperature decreases to less than 70°F.

C. All FWST heater groups are tripped. The FWST will remain OPERABLE until FWST temperature decreases to less than 65°F.

D. Only the FWST heater group with the overtemperature condition has tripped. The FWST will remain OPERABLE until FWST temperature decreases to less than 65°F.

General Discussion

The first part of the questions deals with FWST heater operations. The stem is questioning "heater" overtemperature not Tank overtemperature. This sometimes comes in during heater operation which would be energized to PREVENT the temperature from going low. Because the condition prevents ALL of the heaters from operating, the result would be a LOW temperature in the FWST.

In accordance with the Limits and Precaution for the FW system, the minumum temperature for the FWST is 70°F. This is also the low limit for OPERABILITY in accordance with TS 3.5.4, RWST, SLC 16.9.11, Borated Water Sources - Operating, and SLC 16.9.14, Borated Water Sources - Shutdown.

While there are no low temperature limits for boron concentration which are specific to Emergency Boration, the low temperature limit for the FWST are an operational implication tied to the operability of that water sources and its associated flowpaths under all operating conditions including times when Emergency Boration is required. Since this is a potential source of water during Emergency Boration the KA is matched.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. Plausible because there are temperature indications for each individual heater group. However, a high temperature on one group of heaters trips all groups. The temperature limit for operability is correct.

Answer C Discussion

Incorrect. It is correct that all heater groups trip. The temperature limit is plausible because it is the correct temperature limit for the BAT (another source of water for emergency boration).

Answer D Discussion

Incorrect. Plausible because there are temperature indications for each individual heater group. However, a high temperature on one group of heaters trips all groups. Temperature limit is plausible because it is correct for the BAT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
SLC 16.9.11, Borated Water Sources (Operating) Lesson Plan OP-MC-FH-FW Objective 6 page 23, Objective 4 page 43 and Objective 7 page 31.	

QuestionBank #	KA_system	KA_number
1859	APE024	AK1.04

KA_desc

Knowledge of the operational implications of the following concepts as they apply to Emergency Boration: (CFR 41.8 / 41.10 / 45.3)□Low temperature limits for born concentration ....

401-9 Comments:

APE024AK104
CAF: The KA is for low temperature limits for Boron Concentration. This Q references an over-temperature annunciator. Is this for a high temperature or a low temperature condition? The ref does not explain well.
Stem: Is this a high Temperature or a low temperature condition?
Remove the double period from "C" and "D"

401-9 Comments RESPONSE

10/14/09
Revised distracter discussion to better explain low temp angle. Will discuss with Ron when on site, should be OK. There is no double period.

Question 59 References:

From SLC 16.9.11:

16.9 AUXILIARY SYSTEMS

16.9.11 Borated Water Sources (Operating)

COMMITMENT **As a minimum, the following borated water source(s) shall be OPERABLE as required by SLC 16.9.9:**

a. A boric acid tank (BAT) and,

b. The refueling water storage tank.

APPLICABILITY **MODES 1, 2, and 3,**
MODE 4 with all RCS cold leg temperatures > 300°F.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. **Required boric acid tank inoperable.**	A.1 Restore the required boric acid tank to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Borate to the SDM requirements of TS 3.1.1 <u>AND</u> B.3 Restore the required boric acid tank to OPERABLE status.	6 hours 6 hours 7 days
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 4 with any RCS cold leg temperature $\leq$ 300°F.	30 hours

(continued)

REMEDIAL ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Refueling water storage tank inoperable.	D.1 Enter the applicable Conditions and Required Actions of LCO 3.5.4, "Refueling Water Storage Tank."	Immediately

TESTING REQUIREMENTS

TEST	FREQUENCY
TR 16.9.11.1 **Verify the refueling water storage tank solution temperature is $\geq$ 70°F and $\leq$ 100°F when the outside air temperature is < 70°F or > 100°F.**	24 hours
TR 16.9.11.2 Verify the boron concentration of the required borated water source is within the limits specified in the COLR.	7 days
TR 16.9.11.3 Verify the borated water volume of the required borated water source is within the limits specified in the COLR.	7 days
TR 16.9.11.4 **Verify the boric acid tank solution temperature is $\geq$ 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 Modes 1-3 and Mode 4 with all RCS cold leg temperatures above 300 °F, a minimum of two borated water sources are required to ensure single functional capability in the event an assumed failure renders one of the sources inoperable. The boration capability of either borated water source, in association with a flow path and charging pump, is sufficient to provide a SDM from expected operating conditions of 1.3% delta k/k after xenon decay and cooldown.

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

BASES (continued)

From Lesson Plan OP-MC-FH-FW page 23:

Objective 6

2.6 Refueling Water Storage Tank Design Basis

The FWST has (as a minimum) a usable capacity of 372,100 gallons of borated water. The water in the FWST is electrically heated when water temperature decreases to < 75°F. The tank capacity provides an adequate amount of borated water to insure:

- A sufficient volume of borated refueling water needed to increase the boron concentration of the initially spilled water to a point that assures no return to criticality with the reactor at cold shutdown and all control rods fully inserted in the core with the exception of the most reactive rod cluster control assembly.
- A sufficient volume of water in the lower compartment of the containment following ECCS Injection to permit the initiation of Cold and Hot Leg Recirculation.
- A sufficient volume of borated water to insure that the radiation dose at the surface of the refueling cavity is limited to 2.5 milli rem 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	372,100 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

From Lesson Plan OP-MC-FH-FW page:

3.0 SYSTEM OPERATION

3.1 Normal Operation

Objective 4

Limits and Precautions

Maximum water temperature in FWST is 100°F.

Basis: Accident Analysis assumes 100°F or less. If greater than this temperature, Containment pressure could exceed its maximum assumed value.

Minimum water temperature in FW Header is 70°F.

Basis: In the ECCS analysis, the containment spray temperature is assumed to be equal to the RWST lower temperature of 70°F. The lower temperature limit is based on the following:

- If the lower temperature limit is violated, the containment spray further reduces the containment pressure which decreases the saturated steam specific volume (density decreases). This means that each pound of steam generated during core reflood tends to occupy a larger volume which decreases the rate at which steam can be vented out the break and increase the peak clad temperature.

All electrically operated engineered safeguard valves must be operated electrically after any manual operation.

Basis: This ensures that the valve's actuator still has the capability to function properly. Manual operation of valves can result in exceeding torque and limit switch setpoints. Electric operation ensures no damage has occurred when the valve was manually operated.

Maximum FWST level is 483 inches unless FWST overflow is required.

Basis: Overflow to the SFP occurs at 484". Overfilling the FWST can also result in exceeding stress limits on the FWST itself caused by overpressure. The fill rate may exceed the overflow rate.

From Lesson Plan OP-MC-FH-FW page 31:

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

Objective 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.

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.

Objective 7

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)

QuestionBank #	KA_system	KA_number
1860	APE061	AA2.04

KA_desc
Ability to determine and interpret the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: (CFR: 43.5 / 45.13)□ Whether an alarm channel is functioning properly ....

Given the following conditions on Unit 1:

- Unit is in Mode 6
- The reactor is being defueled
- The following alarm has <u>JUST</u> been received in the Main Control Room:
  - "1EMF-16 CONTAINMENT REFUELING BRIDGE" annunciator

Which ONE (1) of the following alarms could **<u>NOT</u>** be used to confirm that the 1EMF-16 alarm is valid?

(CONSIDER EACH OF THE FOLLOWING ALARMS SEPARATELY)

A. 1EMF-51A (REACTOR BUILDING ACTIVITY) alarm

B. 1EMF-17 (SPENT FUEL BLDG REFUEL BRIDGE) annunciator

C. (SPENT FUEL POOL LEVEL LOW) computer alarm

D. (INCORE INST ROOM SUMP HI LEVEL) annunciator

General Discussion

For 1EMF-16, other valid alarms which could be used to confirm that the alarm is valid are:

1EMF-17 (indicating a loss of Refueling Cavity and Spent Fuel Pool Level)
Spent Fuel Pool Level Low (indicating a loss of Refueling Cavity and Spent Fuel Pool Level)
Incore Inst Room Sump Hi Level (indicating a loss of Refueling Cavity and Spent Fuel Pool Level)
Any Unit Vent or Spent Fuel Building Ventilation monitor alarm (indicating fuel damage)

1EMF-51A would not be a valid alarm to confirm that 1EMF-16 is valid since it is a high range alarm and should not be in alarm if 1EMF-16 has just been received.

K/A is matched because the applicant must know which redundant indications can be used to evaluate whether the alarming Area Radiation Monitor is functioning properly.

Question is comprehensive because the candidate must evaluate the validity of a given alarm against a set of alternate indications. This process of understanding the relationships between the given alarm puts this question on the analysis level.

Answer A Discussion

CORRECT.

Answer B Discussion

Incorrect. This would confirm 1EMF-16 is valid if there was a leak which resulted in a lowering Refueling Cavity / Spent Fuel Pool Level.

Answer C Discussion

Incorrect. This would confirm 1EMF-16 is valid if there was a leak which resulted in a lowering Refueling Cavity / Spent Fuel Pool Level.

Answer D Discussion

Incorrect. This would confirm 1EMF-16 is valid if there was a leak which resulted in a lowering Refueling Cavity / Spent Fuel Pool Level.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
AP-40, Loss of Refueling Cavity Level page 2 AP-25, Spent Fuel Damage page 2	

QuestionBank #	KA_system	KA_number
1860	APE061	AA2.04

KA_desc

Ability to determine and interpret the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: (CFR: 43.5 / 45.13)□Whether an alarm channel is functioning properly ....

401-9 Comments:

401-9 Comments RESPONSE

Question 60 References:

From AP-40 page 2:

MNS AP/1/A/5500/40 UNIT 1	LOSS OF REFUELING CAVITY LEVEL	PAGE NO. 2 of 8 Rev. 6

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

__ 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. **GO TO** Step 4.

From AP-25 page 2:

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.**

QuestionBank #	KA_system	KA_number
1861	APE067	AK3.02

KA_desc
Knowledge of the reasons for the following responses as they apply to the Plant Fire on Site: (CFR 41.5,41.10 / 45.6 / 45.13)□Steps called out in the site fire protection plan, FPS manual, and fire zone manual ....

If a fire was reported in the McGuire Office Complex (MOC), which one of the following responses is correct by station procedures?

A. Offsite fire departments are responsible for all fire suppression activities at the scene. The Fire Brigade may provide limited support if resources allow.

B. Offsite fire departments are responsible for all fire suppression activities at the scene. The Fire Brigade cannot respond to any events outside the protected area.

C. Fire Brigade members are responsible for fire suppression activities at the scene. An offsite fire department may be called to provide support if additional resources are required.

D. Fire Brigade members are responsible for fire suppression activities at the scene. They are required to turn over control of the scene as soon as an offsite fire department arrives and immediately return to the protected area.

General Discussion

The Offsite Fire Department is responsible for fire suppression activities outside the protected area. The site Fire Brigade may provide limited support for a fire outside the protected area. Offsite Fire Department must be notified for all fires that occur outside the protected area, including those extinguished by the site Fire Brigade.

The K/A is matched because it requires the applicant to know the procedure requirements related to the responsibilities of the on site fire brigade. In order to eliminate the given distracters must understand the reasons for the limited response available for a fire outside the protected area.

Answer A Discussion

Plausible they have restrictions regarding leaving the site.

Answer B Discussion

CORRECT

Answer C Discussion

Plausible if the candidate thinks that they cannot remain outside the protected area

Answer D Discussion

Plausible If the candidate does not understand fire brigade responsibilities.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS SSRFYN01

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Technical Reference(s): RP/0/A/5700/025 Rev 15
Enc 4.1 pg 5 of 5
OMP 2-2 Pg 13 of 37

Student References Provided

QuestionBank #	KA_system	KA_number
1861	APE067	AK3.02

KA_desc

Knowledge of the reasons for the following responses as they apply to the Plant Fire on Site: (CFR 41.5,41.10 / 45.6 / 45.13)□Steps called out in the site fire protection plan, FPS manual, and fire zone manual ....

401-9 Comments:

401-9 Comments RESPONSE

Question 61 References:

From RP/0/A/5700/025 Enclosure 4.1 page 5 of 5:

NOTE:	**The Offsite Fire Department is responsible for fire suppression activities outside the protected area. The site Fire Brigade may provide limited support for a fire outside the protected area. Offsite Fire Department must be notified for all fires that occur outside the protected area, including those extinguished by the site Fire Brigade.**

_____ 17. **IF** fire is involved or suspected outside the Protected Area. perform the following:

_____ 17.1 Dispatch Fire Brigade Leader.

_____ 17.2 Dial 9-911 and request a response from Gilead and/or Cornelius Fire Departments.

_____ 17.3 Inform 911 Dispatcher to have Fire Department enter McGuire Nuclear Station Road at traffic light on Hwy. 73.

_____ 17.4 Perform the following:

_____ 17.4.1 Call Security (ext. 2688/4900).

_____ 17.4.2 **IF** fire location is on Island during non-regular working hours. request Security to open the entrance gate to Island.

_____ 17.4.3 Request a Security Officer to meet and escort Fire Department to fire location.

End of Enclosure

From OMP 2-2 page 13:

Assists the WCC SRO during high activity periods when Plant SRO is **NOT** required in the plant.

Plant SRO normally functions as the dedicated Fire Brigade Leader. This position can be assigned to any SRO or NCO who is NOT dedicated to another required position.

4.3.2.6 Fuel Handling SRO

A SRO who has no other concurrent responsibilities will be assigned to fuel handling during core alterations.

Core Alteration activities include:

- Fuel Movement
- Control Rod Movement including latching and unlatching control rods
- Neutron source manipulation
- Removal and replacement of Reactor Vessel Internals

Fuel Handling SRO must be on the reactor building operating deck to observe core alterations.

Fuel Handling SRO is responsible to ensure Fuel handling operations are performed safely and per procedure.

Fuel Handling SRO may approve use of fuel handling bypass interlocks as necessary when **NOT** specified by an approved procedure.

Fuel Handling SRO is responsible for securing Fuel Handling operations as required by Tech Specs, Plant conditions, Safety concerns, or during times of uncertainty.

Should monitor refueling cavity to insure FME is being maintained.

Fuel Handling SRO should maintain constant communication with the Control Room during core alterations. Should assist the Control Room in monitoring refueling canal level, audible count rate, and EMF or containment evacuation alarms.

Gives verbal clearance prior to pulling control rods during control rod latching, unlatching, and drag testing activities.

MNS Exam Bank Question SSRFYN01:

SSRFYN01

1 Pt If a fire was reported in the McGuire Office Complex (MOC), which one of the following responses is correct by station procedures?

A. Offsite fire departments are responsible for all fire suppression activities at the scene. The Fire Brigade must be held in reserve for station fires inside the protected area.

B. Offsite fire departments are responsible for all fire suppression activities at the scene. The Fire Brigade may provide limited support if resources allow.

C. The Fire Brigade is responsible for the initial response at the scene. They are required to turn over control of the scene as soon as an offsite fire department arrives and immediately return to the protected area.

D. The Fire Brigade is responsible for fire suppression activities at the scene. An offsite fire department may be called to provide support if additional resources are required.

Answer 1093

Answer: B

Distracter Analysis:

A. Incorrect: - the Fire Brigade is allowed to leave the protected area.
Plausible: - they have restrictions regarding leaving the site.

B. Correct answer

C. Incorrect: - the Fire Brigade is not responsible for initial response and they are not required to return to the protected area.
Plausible: - if the candidate thinks that they cannot remain outside the protected area.

D. Incorrect: - The Fire Brigade is not primarily responsible to fight fire outside the protected area.
Plausible: - If the candidate does not understand fire brigade responsibilities.

Level: RO&SRO
KA: APE 067 K3.02 (2.5/3.3)
Lesson Plan Objective: None
Source: Bank;
Level of knowledge: memory
References:

1. RP/1/A/5700/025 Enclosure 4.1 page 5

QuestionBank #	KA_system	KA_number
1862	APE068	2.1.28

KA_desc
APE068 GENERIC□Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

Which ONE (1) of the following describes the expected method of Pressurizer level control, in accordance with AP-24 (Loss of Plant Control Due to Fire or Sabotage)?

A. Maintain level approximately 25% by cycling charging (Standby Makeup pump Start/Stop) and letdown flow (Reactor Vessel Head vents, NV-272 and NV-273).

B. Maintain level between 60-80% with either Normal or Excess Letdown flow and manual adjustment of Charging Line Flow Control valve, NV-238 and NCP Seal Injection flow, NV-241.

C. Maintain level approximately 60-80% through adjustment of the Reactor Vessel Head vents, NV-272 and NV-273, with charging supplied by the Standby Makeup pump through the NCP seals.

D. Maintain level approximately 25%, utilizing letdown flow (Normal or Excess Letdown) and manual adjustment of Charging Line Flow Control valve, NV-238.

General Discussion

In accordance with AP/24, the operator at the SSF will control presurizer level by cycling the Reactor Vessel Head vents. Charging is supplied by the Standby Makeup Pump through the NC Pump Seals.

This K/A is matched because the applicant must know the function of various components during a scenario when the Control Room must be evacuated and controlled from a remote facility. In this case the applicant must know the difference in how components function when operated from the SSF as opposed to the ASP.

Answer A Discussion

Incorrect. The level is plausible as it is the correct level that would be maintained if the plant was being controlled from the ASP in accordance with AP/17. Charging is via the standby makeup pump but it remains in operation and is not cycled.

Answer B Discussion

Incorrect. Correct level wrong flowpath for letdown flow and wrong flowpath for charging. Flowpaths are plausible because they are the normal flowpaths for letdown or charging.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Wrong level and wrong flowpaths. Level is plausible as this is the level if the plant was being controlled from the ASP. Flowpaths are plausible as they are normal charging and letdown flowpaths.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank Question CPSS006

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
AP/24, Loss of Plant Control Due to Fire or Sabotage, page 7 and 9	

QuestionBank #	KA_system	KA_number
1862	APE068	2.1.28

KA_desc
APE068 GENERIC□Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

401-9 Comments:

401-9 Comments RESPONSE

Question 62 References:

From AP/24 pages 7 and 9:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. **<u>WHEN</u> Standby Makeup pump is on <u>AND</u> Pzr level is greater than 60% as read at SSF, <u>THEN</u> perform the following:**	
__ a. Check control room - MANNED.	__ a. Observe Note prior to Step 15.c and **<u>GO TO</u>** Step 15.c.
b. Stop all of the following: __ • 1A NV pump __ • 1B NV pump __ • PD pump.	

<u>NOTE</u>
- Operator performing Enclosure 2 (Unit 1 EMXA4 - AP-24 Actions) should be available to perform next step.
- Electrical PPE is not required in this step since actions may be time critical.

c. Dispatch operator to perform the following:

1) At 1ETA-10 (1A Chemical & Volume Control Pump) perform the following:

__ a) Pull control power fuses.

__ b) Ensure 1A NV pump breaker is open by depressing trip button on breaker.

2) At 1ETB-10 (1B Chemical & Volume Control Pump) perform the following:

__ a) Pull control power fuses.

__ b) Ensure 1B NV pump breaker is open by depressing trip button on breaker.

__ 3) Open PD pump breaker 1MXK-F2C (Unit 1 NV Positive Displacement Pump Motor) (aux bldg, 750, NN-56).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
- Subcooling is maintained by keeping NC System Pressure above 1500 PSIG.
- It is acceptable to allow the NC System to go solid in order to maintain subcooling.
- With the NC System solid, Reactor Vessel Head Vents are used to control pressure.

17. **Maintain Pzr level and NC System pressure as follows:**

    a. **Have operator at SSF cycle Reactor Vessel Head Vents in accordance to the following table.**

    __ • **1NC-272AC (U1 A Train Head Vent to PRT Isol)**

    __ • **1NC-273AC (U1 A Train Head Vent to PRT Isol).**

Condition	Action
IF AT ANY TIME NC Pressure less than 1500 PSIG THEN:	CLOSE Reactor Vessel Head Vents
IF AT ANY TIME Pzr Level less than 60% THEN:	CLOSE Reactor Vessel Head Vents
IF AT ANY TIME Pzr Level greater than 80% AND NC Pressure greater than 2000 PSIG THEN:	OPEN Reactor Vessel Head Vents

MNS Exam Bank Question CPSS006:

CPSS006

1 Pt

Which ONE (1) of the following describes the expected method of Pressurizer Level Control, in accordance with Abnormal Procedure AP/5500/24, Loss of Plant Control Due to Fire or Sabotage?

A. Maintain level approximately 25% by cycling charging (Standby Makeup Pump Start/Stop) and letdown flow (Reactor Vessel Head Vents, NV-272 and NV-273).

B. Maintain level between 60-80% with either Normal or Excess Letdown Flow and manual adjustment of Charging Line Flow Control Valve, NV-238 and NCP seal injection flow, NV-241.

C. Maintain level approximately 60-80% through adjustment of the Reactor Vessel Head Vents, NV-272 and NV-273, with charging supplied by the Standby Makeup Pump through the NCP seals.

D. Maintain level approximately 25%, utilizing letdown flow (Normal or Excess Letdown) and manual adjustment of Charging Line Flow Control Valve, NV-238.

Answer 197

C

CP-SS, Attachment 7.3

Objective 2

C

QuestionBank #	KA_system	KA_number
1863	WE03	EK3.2

KA_desc

Knowledge of the reasons for the following responses as they apply to the (LOCA Cooldown and Depressurization) (CFR: 41.5 / 41.10, 45.6 / 45.13)□Normal, abnormal and emergency operating procedures associated with (LOCA Cooldown and Depressurization).

Which ONE (1) of the following describes the basis for establishing conditions so that only one NC pump is running during the performance of ES-1.2 (Post LOCA Cooldown and Depressurization)?

1. Minimize house electrical loads
2. Provide normal Pressurizer Spray
3. Eliminate stratification in the S/Gs
4. Provide mixing of NC system water
5. Minimize NC system heat input

A. 2, 3, 5

B. 1, 2, 4

C. 2, 4, 5

D. 1, 2, 3

General Discussion

Once NC subcooling, Pzr level, and other NC support conditions are established, a NC pump can be started if no NC pumps are running. If more than one NC pump is running, all but one are stopped to minimize NC heat input. The NC pump restarted (or left running) is used to provide normal Pzr spray and mix the NC.

The K/A is since the applicant must have knowledge of the basis for the major action category in ES-1.2, Post LOCA Cooldown and Depressurization.

Answer A Discussion

Incorrect. Plausible since "5" is the primary reason for establishing only one NCP running. "1" & "3" are plausible since they are bases for major actions in other Emergency Procedures.

Answer B Discussion

Incorrect. Plausible since 2 and 4 are correct. Also 1 is a basis for major actions in other Emergency Procedures.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible since 2 is correct. Also 1 and 3 are bases for major actions in other Emergency Procedures.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-EP-E1 Objective 3	

QuestionBank #	KA_system	KA_number
1863	WE03	EK3.2

KA_desc

Knowledge of the reasons for the following responses as they apply to the (LOCA Cooldown and Depressurization) (CFR: 41.5 / 41.10, 45.6 / 45.13)□Normal, abnormal and emergency operating procedures associated with (LOCA Cooldown and Depressurization).

401-9 Comments:

401-9 Comments RESPONSE

Question 63 Resources:

5.3.2 Depressurize NC to Refill Pressurizer

This action is performed prior to NC pump restart or before/after an S/I reduction action. As NC pressure goes down, NC injection flow will go up above to break flow. Consequently, this depressurization action should be sufficient for restoring Pzr level if the LOCA is small. That a "small" LOCA is in progress is first ensured by requiring NC subcooling before depressurization. If subcooling is lost during the depressurization, it should be restored as the cooldown continues.

5.3.3 Start One NC Pump / Stop All But One NC Pump

Once NC subcooling, Pzr level, and other NC support conditions are established, a NC pump can be started if no NC pumps are running. If more than one NC pump is running, all but one are stopped to minimize NC heat input. The NC pump restarted (or left running) is used to provide normal Pzr spray and mix the NC.

5.3.4 Reduce NC Injection Flow

As NC subcooling builds up to specified values, the NV and NI pumps are stopped one at a time in a predetermined sequence. Subcooling criteria are specified such that a minimum NC subcooling will be maintained after the injection flow is reduced. The preferred S/I reduction sequence is to stop NV and NI pumps on alternate trains where possible, and finally to align the last NV pump to normal charging.

If the NC subcooling criterion is not satisfied, but the NC hot leg temperatures are less than the saturation temperature corresponding to the ND pump at minimum pump recirculation flow, the NV or NI can be stopped if a ND pump is running or can be started. Operation of a ND pump for this case ensures the NC subcooling will be maintained after the NV or NI pump is stopped.

QuestionBank #	KA_system	KA_number
1864	WE09	EA1.1

KA_desc
Ability to operate and / or monitor the following as they apply to the (Natural Circulation Operations) (CFR: 41.7 / 45.5 / 45.6)□Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

Unit 1 has entered AP-09 (Natural Circulation). The following conditions are observed:

1. NC system subcooling > 0°F
2. NC system hot leg temperatures at saturation temperature for S/G pressure
3. NC system cold leg temperatures going up slowly
4. NC system hot leg temperatures going down
5. S/G pressure stable
6. NC system cold leg temperatures at saturation temperature for S/G pressure
7. NC system pressure stable
8. Core Exit T/C's stable

Which ONE (1) of the following sets of conditions confirm that Natural Circulation exists and is effective in cooling the core?

A. 1, 3, 4, 5, 7

B. 2, 4, 6, 7, 8

C. 1, 4, 5, 6, 8

D. 1, 2, 3, 4, 5

General Discussion

The indications of Natural Circulation are:
1. NC Subcooling - Greater than 0°F
2. S/G Pressures - Stable or going down
3. NC T-Hots - Stable or going down
4. Core Exit T/Cs - Stable or going down
5. NC T-Colds - At saturation temperature for S/G pressure

This KA is matched because in order for the applicant to monitor components associated with Natural Circlation, they must know which instruments are monitored to determine that Natural Circulation exist and must also know how those indications should be trending.

Answer A Discussion

Incorrect. 1, 4, and 5 are correct. If the candidate confuses Nat Circ (loss of all NC pumps) with the loss of 1 NC pump where T-Cold would increase, 3 is plausible. 7 is plausible since most parameters are "stable or going down" when monitoring for NC.

Answer B Discussion

Incorrect. Plausible since 4, 6, and 8 are correct. 2 would be correct if it was T-Colds.7 is plausble since most parameters are "stable or going down" when monitoring for NC.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible since 1,4, and 5 are correct. If the candidate confuses Nat Circ (loss of all NC pumps) with the loss of 1 NC pump where T-Cold would increase, 3 is plausible. 2 would be correct if it was T-Colds.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	MNS Bank Question AP09003

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
AP/1&2/A/5500/09, Natural Circulation Background Document, pages 3 and 4 AP/1&2/A/5500/003, Natural Circulation Enclosure 1 Natural Circulation Parameters	

QuestionBank #	KA_system	KA_number
1864	WE09	EA1.1

KA_desc

Ability to operate and / or monitor the following as they apply to the (Natural Circulation Operations)
(CFR: 41.7 / 45.5 / 45.6)□Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

401-9 Comments:

401-9 Comments RESPONSE

Question 64 References:

From AP-09 Background Document pages 3 and 4:

STEP DESCRIPTION FOR AP/09

STEP 1:

PURPOSE:

Ensure adequate secondary heat sink.

DISCUSSION:

One of the design requirements for natural circulation flow in the NC System is to have a heat sink.

To ensure the S/Gs are maintained as a heat sink, feed flow to ALL the S/Gs is ensured. This can be from the CM/CF system or the CA System. If feed flow is not present, direction is given to use CA, since this system can typically be established much quicker than CM/CF.

S/G NR level greater than 11% is used to indicate the water level just in the narrow range (MCC-1552.08-00-0208, EP setpoint file). Water level in the NR ensures the tube bundles are covered. If NR indication is not met, direction is given to maintain feed flow greater than 450 GPM until greater than 11%. The setpoint of 450 GPM ensures decay heat removal via steam release and a net inventory gain in the S/Gs. Note: 450 GPM is conservative since this amount of flow covers the maximum amount needed decay heat removal and NC pump heat, and of course there is no NC pump heat during natural circulation.

REFERENCES:

MCC-1552.08-00-0208, EP setpoint file

STEP 2:

PURPOSE:

Provide the parameter values necessary to indicate natural circulation is occurring. If it's not, direction is given to increase dumping steam in an attempt to establish it.

DISCUSSION:

The parameters used to verify natural circulation are:

NC Subcooling > 0°F

Although two-phase and reflux boiling are also forms of natural circulation, the preferred form is subcooled natural circulation. It is the most efficient and results in the lowest core temperatures given everything else equal.

S/G press – stable or going down

Natural circulation cooling is established when the heat generation rate in the core equals the heat transfer rate from the core to the NC System, to the S/Gs, and out of the S/Gs. If S/G pressures are INCREASING, then the heat transfer rate out of the S/Gs is not sufficient, and core temperatures will be increasing.

NC T-Hots – Stable or Going Down

When forced NC flow is lost, it takes a few minutes (5 – 10 minutes) for natural circulation flow to set up. During this time, T-Hots are increasing, as expected. T-Colds are relatively stable since they are tied to S/G pressure, and the assumption is S/G pressure is stable unless a cooldown is taking place. Once the delta-T develops (T-Hot increase) sufficiently for driving head for natural circulation flow, T-Hot should no longer be increasing. From this point forward, T-Hots should be going down as decay heat drops off, or be stable as the decay heat curve levels off.

After the initial time period for natural circulation to develop, if T-Hots are going up this means the heat removal from natural circulation is less than the decay heat generation rate, or in another words, inadequate nat. circ for whatever reason.

Core exit T/Cs – Stable or Going Down

When forced NC flow is lost, it takes a few minutes (5 – 10 minutes) for natural circulation flow to set up. During this time, Core Exit T/Cs are increasing, as expected. T-Colds are relatively stable since they are tied to S/G pressure, and the assumption is S/G pressure is stable unless a cooldown is taking place. Once the delta-T develops (Core Exit T/Cs increase) sufficiently for driving head for natural circulation flow, Core Exit T/Cs should no longer be increasing. From this point forward, Core Exit T/Cs should be going down as decay heat drops off, or be stable as the decay heat curve levels off.

After the initial time period for natural circulation to develop, if Core Exit T/Cs are going up this means the heat removal from natural circulation is less than the decay heat generation rate, or in another words, inadequate nat. circ for whatever reason.

NC T-Colds – At Saturation Temperature For S/G Pressure

The following is an excerpt from the ERGs Generic Issues section concerning T-Colds: "The cold leg temperature readings can be used as additional verification that heat removal through the steam generators is occurring. The loop T-Cold readings in active loops are quite sensitive to changes in heat transfer rates from the reactor to the secondary sides of the steam generators. Actual test have shown that loop T-Colds follow almost exactly the steam generator pressure with minimal time lag".

In another words, if T-Colds are not following steam generator pressure, it is likely heat removal from the S/Gs is not occurring. If this is the case, the core is not being adequately cooled. To facilitate determining whether NC T-Colds are at saturation temperature for S/G pressures, a graph is provided to correlate the two, with a band provided to allow for instrument inaccuracies.

If natural circulation flow is not established, direction is given to increase dumping steam. Since this should lower steam pressure, which should lower NC T-Colds, which should increase the core delta-T and thus the density driving head, this should enhance natural circulation flow.

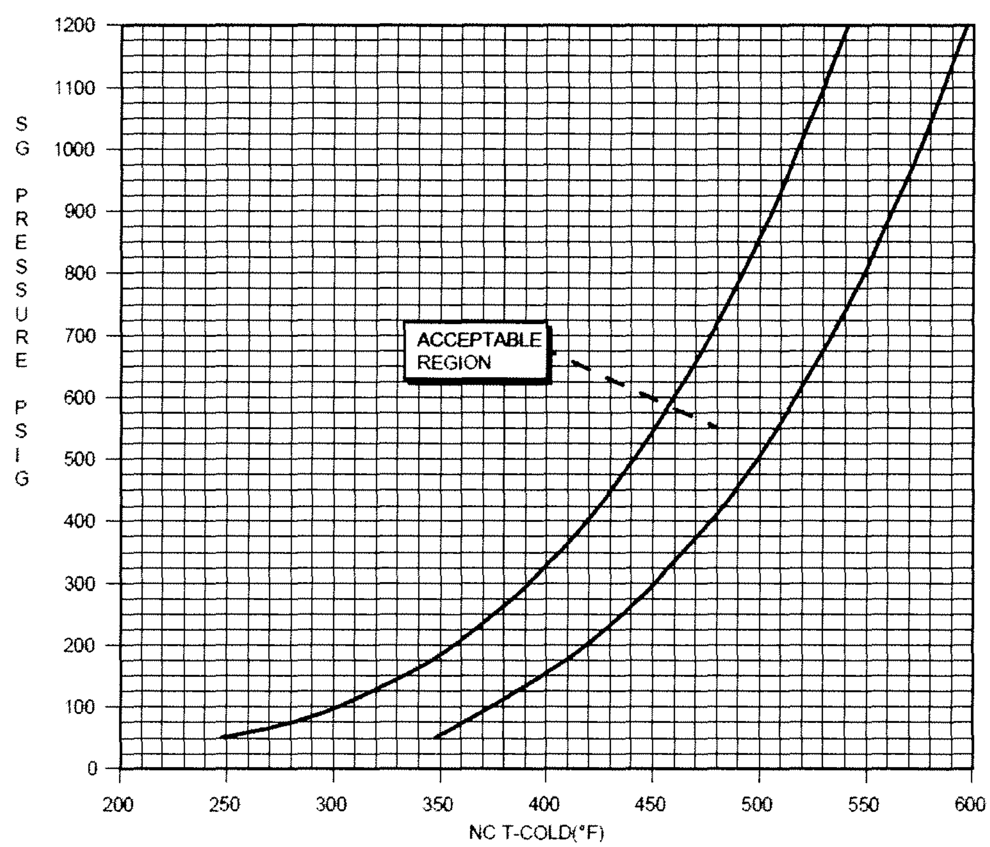
From AP/1&2/A/5500/09 Natural Circulation Enclosure 1, Natural Circulation Parameters:

MNS AP/1/A/5500/09 UNIT 1	NATURAL CIRCULATION Enclosure 1 - Page 1 of 1 **Natural Circulation Parameters**	PAGE NO. 4 of 4 Rev. 2

1. **The following conditions support or indicate natural circulation flow:**

   o NC subcooling - GREATER THAN 0°F
   o S/G pressures - STABLE OR GOING DOWN
   o NC T-Hots - STABLE OR GOING DOWN
   o Core exit T/Cs - STABLE OR GOING DOWN
   o 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 increase dumping steam to establish Natural Circulation flow.



MNS Exam Bank Question AP09003:

AP09003
1 Pt

Unit 1 has entered AP/09 (Natural Circulation).
The following conditions are observed:

1. NC subcooling > 0°F
2. NC System hot leg temperatures at saturation temperature for SG pressure
3. NC System cold leg temperatures going up slowly
4. NC System hot leg temperatures going down
5. SG pressure stable
6. NC System cold leg temperatures at saturation temperature for SG pressure
7. NC System pressure stable
8. Core exit T/C's stable

Which one of the following sets of conditions all support natural circulation exists?

A 1, 3, 4, 5, 7

B 2, 4, 6, 7, 8

C 1, 4, 5, 6, 8

D 1, 2, 3, 4, 5

Answer 624
C

QuestionBank #	KA_system	KA_number
1865	WE13	2.2.37

KA_desc
WE13 GENERIC□Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)

Given the following conditions on Unit 1:

- An inadvertent Main Steam Isolation resulted in a Reactor Trip.
- FR-H.4 (Response to Loss of Normal Steam Release Capability) has been implemented due a Yellow Path on Heat Sink
- The Main Steam Safety valves (MSSVs) have reduced S/G pressures to 1200 PSIG

1) What indications on MC-2 are required to be present to allow for S/G PORV operation?
2) Based on current conditions, how many MSSVs should be open?

A. 1) S/G PORV RESET lights – LIT ONLY
   2) 2 MSSVs on each S/G should be open

B. 1) Main Steam Isolation RESET light – LIT, S/G PORV RESET lights – LIT
   2) 2 MSSVs on each S/G should be open

C. 1) S/G PORV RESET lights – LIT ONLY
   2) 3 MSSVs on each S/G should be open

D. 1) Main Steam Isolation RESET light – LIT, S/G PORV RESET lights – LIT
   2) 3 MSSVs on each S/G should be open

General Discussion

For the S/G PORVs to operate automatically or manually using the Manual Loaders on the Main Control Board, the Main Steam Isolation must be reset and the S/G PORVs must be reset.

MSSV Setpoints - 1170, 1190, 1205, 1220, 1225 (PSIG). Therefore 2 MSSVs should be open based on plant conditions.

The K/A is met because the applicant must determine what conditions must be met for the S/G PORVs to be available and must also determine how many MSSVs should be operating based on plant conditions.

This K/A is comprehension level because the applicant must evaluate a given set of conditions, recall from memory the MSSV setpoints and the interlocks for S/G PORV operation, and
associate those pieces of information to obtain the correct answer.

Answer A Discussion

Incorrect. SG PORVs must be reset but MSI must be reset also. Number of MSSVs open is correct.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. SG PORVs must be reset but MSI must be reset also. 2 MSSVs should be open instead of 3.

Answer D Discussion

Incorrect. Reset lights are correct. 2 MSSVs should be open instead of 3.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
OP-MC-STM-SM Objectives 9 and 7 pages 15, 17, 19 and 23	

QuestionBank #	KA_system	KA_number
1865	WE13	2.2.37

KA_desc
WE13 GENERIC□Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)

401-9 Comments:

401-9 Comments RESPONSE

Question 65 References:

From Lesson Plan OP-MC-STM-SM page 15:

Objective #6

Steam exits from S/G by a 34" main steam line. Steam lines exit Containment into the lower portions of the doghouses.

- **A and D in the exterior doghouse**
- **B and C in the interior doghouse**

2.2 Main Steam line Drains

2.2.1 Isolation valves (SM83, 89, 95 & 101)

A 2 inch drain line taps off the bottom of each main steam line. Each drain line has an air operated isolation valve in it which is Normally Open and FAILS CLOSED on loss of instrument air pressure or upon loss of power to its Solenoid valve(s).

2.2.2 Drain Valves (SM78, 84, 90 & 96)

These drain valves are provided to automatically drain water from steam lines, to prevent water accumulation. Controls are located on MC-9. They are normally selected to auto to allow automatic modulation of drain valve. Operator may manually open drain valve by selecting "OPEN". A new procedure enclosure (SM Drain Valve Failure) is provided if automatic function is lost. The operator is directed to cycle the drain valves at different times based on different power levels.

2.3 Power Operated Relief Valves (PORV's)

The main steam lines rise to the upper portions of the doghouses where a six inch line taps off the top of each line for the PORV.

Objective #9

The PORV's assist the lowest setting safety valve during transients. The PORV lift setpoint is 1125 psig. This ensures the PORV is open prior to the first safety valve setpoint (1170 psig) being reached. They provide a margin for safety valve reseating.
The PORV recloses at 1092 psig. This pressure is low enough to ensure the safety valves reseat.
They also provide a means of removing heat from the NCS if the steam dumps or turbines are not available.
The PORV's are air operated valves that FAIL CLOSED on loss of instrument air pressure (VI), loss of power to valve solenoid or receipt of a Main Steam line isolation signal.

2.3.1 PORV Controls

- PORV Mode select switch (Auto or Manual)
- Manual loader - 0 to 100%

From Lesson Plan OP-MC-STM-SM page 17:

Objective #9

2.3.2 PORV's Modes of operation (Refer to STM-SM-2)

Automatic

The manual loader is normally in auto set at 100% open. Steam line pressure increases to open setting (1125 psig). Limit switch opens 3-way solenoid valve to admit VI to open the PORV.

The VI pressure must pass through the manual loader. The setting of the manual loader (normally set at 100% open) determines how far the PORV will open when/if the setpoint is reached.

When steam line pressure decreases to 1092 psig the 3-way solenoid valve repositions to vent the air pressure on the valve and blocks air pressure to the valve positioner.

Manual

Operator selects manual to admit VI to positioner. PORV will open to manual loader valve position. Prior to selecting manual, operator should close all PORV's manual loaders to prevent inadvertent operation of steam line PORV's.

Local - Manual Operation

This capability is provided for A & D Steam line PORV's only. The control stations are located in the Exterior Doghouse near their respective PORV. The Operator must isolate VI supply from Control Room manual loader and open supply from local manual loader. Operator may now open/close PORV using the local manual loader (valves will no longer operate automatically in this mode).

All the PORV's have a local valve operator extension attached to the valve actuator for true Manual operation. If the Local-Manual control station operation does not work, then the operator can manually operate the PORV. All S/G PORV manual operators are reverse acting (Clockwise to open), 2B AND 2C S/G PORVs are the exceptions which operate per the normal convention (Counter-clockwise to open).

From Lesson Plan OP-MC-STM-SM page 19:

A placard at the valve has the following directions for manual operation:

- Close the instrument air isolation valve
- Open the instrument air vent valve.
- Unscrew the clevis from the end of the manual override shaft.
- Turn handwheel clockwise to expose the actuator shaft below manual override shaft
- Attach the clevis by sliding it completely onto the actuator shaft.
- Turn handwheel **clockwise** to open PORV

For a design basis SGTR where cooldown must be performed locally using SG PORVs, the following times must be met. Note that these times DO NOT meet management expectations for a "normal" SGTR (where control room can control cooldown). The following times are based strictly on offsite dose calculation and may not prevent SG overfill. (SG overfill during a SGTR is not a license condition at McGuire.)

a. Manual trip and SI within 20 minutes of SGTR.

b. Ruptured S/G is isolated (CA and MSIV) within 15 minutes after trip.

c. TD CA steam supply from ruptured SG is isolated locally within 45 minutes after trip.

d. Stuck open S/G PORV on ruptured S/G is locally isolated within 30 minutes after ruptured S/G pressure goes below 1092 PSIG. 20 minutes to dispatch operator, 10 to locally close PORV isolation valve (after dispatch) (note that valve may take a couple minutes to close).

e. At least 2 intact S/G PORVs locally opened within 60 minutes of trip. This allows 45 minutes to dispatch operators and 15 minutes to perform local action to open SG PORV. After reaching valve, setting up equipment on valve to open it, it takes approximately 5 minute to wind it open.

f. After reaching target temperature, Pzr PORV is opened with 10 minutes.

PORV operation is blocked following a Main Steam Isolation Signal. To operate the PORV's following a MSI, the operator must "Reset" the Main Steam Isolation Signal, and then "Reset" the Main Steam PORV's.

NOTE: The MSI caused by Hi-Hi Containment Pressure will not prevent resetting the MSI signal and does not have to be blocked or cleared.

PORV capacity is ≈10% of total steam flow (2.5% per S/G).

The discharge of the PORV's are provided with vent stacks so that exhaust is vented above the roof.

From Lesson Plan OP-MC-STM-SM page 23:

2.5 Main Steam Safety Valves (Located on 34" line)

2.5.1 Five (5) safety valves per steam line provide overpressure protection.

Operability of the safety valves ensures that main steam pressure is limited to within 110% of the design pressure of 1185 psig during the most severe anticipated system operational transient (Trip from 100% Rated Thermal Power (RTP) with loss of condenser heat sink).

Objective #7

Set points at different pressures to limit steam release transients.

Only the number of valves required to control the pressure transient are open. If pressure can be controlled using only one or two safety valves, then why open more than that. This prevents all valves from cycling around the same setpoint (chattering).

Set points 1170, 1190, 1205, 1220 and 1225 psig.

Safety valves design capacity is 108% steam flow (17.1 E6 lbm/hr at 1292 psig).

(100% RTP total steam flow is 15.14 E6 lbm/hr).

Located inside of SM Doghouse and provided with discharge tailpieces and vent stacks so that exhaust is vented above the roof.

2.6 Main Steam Isolation Valves (MSIV's) (SM1, 3, 5 & 7)

2.6.1 Located in each 34" main steam line (in doghouses).

Provided to isolate the S/G's in the event of a main steam line break, to limit the cooldown of NCS and to limit the peak containment pressure that would be achieved if the steam break is located inside containment.

Description of Operation (Drawing 7.4 and 7.5)

The normal flow direction is overseat. The valve has been designed to close against overseat (forward) or underseat flow (reverse flow) during a guillotine pipe rupture event and with line pressure. The valves are equipped with pneumatic actuators used to open the valve and with mechanical springs to close the valve. The valve is a balanced disk design with a main poppet and pilot poppet. The pilot poppet opens and closes to equalize the valve bonnet pressure with the flowing line pressure to significantly reduce the valve dP loads. Under reverse flow conditions the pilot poppet is designed to open once the differential pressure exceeds the full lift poppet pressure. (**See PIP M-04-3928 and PIP M-07-3148 in O.E. section for reverse flow concerns**) The valve is normally open with a safety function to close. The valve is designed to close within 8 seconds on the receipt of an actuation signal.

QuestionBank #	KA_system	KA_number
1866	GEN2.1	2.1.28

KA_desc
Conduct of Operations□Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

Which ONE (1) of the following correctly describes the function of the Pressurizer Pressure Control Selector Switch?

A. In the "1-3" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 3 actuates PORV 32B & 34A.

B. In the "3-2" Position, CHANNEL 2 inputs the master pressure controller and CHANNEL 3 actuates PORV 32B & 36B.

C. In the "1-2" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 2 actuates PORV 32B & 34A.

D. In the "1-4" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 4 actuates PORV 32B & 36B.

General Discussion

In the "1-4" position, Channel 1 inputs the Master Pressure Controller and Channel 4 actuates PORV 32B and 36B.

The K/A is matched since the applicant must have knowledge of the function of the Pressurizer Pressure Control Selector Switch.

Answer A Discussion

Incorrect. There is NO "1-3" position for the Pressurizer Pressure Control Selector Switch. However, this answer is still plausible since there is a "1-3" position for the Pressurizer Level Control Selector Switch. The applicant could confuse the two.

Answer B Discussion

Incorrect. Plausible because this is one of the positions on the selector switch. However, Channel 3 inputs the Master Pressure Controller and Channel 2 actuates PORV 32B and 36B.

Answer C Discussion

Incorrect. Plausible because this is the normal position of the selector switch and Channel 1 inputs the Master Pressure Controller. Channel 2 does actuate the PORVs. However, it actuates 32B and 36B and not 34A.

Answer D Discussion

CORRECT.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	From MNS Exam Bank Question PSIPE004

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-PS-IPE Figure 7.1	

QuestionBank #	KA_system	KA_number
1866	GEN2.1	2.1.28

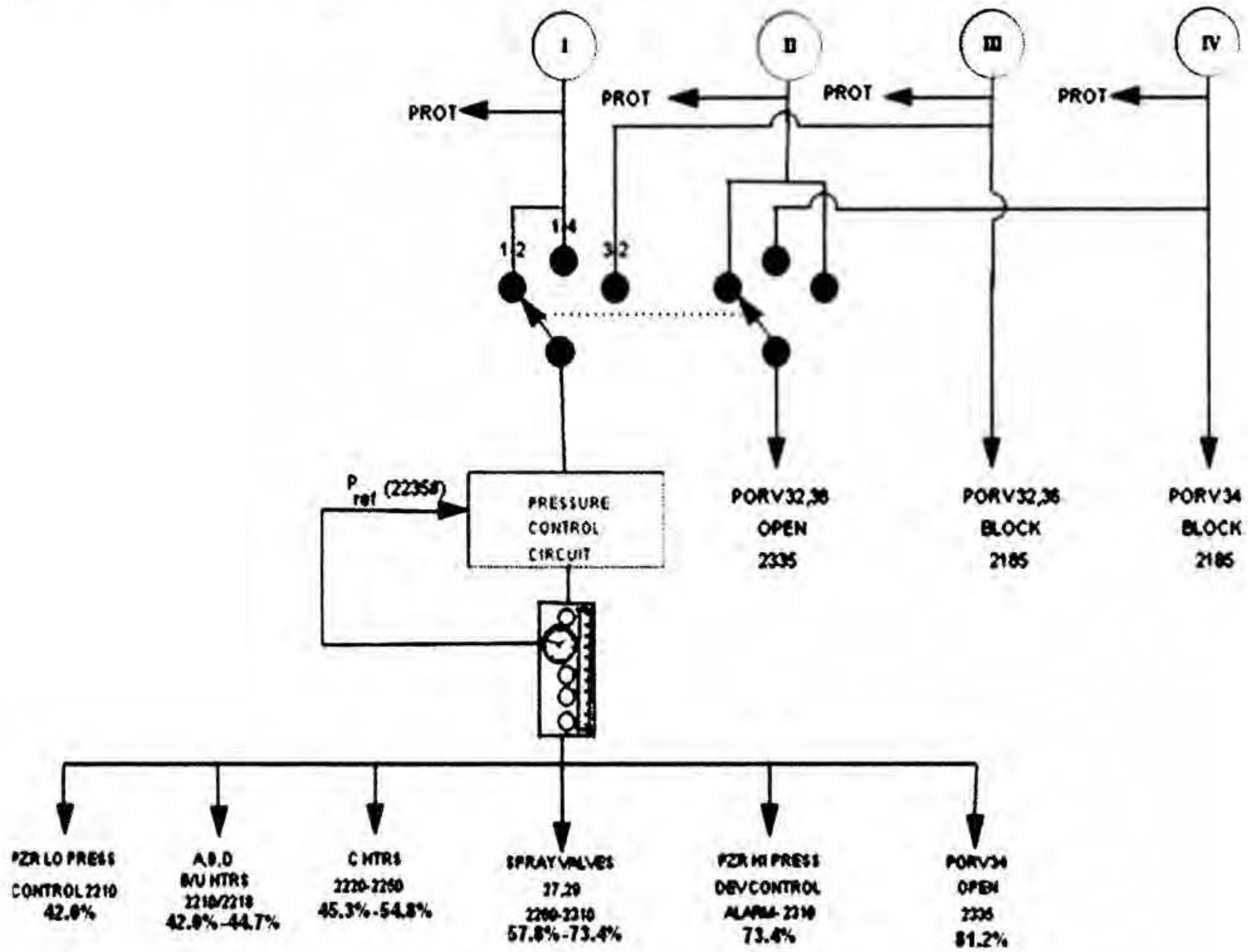
KA_desc
Conduct of Operations□Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

401-9 Comments:

401-9 Comments RESPONSE

Question 66 References:

From Lesson Plan OP-MC-PS-IPE Figure 7.1 (Simplified Pressurizer Pressure Control)



MNS Exam Bank Question PSIPE004:

PSIPE004

1 Pt Which ONE (1) of the following best describes the arrangement of the Pressurizer Pressure Control Selector Switch?

A. In the "1-3" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 3 actuates PORV 32B & 34A.

B. In the "3-2" Position, CHANNEL 2 inputs the master pressure controller and CHANNEL 3 actuates PORV 32B & 36B.

C. In the "1-2" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 2 actuates PORV 32B & 34A.

D. In the "1-4" Position, CHANNEL 1 inputs the master pressure controller and CHANNEL 4 actuates PORV 32B & 36B.

Answer 549

D

PS-IPE, Attachment 7.1

C

QuestionBank #	KA_system	KA_number
1867	GEN2.1	2.1.30

KA_desc
Conduct of Operations□Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)

Given the following conditions on Unit 1:

- The unit was operating at 100% RTP
- A spurious Safety Injection signal occurs on both trains

Which ONE (1) of the following describes the MINIMUM requirements to regain control of ESF equipment and stop one of the RN pumps during the recovery from the spurious SI?

A. Reset Sequencer ONLY.

B. Depress the Safety Injection RESET pushbuttons ONLY.

C. Depress the Safety Injection RESET pushbuttons AND depress the Diesel Generator Sequencer RESET pushbuttons.

D. Depress the Safety Injection RESET pushbuttons AND momentarily place the Reactor Trip Breaker control switches to CLOSE.

C

General Discussion

To regain control of Safeguards equipment after a Safety Injection signal, the Safety Injection RESET pushbuttons must be depressed. If the equipment is operated by the Sequencer, the Sequencer RESET pushbuttons must also be depressed.

This KA is matched because the applicant must know the location of the RESET pushbuttons and consequences of operating those controls.

Question is comprehensive because the candidate must explain how to perform the described actions, this is testing on the application level. In this question, the candidate must evaluate a given plant scenario, recall system knowledge and apply that knowledge to this scenario.

Answer A Discussion

Incorrect. Plausible because this is one of the actions that must be performed and if the equipment is not operated by the sequencer, the Diesel Generator Sequencer RESET pushbuttons do not have to be reset.

Answer B Discussion

Incorrect. Plausible because the actuating signal must be clear and SI reset. However, the Sequencer must also be reset.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Plausible because the actuating signal must be clear and SI must be reset. Closing the reactor trip breakers is not required to stop an RN pump but is required to regaing control of other equipment.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Exam Bank Question ECCISEN07.

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-DG-EQB Objective 7 page 27	

QuestionBank #	KA_system	KA_number
1867	GEN2.1	2.1.30

KA_desc
Conduct of Operations□Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)

401-9 Comments:

401-9 Comments RESPONSE

Question 67 References:

From Lesson Plan OP-MC-DG-EQB page 27:

To recover control after a Safety Injection actuation

1. **The actuating signal must be no longer present.**
2. **Reset SI using pushbuttons on MCB.**
3. **Reset Diesel Generator Sequencer using MCB or local reset pushbutton.**
4. **If the Diesel Generator Load Sequencer RESET Pushbuttons are depressed while the Accelerated Sequence is in progress, the time that it takes for the Accelerated and Committed Sequences to complete will be increased. This is because depressing the RESET Pushbuttons places the Safety Injection Sequence back to its ground state. If the Safety Injection RESET Pushbuttons on the Main Control Board have not been RESET, then the Safety Injection Signal is still present. This signal will again actuate the Safety Injection Sequence and start the process over again.**

NOTE 1 Since normal power is available to the 4160V bus during an SI only event, a check for 4160V bus frequency is unnecessary. Prior to and during the accelerated sequence, if 4160V bus voltage drops below the 92.5% setpoint, the accelerated sequence is halted and remains halted until bus voltage is again above the setpoint.

NOTE 2 The committed sequence looks at neither voltage nor frequency. When the time delay relay associated with a given load group's sequence timer has timed out, the committed sequence applies that load group regardless of voltage or frequency.

3.5 Safety Injection Actuation during a Blackout

Initial conditions - Blackout has occurred with subsequent load sequencing in progress or the sequence is complete and the diesel generator loaded with blackout loads.

Objective # 7

1. The 4160V is cleared of all non-SI loads, SI logic actuated.
2. SI loads previously running continue to operate.
3. Sequence timers for load groups 3 and 4 (ND & NS) are now in the circuit with the other committed sequence timers.
4. If the blackout signal has not been reset, SI loads (groups 1-10) are sequenced on through the accelerated sequence at 2 second intervals, provided bus voltage remains >92.5% and frequency remains >97%.

   If the blackout signal has been reset, bus frequency is no longer a permissive for loading. Loads would be sequenced on as if there were a Safety Injection signal, with no blackout.

MNS Exam Bank Question ECCISEN07:

ECCISEN07

1 Pt

Unit 1 is operating at 100% power when a spurious safety injection occurred on both safeguards trains.

What are the minimum steps required to regain control and stop one of the RN pumps during recovery from the spurious safety injection?

A. Reset the safety injection signal

B. Reset the safety injection signal and close the reactor trip breakers.

C. Reset the safety injection signal and reset the diesel generator sequencer

D. Clear the safety injection signal and reset safety injection

Answer 602

Answer: C

KA: SYS 013 K5.02 (2.9/3.3)

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 could have caused this alarm?

A. - NC system temperature less than 320°F
- 2NC34A OR 2NC32B PORV OVERPRESS PROTECTION SELECT switches in "NORM"

B. - NC system pressure less than 380 PSIG
- 2NC34A OR 2NC32B PORV OVERPRESS PROTECTION SELECT switches in "NORM"

C. - NC system temperature less than 320°F
- 2NC34A OR 2NC36B PORV OVERPRESS PROTECTION SELECT switches in "NORM"

D. - NC system pressure less than 380 PSIG
- 2NC34A OR 2NC36B PORV OVERPRESS PROTECTION SELECT switches in "NORM"

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	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Lesson Plan OP-MC-PS-NC Objective 14 page 35 OP/1/A/6100/10 G, Annunciator Response for Panel 1AD-6 page 15	

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:

401-9 Comments RESPONSE

Question 68 References:

From OP/1/A/6100/10 G page 15:

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 1NC34A (1NC32B)"

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 1NC34A"
- "PORV Overpress Protection Select 1NC32B"

Supplementary Action: None

References: MCEE-150-00.03-01

End Of Response

From Lesson Plan OP-MC-PS-NC page 35:

There are four **Pzr pressure channels** which have meter indication on 1(2)MC10. These channels provide 2 out of 4 logic for the high pressure (2385 psig) and low pressure (1945 psig) reactor trips. These channels provide the 2 out of 4 logic for the low pressure Safety Injection (1845 psig). Channels 1,2 and 3 provide the 2 out of 3 logic for P11 (1955 psig). One of the channels can be selected for recording. Channels 1 or 3 can be selected for Pzr Pressure Control.

The Pressurizer Pressure Control and Level Control are covered in more detail in lesson plans OP-MC-PS-IPE and OP-MC-PS-ILE.

2.7 Pressurizer Power Operated Relief Valves

Objective # 13

Each unit has three **pressurizer power operated relief valves** (PORVs): NC32B, 34A and 36B. The purpose of these valves is to limit pressure for large power mismatches, prevent high pressure reactor trip and minimize undesirable opening of code safety valves. Each PORV has its own block valve which can be operated from the main control board section 1(2)MC10. Each PORV block valve is equipped with a 3-position control switch: "Override - CLSD - OPEN". The block valves switches are interlocked such that only the first valve placed in the "CLSD" position will close. In order to close the other block valves, their switches must be place in the "Override'" position.

Objective # 14

In automatic, the pressurizer PORVs are controlled by the pressure master. The pressure master has compensating circuitry which can compensate for rapid pressure increases or longer intervals where pressure remains above or below setpoint for longer periods of time. This compensating ability can modify the PORV lift setpoint however, 2335 psig is the generally accepted lift setpoint for the PORVs. 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 NI431B and NC34A is supplied from CLA "A" via NI430A. Annunciator alarms on 1(2)AD6 alert the operator that the N_2 from the CLA to NC32B and 34A has been enabled. 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.

QuestionBank #	KA_system	KA_number
1869	GEN2.2	2.2.21

KA_desc
Equipment Control□Knowledge of pre- and post-maintenance operability requirements. (CFR: 41.10 / 43.2)

Given the following plant conditions:

- Unit 1 is in MODE 3
- The OATC has just denied a request from maintenance to close 1ND-15B (Train B ND TO HOT LEG ISOL) for valve stroke time testing.

Which ONE (1) of the following describes the reason for the OATC's decision?

A. 1ND-15B is interlocked with 1ND-58A (TRAIN A ND TO NV & NI) and this will defeat the interlock and prevent 1ND-58A from opening.

B. Although this would be permitted in MODE 3, closing 1ND-15B would cause one ND train to become INOPERABLE and is prohibited in MODE 4.

C. 1ND-15B is interlocked with 1NI-136B (B NI PUMP SUCTION FROM ND) and will defeat the interlock and prevent 1ND-58A (TRAIN A ND TO NV & NI) from opening.

D. This action would isolate the cross tie between the ND trains which ensures one ND pump can inject into all four NC loops. Closing it in MODE 3 would make both trains of ND INOPERABLE.

General Discussion

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.
On an ECCS actuation, the ND System must be capable of providing flow to all four NCS loops (even with single failure). By having ND-15B and ND-30A open, either ND pump is capable of supplying all four NCS loops. Therefore, closing either ND-15B or ND-30A in Mode 1, 2, or 3 will make both ND trains inoperable. An alarm is actuated on the BOP panel whenever either of these valves reaches the "closed" position.

KA is matched because know the operability requirements for a proposed maintenance activity on a given component. Specifically, why the component cannot even be repositioned.

Question is comprehensive because the candidate must evaluate a given plant condition and mode and then evaluate the effect of a give component manipulation on system operability. This requires not only the recall of system knowledge but application of that knowledge to a given set of conditions.

Answer A Discussion

Plausible 1ND-58A is interlocked with other "B" train valves.. There are many interlocks associated with the train related electric valves associated with the ND system and would not be unreasonable to confuse this valve in that scheme

Answer B Discussion

Plausible: Because it is a "B" train valve it would be reasonable for a candidate to believe that it would only affect the "B" train of ND

Answer C Discussion

Plausible. There are many interlocks associated with the train related electric valves associated with the ND system and would not be unreasonable to confuse this valve in that scheme

Answer D Discussion

Correct

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS PSND019

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
Technical Reference(s)□OP-MC-PS-ND Rev 40 Pg 39 Learning Objective:□OP-MC-PS-ND, Obj. 9	

QuestionBank #	KA_system	KA_number
1869	GEN2.2	2.2.21

KA_desc
Equipment Control□Knowledge of pre- and post-maintenance operability requirements. (CFR: 41.10 / 43.2)

401-9 Comments:

Remove double period from "A" and "C"
Distracter analysis: "D" what does "the exposure will be greater if you wear the respirator" have to do with this Q?
"B" and "D": remove "to provide …" as this is teaching. Plus it is additional information that is not needed.
RFA 10/09/09

401-9 Comments RESPONSE

Current Question has no double periods. Dist D analysis comment removed. Removed everything after "to provide..." in distracters B & D. Answers were reordered to rebalance question and "D" is now the correct answer

Question 69 References:

OBJECTIVES

	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
8	Explain the operation and flowpaths for normal cooldown, emergency injection and recirculation phases for the ND System. PSND008	X	X	X	X	X
9	Given a Limit and Precaution associated with the ND System, discuss its basis and when it applies. PSND009		X	X	X	X
10	Concerning AP/1or 2/A/5500/19; Loss of ND or ND System Leakage, explain the purpose of the AP PSND010			X	X	
11	Concerning the Technical Specifications related to the ND System:					
	• Given the LCO title, state the LCO including the composition of an RHR loop listed in the LCO section of Bases (including any COLR values) and applicability.			X	X	X
	• For any LCO's that have action required within one hour, state the action.			X	X	X
	• Given a set of parameter values or system conditions, determine if any Tech Spec LCO's is (are) not met and any action(s) required within one hour.			X	X	X
	• Given a set of parameter values or system conditions and the appropriate Tech Spec, determine required action(s).			X	X	X
	• Discuss the bases for a given Tech. Spec. LCO or Safety Limit.				X	*
	*** SRO ONLY** PSND011					

From OP-MC-PS-ND Pg 39

- Maintain a minimum ND HX outlet temperature of greater than or equal to 65^0F until after the Reactor Vessel Head is unbolted.

  Basis: Value was reduced to 65^0F from 80^0F as a result of SER90-17 " RCS temperature below analyzed value. The temperature limits thermal stress on the reactor vessel head bolts.

- **If** the 1A(1B) ND AHU does not start when their associated pump starts, inform the WCC SRO.

  Basis: SLC16.9.16 addresses temperature limitations on the ND pump room and the required actions.

- Closing 1ND-30A (Train A ND to hot leg Isol) or 1ND-15B (Train B ND to hot leg Isol) in Modes 1,2, or 3 make both trains of ND inoperable.

  Basis: Either Train of ND must be capable of discharging to all four NCS loops. In order for this to be possible, both ND30A and ND-15B must be open.

- During Mid Loop operation (Less than or equal to 15" NC System level), total ND Flow is limited to less than or equal to 3000 gpm. (Commitment to INPO observation of Jan 1992).

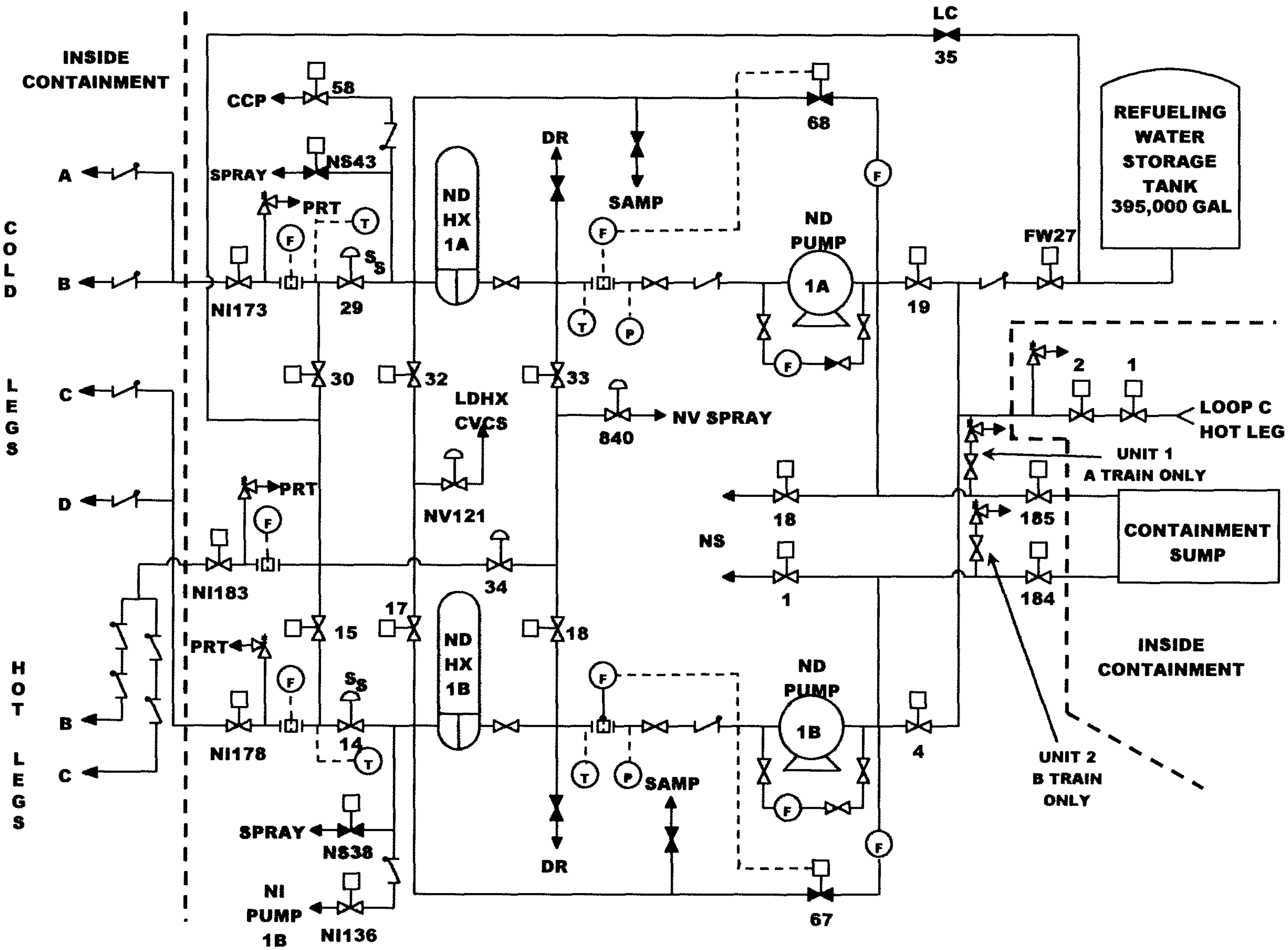
  Basis: This flow limit is to ensure that the ND pump suction does not experience vortexing (air being drawn into the pump suction).

- **When** NC System level is below the Reactor Vessel flange, careful consideration must be given to any activity which could adversely affect ND System operation. Evaluate activities for potential impact on:
  - ND System (pumps, valves, instrumentation, support systems, power supplies).
  - Makeup paths to NC System
  - Potential NC inventory loss (breaches to system, NV System alignment changes, chemistry sampling, filling and draining activities).
  - Operation parameters (ND flow and temperature, NC System level).

  Basis: Heightened awareness must be exercised during outage situations. ND could be adversely affected by any of the listed activities, possibly resulting in a loss or reduction of ND capabilities.

- Maintain KC flow to the ND HX(s) greater than 2000 GPM anytime NC System temperature is greater than or equal to 200^0F.

  Basis: This will ensure that the KC liquid inside or leaving the ND heat exchanger will not be steam/vapor which can produce water hammer in the lines. McGuire has had problems with this in the past.


INSIDE CONTAINMENT
COLD LEGS
HOT LEGS
A
B
C
D
B
C
CCP
58
SPRAY
NS43
PRT
NI173
29
30
32
33
LC
35
68
DR
SAMP
ND HX 1A
ND PUMP
1A
19
FW27
REFUELING WATER STORAGE TANK 395,000 GAL
LDHX CVCS
840
NV SPRAY
NV121
NI183
34
2
1
LOOP C HOT LEG
UNIT 1 A TRAIN ONLY
18
185
CONTAINMENT SUMP
NS
1
184
INSIDE CONTAINMENT
15
17
18
ND HX 1B
ND PUMP
1B
4
NI178
14
SPRAY
NS38
NI PUMP 1B
NI136
DR
SAMP
67
UNIT 2 B TRAIN ONLY

QuestionBank #	KA_system	KA_number
1870	GEN2.2	2.2.35

KA_desc
Equipment Control□Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13)

Given the following conditions on Unit 1:

- NC system temperature is 85°F
- All Reactor Vessel head bolts are fully tensioned
- Reactor Vessel head disassembly is in progress in preparation for Refueling

Which ONE (1) of the following describes the current plant MODE and the Reactivity Condition requirements which apply (if any) per Technical Specifications?

A. MODE 5, K_{eff} must be less than 0.95

B. MODE 5, K_{eff} must be less than 0.99

C. MODE 6, K_{eff} must be less than 0.95

D. MODE 6, no Reactivity Condition requirements

General Discussion

MODE 5 is defined as <200°F with Keff <.99 and all reactor vessel head closure bolts fully tensioned. MODE 6 is defined as <200°F with at least one reactor vessel head closure bolt not fully tensioned. There are no reactivity condition requirements defined for MODE 6 in the MODE table in Tech Specs. However, the COLR requires that the reactivity condition requirement for MODE 6 is <0.95.

This KA is met because the applicant must evaluate a given set of conditions and determine the plant MODE and additional conditions which apply to that MODE.

This is an analysis level question because the applicant must associate three pieces of information to determine the correct answer. The candidate must recall from memory the general requirements for MODE 5 & 6 from the table in Tech Specs. The applicant must then determine from the given information that all reactor vessel head bolts are fully tensioned applying a note in the TS Table to differentiate between MODE 5 and MODE 6. The applicant must then recall the reactivity condition which applies to that MODE.

Answer A Discussion

Incorrect. This is the correct MODE. However, the required Keff is <0.99. Less than 0.95 is plausible as this is the required reactivity condition for MODE 6 described in the COLR.

Answer B Discussion

CORRECT.

Answer C Discussion

Incorrect. Mode 6 is plausible since NC System temperature is less than 200°F and the applicant has already been told that preparations for refueling are in progress. Also, the COLR requires Keff <0.95 for MODE 6.

Answer D Discussion

ncorrect. Mode 6 is plausible since NC System temperature is less than 200°F and the applicant has already been told that preparations for refueling are in progress. In the TS table, reactivity condition is marked as N/A.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
TS 1.1 Definitions, Table 1.1-1 MODES COLR 2.1, Operational Requirements for MODE 6	

QuestionBank #	KA_system	KA_number
1870	GEN2.2	2.2.35

KA_desc
Equipment Control□Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13)

401-9 Comments:

401-9 Comments RESPONSE

Question 70 References:

From the Core Operating Limits Report (COLR):

McGuire 1 Cycle 20 Core Operating Limits Report

2.0 Operating Limits

The cycle-specific parameter limits for the specifications listed in section 1.0 are presented in the following subsections. These limits have been developed using NRC approved methodologies specified in Section 1.1.

2.1 Requirements for Operational Mode 6

The following condition is required for operational mode 6.

2.1.1 The Reactivity Condition requirement for operational mode 6 is that k_{eff} must be less than, or equal to 0.95.

2.2 Reactor Core Safety Limits (TS 2.1.1)

2.2.1 The Reactor Core Safety Limits are shown in Figure 1.

2.3 Shutdown Margin - SDM (TS 3.1.1, TS 3.1.4, TS 3.1.5, TS 3.1.6 and TS 3.1.8)

2.3.1 For TS 3.1.1, SDM shall be $\geq$ 1.3% $\Delta K/K$ in mode 2 with k-eff < 1.0 and in modes 3 and 4.

2.3.2 For TS 3.1.1, SDM shall be $\geq$ 1.0% $\Delta K/K$ in mode 5.

2.3.3 For TS 3.1.4, SDM shall be $\geq$ 1.3% $\Delta K/K$ in modes 1 and 2.

2.3.4 For TS 3.1.5, SDM shall be $\geq$ 1.3% $\Delta K/K$ in mode 1 and mode 2 with any control bank not fully inserted.

2.3.5 For TS 3.1.6, SDM shall be $\geq$ 1.3% $\Delta K/K$ in mode 1 and mode 2 with K-eff $\geq$ 1.0.

2.3.6 For TS 3.1.8, SDM shall be $\geq$ 1.3% $\Delta K/K$ in mode 2 during Physics Testing.

From Technical Specifications Section 1.1 Definitions:

Table 1.1-1 (page 1 of 1)
MODES

MODE	TITLE	REACTIVITY CONDITION (k_{eff})	% RATED THERMAL POWER(a)	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	≥ 0.99	> 5	NA
2	Startup	≥ 0.99	≤ 5	NA
3	Hot Standby	< 0.99	NA	≥ 350
4	Hot Shutdown(b)	< 0.99	NA	$350 > T_{avg} > 200$
5	Cold Shutdown(b)	< 0.99	NA	≤ 200
6	Refueling(c)	NA	NA	NA

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

(c) One or more reactor vessel head closure bolts less than fully tensioned.

C

QuestionBank #	KA_system	KA_number
1871	GEN2.3	2.3.12

KA_desc
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:

- A rapid load reduction from 100% power to 60% power was performed on Unit 1 approximately 3 hours ago.
- 1RAD-2 C3 (1EMF 48 REACTOR COOLANT HI RAD) annunciator is LIT
- Chemistry confirms that reactor coolant I-131 activity indicates that fuel damage has occurred.

Which ONE (1) of the following actions would reduce the radiation levels in the Auxiliary Building caused by this event?

A. Ensure an NC filter is in service.

B. Raise letdown flow to 120 GPM.

C. Place the Cation demineralizer in service.

D. Ensure 1NV-127A (L/D Hx Outlet 3-way Temp Cntrl) in "VCT" position

C

General Discussion

Since the high activity is due to failed fuel, the appropriate action would be to ensure that a mixed bed demineralizer is in service (per AP-18).

K/A is matched bacause the candidate is asked to evlauate a given set of plant conditions which represent a concern with elevated radiation levels in the auxilliary building. He is then asked to evaluate actions which would result is lowering the rad levels. This is consistant with the radiological safety principle of ALARA and the actions described are operational in nature and therefore not part of general rad working training.

This is a comprehensive level question because the candidate must evaluate multiple pieces of information given and then analyize a proposed set of actions to take and arrive at an apropriate conclusion for the correct couse of action.

Answer A Discussion

Incorrect. Plausible if the high activity is due to a crud burst.

Answer B Discussion

Incorrect. Plausible if the high activity is due to a crud burst.

Answer C Discussion

CORRECT

Answer D Discussion

Incorrect. Plausible because this is the right valve. However, it is the wrong position.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	CNS 2006 NRC Q71 (Bank 148)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
AP-18, High Activity in Reactor Coolant page 3	

QuestionBank #	KA_system	KA_number
1871	GEN2.3	2.3.12

KA_desc

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:

401-9 Comments RESPONSE

Question 71 References:

From AP-18 page 2 & 3:

MNS AP/1/A/5500/18 UNIT 1	HIGH ACTIVITY IN REACTOR COOLANT	PAGE NO. 2 of 4 Rev. 3

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B. Symptoms	
• **"1EMF-48 REACTOR COOLANT HI RAD" alarm**	
• **"1EMF-18 REACTOR COOLANT FILTER 1A" alarm**	
• **"1EMF-19 REACTOR COOLANT FILTER 1B" alarm**	
• **Chemistry sample results indicate an unexpected increase in NC System activity.**	
C. Operator Actions	
__ 1. **Place one Outside Air Pressure Filter train in service PER Enclosure 1 (Pressurizing the Control Room).**	
__ 2. **Check 1NV-127A (L/D Hx Outlet 3-Way Temp Cntrl) - ALIGNED TO DEMIN.**	__ **Align valve to "DEMIN" position.**
3. **Determine cause of high activity as follows:**	
__ a. Request Chemistry to check decontamination factor of mixed bed demineralizer.	
__ b. Notify Chemistry to perform an NC System isotopic analysis to determine if high activity is from a crud burst or failed fuel.	
__ 4. **IF AT ANY TIME it is determined that high activity is from crud burst, THEN raise letdown flow to 120 GPM PER OP/1/A/6200/001 A (Chemical and Volume Control System Letdown), Enclosure 4.5 (Establishing Maximum Normal Letdown).**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

5. **IF AT ANY TIME it is determined that high activity is from failed fuel, THEN perform the following:**

__ a. Ensure mixed bed demineralizer in service.

__ b. Notify Chemistry to consult with Reactor Group and RP to determine if the cation bed demineralizer should be placed in service.

__ c. IF AT ANY TIME Chemistry requests cation bed demineralizer be placed in service, THEN place in service PER OP/1/A/6200/001D (Chemical and Volume Control System Demineralizers), Enclosure 4.3 (Removing/Returning the Cation Bed Demineralizer from/to Service).

__ d. REFER TO RP/0/A/5700/000 (Classification of Emergency).

__ e. Notify Reactor Group to discuss high activity in NC System with General Office Nuclear Engineering.

__ 6. **Notify Radwaste to ensure VCT H_2 purge flow is established.**

__ 7. **REFER TO Tech Spec 3.4.16 (RCS Specific Activity).**

__ 8. **WHEN station management determines Control Room pressurization no longer required, THEN secure PER OP/0/A/6450/011 (Control Area Ventilation/Chilled Water System), Enclosure 4.4 (Control Room Atmosphere Pressurization During Abnormal Conditions).**

END

D

QuestionBank #	KA_system	KA_number
148	GEN2.3	2.3.10

KA_desc
Radiation Control□Deleted

Given the following:

- A rapid load reduction from 100% power to 60% power was performed on Unit 1 approximately 3 hours ago.
- 1RAD-3 E/4 (1EMF 48 NC SAMPLE LINE REACTOR COOLANT) annunciator is LIT
- Chemistry confirms that reactor coolant I-131 activity exceeds Technical Specification transient limits.

Which one of the following actions does AP/1/A/5500/018 (High Activity in Reactor Coolant) direct that would limit the effect of the increased I-131 activity?

A. Ensure an NC filter is in service.

B. Raise letdown flow 120 gpm.

C. Ensure 1NV-153A (Letdn Hx Otlt 3-way Vlv) in “VCT” position.

D. Ensure an NV demineralizer is in service.

2006 RO NRC Retake Examination QUESTION 71

D

General Discussion

Answer A Discussion

A is incorrect. NC filters are swapped per 1RAD3 D/3 but demineralizers are used to limit activity.

Answer B Discussion

B is incorrect. Raise letdown would clean up NC system but not required by AP/18.

Answer C Discussion

C is incorrect. Right valve , wrong position.

Answer D Discussion

Job Level	Cognitive Level	QuestionType	Question Source
RO	Memory	BANK	

☑ Developed

☑ OPT Approved

☑ OPS Approved

☑ NRC Approved

Development References	Student References Provided
AP/1/A/5500/18	

QuestionBank #	KA_system	KA_number
148	GEN2.3	2.3.10

KA_desc
Radiation Control□Deleted

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1872	GEN2.3	2.3.14

KA_desc
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)

After realigning the NV system for startup, a valve located in a high radiation area requires independent verification.

Given the following conditions:

- General area radiation levels are 130 MREM / hr
- Estimated time to independently verify the position is 10 minutes
- There are no known hot spots in the area
- There is no airborne activity in this room
- The room has no surface contamination areas

What are the ALARA requirements (if any) for waiving the independent verification of this valve?

A. Independent verification may be waived after an evaluation by the NLO.

B. Independent verification is waived for all valves in high radiation areas until after shutdown.

C. Independent verification may not be waived for ALARA considerations under these conditions.

D. Independent verification may be waived because the exposure to the operator exceeds ALARA guidelines.

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. This waiver requires supervisory approval and documentation.

This KA is met because the applicant must evaluate a potential exposure hazard and determine which requirement applies to that potential exposure.

This is an analysis question because the applicant is required to calculate the potential exposure and then apply a limit recalled from memory to correclty answer the question.

Answer A Discussion

Incorrect. Plausible because the IV can be waived and it does require evaluation. However, it must be evaluated and approved by a supervisor.

Answer B Discussion

Incorrect. Plausible because IV in a high radiation could potentially exceed the 10 mrem guidance for a single exposure. However, IV cannot be waived simply because the component is in a High Radiation Area.

Answer C Discussion

Incorrect. 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.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	MNS Bank Question ADMOMPN036

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

NSD 700 Verification Techniques page 9 (previously OMP 8-2 Verification Techniques) and Lesson Plan OP-MC-ADM-OMP objective 22 related to OMP 8-2. OMP 8-2 was deleted in April 2009 and the ADM-OMP Lesson Plan has not yet been revised to make the change to NSD 700. However, the applicants would have been responsible for the requirements of OMP 8-2 and those requirements did not change with NSD 700.

Student References Provided

QuestionBank #	KA_system	KA_number
1872	GEN2.3	2.3.14

KA_desc

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:

401-9 Comments RESPONSE

Question 72 References:

From NSD 700 page 9:

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.

From Lesson Plan OP-MC-ADM-OMP:

	OBJECTIVE	NLO	NLOR	LPRO	LPSO	LOR
21.	Concerning OMP 8-1, STAR and Peer Checking: • Describe the STAR process. • Describe the Peer Checking process. • Give examples when STAR and Peer Checking should be used. ADMOMP015	X	X	X	X	X
22.	Concerning OMP 8-2, Component Verification Techniques: • Define the following terms: 1. Correct Component Verification. 2. Independent Verification. 3. Separate Verification. 4. Double Verification. 5. Self Verification • State the requirements for a component to be "Essential to Safety". • List examples of components that require independent verification. • **List all situations in which independent verification requirement can be waived.** • Explain the methods utilized to verify the following: 1. Manual Valve position. 2. "Locked Open" or "Locked Closed" valve positions. 3. "Locked Throttle" valve position. 4. Motor Operated and Pneumatic valve positions. 5. Verification of Breaker Position. 6. Verification of Control Power. ADMOMP016	X	X	X	X	X

QuestionBank #	KA_system	KA_number
1873	GEN2.3	2.3.7

KA_desc
Radiation Control□Ability to comply with radiation work permit requirements during normal orabnormal conditions. (CFR: 41.12 / 45.10)

A radiation worker is repairing a valve in a contaminated area, which has the following radiological characteristics:

- The worker's present exposure is 1938 MREM for the year
- The RWP states:
  - General area dose rate = 30 MREM/hr
  - Airborne contamination concentration = 10.0 DAC

The job will take 2 hours if the worker wears a full-face respirator. It will only take 1 hour if the worker does not wear the respirator.

If the RP Manager grants all applicable dose extensions, which ONE (1) of the following choices for completing this job would maintain the worker's exposure within the station administrative requirements?

A. The worker should not wear the respirator.
The dose received wearing a respirator will exceed site annual personnel dose limits.

B. The worker should not wear the respirator.
The calculated TEDE dose received will be less than if he does wear one.

C. The worker should wear the respirator.
The calculated TEDE dose received will be less than if he does not wear one.

D. The worker should wear the respirator.
He could exceed DAC limits.

General Discussion

Radiation exposure comparison:
Without respirator DDE = 30 mrem/hr x 1 hr = 30 mrem
From airborne contamination: CEDE = 10 DAC 1 hr x 2.5 mrem/DAC-hr = 25 mrem TEDE = 30 + 25 = 55 mrem from job Total exposure for year = 1938 + 55 = 1993 mrem
With respirator
DDE = 30 mrem/hr x 2 hr = 60 mrem CEDE = 0 TEDE = 60 mrem
Total exposure for year = 1938 + 60 = 1998 mrem
(With respirator) (Without respirator)
TEDE = 60 mrem > 55 mrem = do not use a respirator

K/A is matched because the information given in the stem of the question would be provided on a room survey map. This information would then be used to comply with the associated RWP for the work being performed. This question represents the kind of evaluaton which could be encountered in order to comply with the requirements on an RWP

This is a comprehension level question because the applicant must recall multiple pieces of information such as DAC hour conversion and Exposure limits. He must them perform a calculation and predict an outcome.

Answer A Discussion

Incorrect: the dose will not exceed the 2000 mrem limit based on calculation.
Plausible: If the candidate miscalculates the dose

Answer B Discussion

Correct answer

Answer C Discussion

Incorrect: The calculated exposure will be greater if you wear the respirator. Plausible: If the candidate incorrectly computes the exposure - this was the correct answer on a previous exam

Answer D Discussion

Incorrect: DAC limits are not direct ALARA controls.
Plausible: If the candidate does not understand the concept of derived airborne concentrations.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2008 NRC Q72 (Bank 211)

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References

Lesson Plan Objective: HP Obj: 22 & 29
1. OP-MC-RAD-HP

Student References Provided

QuestionBank #	KA_system	KA_number
1873	GEN2.3	2.3.7

KA_desc

Radiation Control□Ability to comply with radiation work permit requirements during normal orabnormal conditions. (CFR: 41.12 / 45.10)

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
211	GEN2.3	2.3.2

KA_desc
Radiation Control□Deleted

A radiation worker is repairing a valve in a contaminated area, which has the following radiological characteristics:

- The worker's present exposure is 1943 mrem for the year
- General area dose rate = 30 mrem/hr
- Airborne contamination concentration = 10.0 DAC

The job will take 2 hours if the worker wears a full-face respirator. It will only take 1 hour if the worker does NOT wear the respirator.

If the RP Manager grants all applicable dose extensions, which one of the following choices for completing this job would maintain the worker's exposure within the station administrative requirements?

A. The worker should NOT wear the respirator because the calculated TEDE dose received will be less than if he wears one.

B. The worker should NOT wear the respirator because the dose received without wearing a respirator will exceed site annual personnel dose limits.

C. The worker should wear the respirator because the calculated TEDE dose received will be less than if he does not wear one.

D. The worker should wear the respirator otherwise he could exceed DAC limits.

General Discussion

Radiation exposure comparison:
Without respirator
DDE = 30 mrem/hr x 1 hr = 30 mrem
From airborne contamination:
CEDE = 10 DAC 1 hr x 2.5 mrem/DAC-hr = 25 mrem
TEDE = 30 + 25 = 55 mrem from job
Total exposure for year = 1943 + 55 = 1998 mrem

With respirator
DDE = 30 mrem/hr x 2 hr = 60 mrem
CEDE = 0
TEDE = 60 mrem
Total exposure for year = 1943 + 60 = 2003 mrem

(With respirator) (Without respirator)
TEDE = 60 mrem > 55 mrem = do not use a respirator

Answer A Discussion

Correct answer

Answer B Discussion

Incorrect: the dose will exceed the 2000 mrem limit based on calculation.
Plausible: If the candidate miscalculates the dose

Answer C Discussion

Incorrect: The calculated exposure will be greater if you wear the respirator. Plausible: If the candidate incorrectly computes the exposure - this was the correct answer on a previous exam

Answer D Discussion

Incorrect: DAC limits are not direct ALARA controls.
Plausible: If the candidate does not understand the concept of derived airborne concentrations.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	Bank Question: 353.3

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

Development References	Student References Provided
Lesson Plan Objective: HP Obj: 2, 4 1. OP-CN-RAD-HP pages 14-15	

QuestionBank #	KA_system	KA_number
211	GEN2.3	2.3.2

KA_desc
Radiation Control□Deleted

401-9 Comments:

401-9 Comments RESPONSE

D

QuestionBank #	KA_system	KA_number
1874	GEN2.4	2.4.16

KA_desc

Emergency Procedures / Plan□Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident management guidelines. (CFR: 41.10 / 43.5 / 45.13)

With the following conditions on Unit 1:

- A Loss of Offsite Power (LOOP) has resulted in a Reactor Trip and Safety Injection
- All Rod Bottom Lights are LIT
- Train 'A' Reactor Trip breaker is CLOSED
- Both Unit 1 D/G's FAILED to start

Which ONE (1) of the following correctly states which procedure will have the highest PRIORITY for the above conditions?

A. AP-007 (Loss of Electrical Power)

B. FR-S.1 (Response to Nuclear Power Generation/ATWS)

C. ES-0.0 (Rediagnosis)

D. ECA-0.0 (Loss of All AC Power)

General Discussion

With the conditions given in the stem of this question, a loss of all AC has occurred. In addition, entry conditions into FRP S-1 are presented but the situation given would require the crew to enter ECA 0.0 instead of the FRP. All EP;s with the exception of the ECA 0.0 series are written assuming at least one train of AC power is available therefore ECA would take priority of the CSF Red path for sub criticality as well as the other EP's listed in the distracters.

KA is matched because the candidate must demonstrate an understanding of the implementation hierarchy of emergency, specifically the understanding that ECA 0.0 takes priority over all other procedures.

This question is analysis level because the candidate must first determine from given information that a loss of all AC has occurred. In addition, the determination of a red path for FRP S-1 is warranted. The candidate must then take this information and evaluate the correct procedure priority. This demonstrates an analysis and subsequent application of the results of that analysis.

Answer A Discussion

Incorrect: See explanation above. Plausible: AP/07 is implemented in E-0 for loss of electrical power scenarios but it will not take priority over ECA 0.0.

Answer B Discussion

Incorrect: See explanation above. Plausible: A valid red path is given and this is normally the highest priority procedure. If a loss of all AC was not in progress this would be the correct answer

Answer C Discussion

Incorrect: See explanation above. Plausible: □This procedure can be entered "at any time". But this procedure tells you if you are in any of the other 3 to go back to procedure in effect.

Answer D Discussion

Correct: See explanation above

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	2006 NRC Q74 (Bank 680)

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

Development References

References:
1Lesson Plan OP-MC-EP-ECA-0, rev. 15 page 11,13
OMP 4-3 Pg 6

Student References Provided

QuestionBank #	KA_system	KA_number
1874	GEN2.4	2.4.16

KA_desc

Emergency Procedures / Plan□Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident management guidelines. (CFR: 41.10 / 43.5 / 45.13)

401-9 Comments:

401-9 Comments RESPONSE

FBK 8/26
Question revised on 9/22/09

1.0 PROCEDURE SERIES BACKGROUND

The loss of all AC power procedures are unique within the EPs. With the exception of these procedures, all other EPs are written on the premise that at least one AC emergency bus is energized and associated equipment can be powered from the energized AC emergency bus. Consequently, the guidance provided in other EPs is not applicable following the loss of all AC power.

Thus, ECA-0.0, Loss of All AC Power, has priority over all other EPs.

ECA-0.0 provides guidance from when a loss of all AC power condition is diagnosed until AC power is restored and the operator selects one of the two plant recovery procedures.

The following criteria is used to determine which recovery procedure to implement after AC power is recovered:

1. ***The existence of NC system subcooling***

2. ***The existence of pressurizer level***

3. ***The confirmation S/I equipment is not operating***

If plant conditions have not deteriorated significantly prior to AC power restoration (all three criteria are satisfied), the operator is instructed to implement procedure ECA-0.1 and attempt to stabilize the plant utilizing normal operational systems.

If plant conditions have deteriorated significantly (any criterion is not satisfied), the operator may have insufficient or conflicting indications as to plant status and a concurrent event may be contributing to the deterioration of NC system conditions. Under these conditions, the operator is instructed to implement procedure ECA-0.2 and initiate plant recovery utilizing S/I operational systems.

2.0 ECA-0.0, LOSS OF ALL AC POWER

2.1. *Purpose*

The objective of the recovery/restoration technique incorporated into ECA-0.0, Loss of All AC Power, is to mitigate deterioration of NC system conditions while AC emergency power is not available.

ECA-0.0 is structured to address the loss of all AC power as an initiating event while including actions addressing possible coincident occurrences such as loss of reactor coolant, loss of secondary coolant, or S/G tube rupture.

Since the guidance contained in ECA-0.0 has priority over all other EPs, the steps also include actions that implicitly monitor and maintain the CSFs.

From Lesson Plan OMP 4-3 page 6:

7.15 Usage of Status Trees

There are six different trees, each one evaluating a separate Critical Safety Function (CSF) of the plant. Color-coding of the status tree end points will be either red, orange, yellow, or green, with green representing a "satisfied" safety status. Each non-green color represents an action level that should be addressed according to the Rules of Priority as discussed below.

The six Status Trees are always evaluated in the sequence:

- Subcriticality
- Core Cooling
- Heat Sink
- Integrity
- Containment
- Inventory

IF identical color priorities are found on different trees during monitoring, the required action priority is determined by this sequence.

Initial monitoring of the status trees should begin on either of the following conditions:

- As directed by an action step in EP/1,2/A/5000/E-0 (Reactor Trip or Safety Injection).
- WHEN a transfer is made out of the Safety Injection procedure to another EP.

  An exception to this is that CSF procedures are NOT required to be implemented during the Loss of All AC Power EP since none of the electrically powered safeguards equipment can be used. WHEN power is subsequently restored, EP/1,2/A/5000/ECA-0.1 or 0.2 (Loss of All AC Power Recovery procedures) will direct the operator when implementing CSF procedures is required.

From OMP 4-3 page 22:

7.18 Multiple Use of EPs and APs.

The Control Room SRO will determine how many procedures can be implemented at a time and their priority based on manpower availability and the particular event in progress. More than one EP shall **NOT** be run concurrently unless directed by the procedure. Generally the use of APs in conjunction with EPs should be avoided. In some instances it would be proper to use an AP concurrently during a major accident which is being addressed by the EPs. An example of this is upon loss of all Nuclear Service Water in the middle of an accident, the operators would need to utilize the AP for Loss of RN also. **IF** an AP is used during an S/I event, USE CAUTION. APs are generally written assuming an S/I has **NOT** occurred (exception - AP/35, ECCS Actuation During Plant Shutdown). Evaluate any AP steps in post S/I events to ensure the steps do **NOT** conflict with any EP in effect. **NOT** all AP actions would be appropriate if an S/I occurred. (Enclosures in EP/G-1 (Generic Enclosures) may be used when reference by EPs or APs.)

From Lesson Plan OP-MC-CNT-RV page 37:

7. Use Of Approved Procedure

7.1 EP/AP Usage

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. Emergency procedures referenced by them may be used to correct the alarming condition.

7.2 Use of Control Copies

Since EPs and APs 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 should be replaced by the SSA. The procedure group should be contacted after the use of any EP or AP.

QuestionBank #	KA_system	KA_number
680	N/A	

KA_desc

With the following conditions on Unit 1:

- Valid reactor trip annunciator is lit
- All Rod Bottom Lights are lit
- Intermediate Range Startup Rate is positive
- Power Ranges indicate 6%
- All 6900v busses are deenergized
- 1ETA is deenergized
- 1B D/G is OFF
- Safety Injection status light is lit

Which one of the following correctly states which procedure will have the highest priority for the above conditions?

A. EP/1/A/5000/E-0 (Reactor Trip or Safety Injection)

B. EP/1/A/5000/FR-S.1 (Response to Nuclear Power Generation/ATWS)

C. EP/1/A/5000/ES-0.0 (Rediagnosis)

D. EP/1/A/5000/ECA-0.0 (Loss of All AC Power)

D

General Discussion

Answer A Discussion

Plausible: A major entry procedure which can be used to enter A, or D but it is of no use if no power

Answer B Discussion

Plausible: The highest priority CSF Procedure. Using this procedure has no effect if no power available for equipment.

Answer C Discussion

Plausible: This procedure can be entered "at any time". But this procedure tells you if you are in any of the other 3 to go back to procedure in effect.

Answer D Discussion

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	BANK	

☑ Developed
☑ OPT Approved
☑ OPS Approved
☑ NRC Approved

Development References

References:
1. CSF Lesson
2 OP-CN-EP-EP510.

Student References Provided

QuestionBank #	KA_system	KA_number
680	N/A	

KA_desc

401-9 Comments:

401-9 Comments RESPONSE

QuestionBank #	KA_system	KA_number
1875	GEN2.4	2.4.46

KA_desc
Emergency Procedures / Plan Ability to verify that the alarms are consistent with the plant conditions. (CFR: 41.10 / 43.5 / 45.3 / 45.12)

A Reactor Trip and Safety Injection have occurred on Unit 1 due to a Loss of Coolant Accident (LOCA). The following conditions exist:

- Containment pressure is 10 PSIG
- All NC pumps have been secured
- NC system subcooling is -50°F
- CETs indicate 750°F
- Reactor Vessel Lower Range Level is currently 32%

The Critical Safety Function status for Containment is ___(1)___ and the status of Core Cooling is ___(2)___.

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

A. (1) ORANGE
(2) ORANGE

B. (1) RED
(2) ORANGE

C. (1) ORANGE
(2) RED

D. (1) RED
(2) RED

C

General Discussion

With containment pressue greater than 3 PSIG but less than 15 PSIG Containment CSF will be Orange.
With no NC pumps running, subcooling less than 0°F, CETs greater than 700°F, and Rx Vessel lower range level less than 39%, the Core Cooling CSF will be RED.

This KA is met because the applicant must analyze a given set of conditions and determine the status of CSFST indications (alarms). This requires a knowledge of emergency procedures (F-0) and the ability to determine applicability.

This question is comprehension level because the applicant must associate multiple pieces of information (some given and some recalled from memory) to determine the correct answer. The applicant must recall all setpoint for the Core Cooling and Subcriticality Safety Functions and apply the given conditions to determine the status of those two Safety Functions.

Answer A Discussion

Incorrect. Part 1 correct. Part 2 is plausible if the applicant does not recall the setpoint for CETs or Reactor Vessel Lower Range Level.

Answer B Discussion

Incorrect. Part 1 is plausible as there are procedure actions relative to the Containment Spray system which must be performed when containment pressure reaches 10 psig. Part 2 plausible if applicant does not recall CET or RV level setpoints.

Answer C Discussion

CORRECT.

Answer D Discussion

Incorrect. Part 2 correct. Part 1 is plausible as there are procedure actions relative to the Containment Spray system which must be performed when containment pressure reaches 10 psig.

Job Level	Cognitive Level	QuestionType	Question Source
RO	Comprehension	NEW	

- [x] Developed
- [x] OPT Approved
- [x] OPS Approved
- [ ] NRC Approved

Development References	Student References Provided
F-O Critical Safety Function Status Trees	

QuestionBank #	KA_system	KA_number
1875	GEN2.4	2.4.46

KA_desc

Emergency Procedures / Plan□Ability to verify that the alarms are consistent with the plant conditions. (CFR: 41.10 / 43.5 / 45.3 / 45.12)

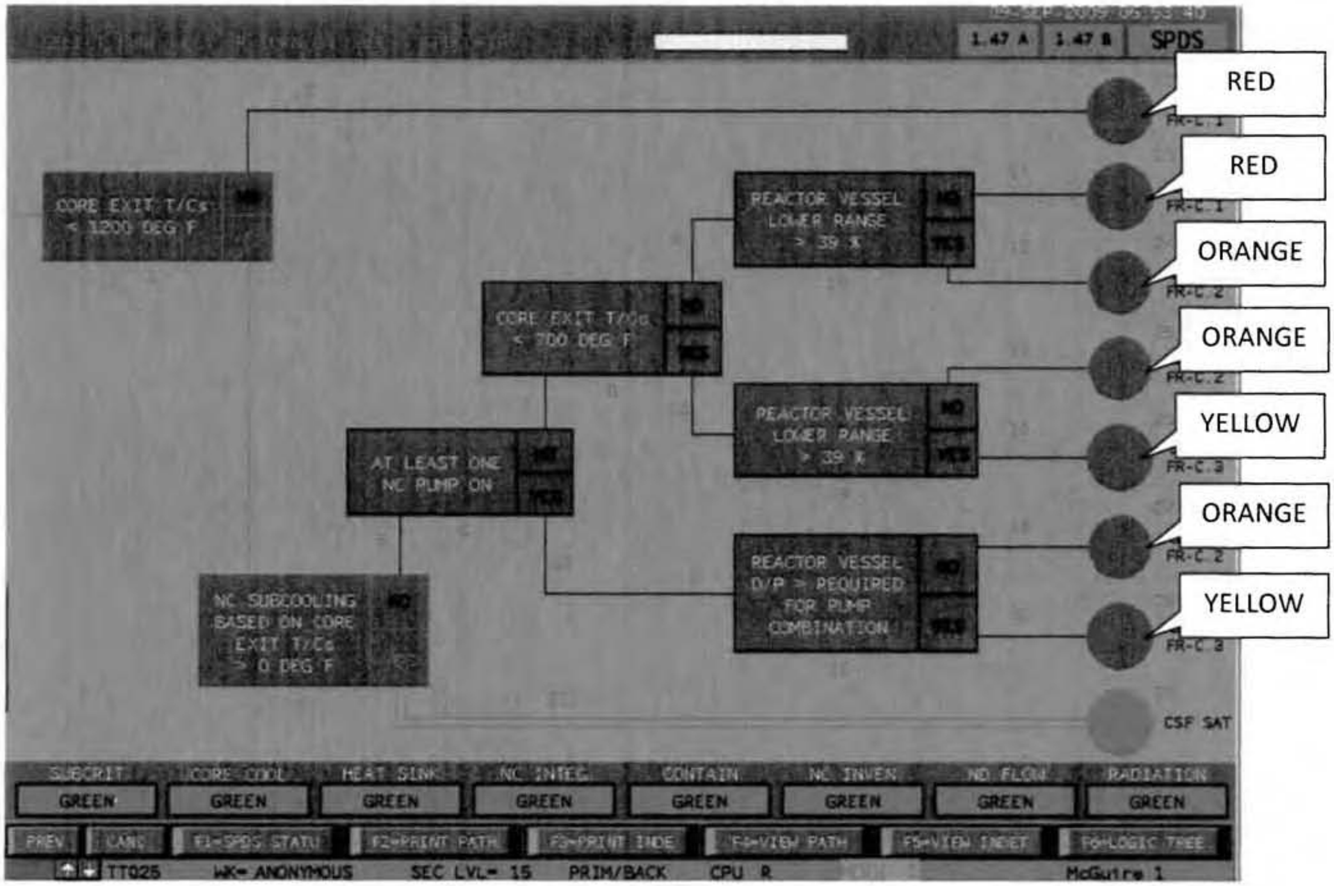
401-9 Comments:

401-9 Comments RESPONSE

HCF 09/08/09

Question 75 References:

Core Cooling CSFSTs:



Containment CSFST: