Catawba 2013-301

Catawba submitted a 213-page combined RO/SRO draft written exam for the 2013-301 exam. The following are pages 1-160, which comprise the RO portion of the draft exam.

Question 1
007EK1.03
Reactor Trip - Stabilization - Recovery
Knowledge of the operational implications of the following concepts as they apply to the reactor trip:
Reasons for closing the main turbine governor valve and the main turbine stop valve after a reactor trip

Given the following Unit 1 initial conditions:

- The Unit is at 58% power.
- Turbine bearing #8 vibration began to rise rapidly.
- With bearing #8 vibration at 16 mils and continuing to rise, the operator attempted to manually trip the turbine by depressing the Turbine Trip pushbutton.

Current Conditions:

- All turbine stop and control valves are OPEN.
- 1AD-1, B/7 (Manual Turb Trip C/R) is DARK.
- The crew is performing the Immediate Actions of AP/1/A/5500/002, (Turbine Generator Trip).

In accordance with AP/02, the operator will attempt to CLOSE the turbine control valves at a rate of 100% over a period of ________(1)________ .

If that action is NOT successful, the NEXT required action is to __________(2)__________ .

A. (1) 3 minutes
(2) trip the reactor

B. (1) 3 minutes
(2) close all MSIVs and bypass valves

C. (1) 45 seconds
(2) trip the reactor

D. (1) 45 seconds
(2) close all MSIVs and bypass valves

QUESTION 1

Distractor Analysis

A. Incorrect. The first part is plausible because 3 minutes is the normal time required for control valve closure (i.e., if manual and control valve lower is depressed without depressing "Fast Rate"). The second part is correct.

B. Incorrect. The first part is plausible because 3 minutes is the normal time required for control valve closure (i.e. if manual and control valve lower is depressed without depressing "Fast Rate"). The second part is plausible because this would be the required action if the applicant were performing similar steps in EP/1/A/5000/E-0 to verify turbine trip (which does not require a Reactor Trip). Also plausible if the applicant is unfamiliar with the turbine trip abnormal procedure and applies the same logic to MSIVs as the Main Turbine (i.e. no Reactor trip required if less than 69% power).

C. **CORRECT.** The applicant should determine that AP/1/A/5500/002 (Turbine Generator Trip) is entered. AP-02 requires placing the Main Turbine control in Manual, then to depress "CONTROL VALVE LOWER" and 'FAST RATE" to rapidly close the turbine control valves (45 seconds) upon failure of the turbine trip. If this is unsuccessful, the operator is then required to trip the Reactor prior to isolating steam flow to the turbine via closure of MSIVs and MSIV bypass valves.

D. Incorrect. The first part is correct. The second part is plausible because this would be the required action if the applicant were performing similar steps in EP/1/A/5000/E-0 to verify turbine trip (which does not require a Reactor Trip). Also plausible if the applicant is unfamiliar with the turbine trip abnormal procedure and applies the same logic to MSIVs as the Main Turbine (i.e. no Reactor trip required if less than 69% power).

References:

- AP/1/A/5500/002, Revision 32, Step 2
- EP/1/A/5000/E-0, Revision 41, Step 3
- OP-CN-GEN-EHC, Lesson Plan for Digital Turbine Control System, pg. 17, Revision 101
- OP-CN-AP-02, Lesson Plan for AP/02 Turbine Generator Trip, pg. 6, Revision 0

KA Match:

This KA is NOT testing knowledge of what the reasons are for closing the governor and stop valves; it tests knowledge of the operational implications of those reasons. The reason for ensuring the governor and stop valves are closed is to prevent overcooling of the RCS. The operational implications of that reason is that the operator must continue attempts to stop the flow of steam through the turbine, and in as timely a manner as possible.

This question meets that by testing knowledge of what action is available next in an attempt to address the overcooling concern, and how long it will take (operational implication) for the overcooling concern to be mitigated.

Cognitive Level: **Low**

Source of Question: **New**

Question 2
008AK1.01
Pressurizer Vapor Space Accident
Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident:
Thermodynamics and flow characteristics of open or leaking valves

Given the following Unit 1 conditions:

<u>**Initial**</u>

- The crew is recovering from a faulted Steam Generator outside containment, upstream of the MSIVs.
- SI has been terminated.
- The crew is maintaining the plant in a stable condition per EP/1/A/5000/ES-1.1 (SI Termination).
- PZR pressure is 2185 psig and stable.
- PZR level is 50% and stable.

<u>**Current**</u>

- NC pressure starts to decrease rapidly due to a significant leak on one of the PZR safety valves.
- PRT pressure is 20 psig.

Based on the event in progress:

(1) Which parameter requires the manual reinitiation of Safety Injection?

(2) What will the PZR Safety valve tailpipe temperature be indicating?

A. (1) PZR level at 17%
(2) 315°F tailpipe temperature

B. (1) NC subcooling at negative 5°F
(2) 315°F tailpipe temperature

C. (1) PZR level at 17%
(2) 260°F tailpipe temperature

D. (1) NC subcooling at negative 5°F
(2) 260°F tailpipe temperature

QUESTION 2

Distractor Analysis

A. Incorrect. Plausible, since applicant may misapply the fact that for most small break LOCAs, pressurizer level does indeed decrease. For THIS event (vapor space LOCA), PZR level is not a valid indication of NC inventory, since pressure drops to saturation in the vessel and the hot legs, and formation of a two-phase mixture forces flow up the surge line and into the pressurizer. This causes pressurizer level to actually increase until the PZR is full. Second part is plausible, since 315°F is obtained if the applicant uses the Mollier Diagram incorrectly by using the constant entropy line straight up to the saturation curve, instead of the correct constant pressure line up to the saturation curve. This indicates that the applicant fails to understand and apply the thermodynamic principle of tailpipe temperature response.

B. Incorrect. Plausible, since 315°F is obtained if the applicant uses the Mollier Diagram incorrectly by using the constant entropy line straight up to the saturation curve, instead of the correct constant pressure line up to the saturation curve. This indicates that the applicant fails to understand and apply the thermodynamic principle of tailpipe temperature response. Also plausible, since the subcooling part of the distractor is correct.

C. Incorrect. Plausible, since applicant may misapply the fact that for most small break LOCAs, pressurizer level does indeed decrease. For THIS event (vapor space LOCA), PZR level is not a valid indication of NC inventory, since pressure drops to saturation in the vessel and the hot legs, and formation of a two-phase mixture forces flow up the surge line and into the pressurizer. This causes PZR level to actually increase until the PZR is full.

D. **CORRECT**. On a vapor space break, PZR level is not a valid indication of NC inventory, since pressure drops to saturation in the vessel and the hot legs, and formation of a two-phase mixture forces flow up the surge line and into the pressurizer. This causes pressurizer level to actually increase until the PZR is full. The enthalpy of the saturated fluid in the vapor space does not change as it passes through a safety valve, resulting in a temperature indication corresponding to the pressure in the PRT.

References:
- ES-1.1 (SI Termination), Enclosure 1, "Foldout Page", Step 1, Revision 32
- Mollier Diagram

KA Match:
This question tests the knowledge of the thermodynamics of a leaking PZR safety valve, including use of the Mollier diagram, and the operational implications of how it may affect whether manual reinitiation of Safety Injection will be required.

Cognitive Level: **High**
This is a high cognitive level question because the applicant must evaluate a given set of plant conditions, then use a Mollier diagram to determine an expected tailpipe temperature, and then evaluate other plant conditions to make a decision on which parameter requires reinitiation of Safety Injection.

Source of Question: **Bank - 2010 NRC Exam - Modified**

Question 3
009EG2.1.25
Small Break LOCA
Ability to interpret reference materials such as graphs, curves, tables, etc.

Given the following:

- A small-break LOCA has occurred.
- EP/1/A/5000/E-1 (Loss of Reactor or Secondary Coolant) has been entered.
- Both trains of ICCM are NOT available.
- Total CA Flow is 600 gpm and stable.
- Core Exit T/Cs on OAC indicate 545°F.
- All Hot Leg temperatures are 530°F.
- All Cold Leg temperatures are 515°F.
- NC B Loop W/R pressure is stable at 1000 psig.
- Pressurizer level is 33% and stable.

(1) In accordance with E-1, the value of subcooling is ____(1)____ .

(2) S/I termination criteria _____(2)_____ met.

Which ONE of the following completes the above statements?

Reference Provided

A. (1) 0°F
(2) ARE

B. (1) 0°F
(2) are NOT

C. (1) +15°F
(2) ARE

D. (1) - 15°F
(2) are NOT

QUESTION 3

Distractor Analysis

A. Incorrect. Plausible because this value is obtained if the applicant incorrectly uses Hot Leg Temperature instead of Core Exit Thermocouple Temperature along with Figure 57 of the Databook. The ICCM (Inadequate Core Cooling Monitor) calculates subcooling based on Core Exit Thermocouples and Hot Leg Temperature. But EP/1/A/5000/E-1 specifically requires that subcooling be based on Core Exit Thermocouples.

This incorrect value is also obtained if the applicant correctly applies the value of Core Exit Thermocouple Temperature but uses steam tables instead of the Databook figure to determine subcooling. The Databook figure replicates the conservatism factor used by the ICCM; while the steam tables do not.

The second part is also incorrect, but plausible if the applicant believes that subcooling is 0°F and misapplies the SI termination criteria from EP/1/A/5000/E-1 (>0°F subcooling based on Core Exit Thermocouples).

B. Incorrect. Plausible because this value is obtained if the applicant incorrectly uses Hot Leg Temperature instead of Core Exit Thermocouple Temperature along with Figure 57 of the Databook. The ICCM (Inadequate Core Cooling Monitor) calculates subcooling based on Core Exit Thermocouples and Hot Leg Temperature. But EP/1/A/5000/E-1 specifically requires that subcooling be based on Core Exit Thermocouples.

This incorrect value is also obtained if the applicant correctly applies the value of Core Exit Thermocouple Temperature but uses steam tables instead of the Databook figure to determine subcooling. The Databook figure replicates the conservatism factor used by the ICCM; while the steam tables do not.

The second part would be correct if the subcooling value obtained was correct. SI termination criteria of EP/1/A/5000/E-1 is >0°F based on Core Exit Thermocouples.

C. Incorrect. Plausible because this value is obtained if the applicant incorrectly uses Hot Leg Temperature and Steam Tables to determine subcooling. The ICCM (Inadequate Core Cooling Monitor) calculates subcooling based on Core Exit Thermocouples and Hot Leg Temperature. But EP/1/A/5000/E-1 specifically requires that subcooling be based on Core Exit Thermocouples. The Databook figure replicates the conservatism factor used by the ICCM.

The second part is correct if the subcooling value obtained was correct. SI termination criteria of EP/1/A/5000/E-1 is >0°F based on Core Exit Thermocouples.

D. **CORRECT.** Subcooling (per EP/1/A/5000/E-1) is determined by comparing NC pressure vs Core Exit Thermocouple temperature on Figure 57 of the Databook. The Databook figure replicates the 20° conservatism factor used by the ICCM.

The second part is correct per SI termination criteria of EP/1/A/5000/E-1 (>0°F Subcooling based on Core Exit Thermocouples).

References:

- EP/1/A/5000/E-1, (Loss of Reactor or Secondary Coolant), Step 9, Revision 28
- Databook Figure 57, Reactor Coolant Saturation Curve, Wide Range
- OP-CN-PS-CCM, Lesson Plan for Inadequate Core Cooling Monitor, pg., 16, Revision 100
- Steam Tables, Pg. 11 & 12

Provide to Applicant:

- **Databook Figure 57, Reactor Coolant Saturation Curve, Wide Range**

KA Match:
Given a copy of Steam Tables and Databook Figure 57 and Figure 58, this question tests the ability of the applicant to select the appropriate reference (Steam Tables vs. a Databook curve) for a specified condition. It also requires the applicant to correctly interpret that information on a graph.

Cognitive Level: **High**
Applicant must evaluate multiple data points, and know which parameters are appropriate for determining subcooling. Applicant then applies knowledge of requirement for SI termination of EP/1/A/5000/E-1 and compare that to the calculated value of subcooling. Applicant must also apply knowledge of the conservatism factor of the ICCM and interpret a Databook graph to evaluate whether SI can be terminated.

Source of Question: **Bank - TM-CCM #2**

Question 4
011EA1.14
Large Break LOCA
Ability to operate and monitor the following as they apply to a Large Break LOCA: Subcooling margin monitors

During a Large Break LOCA, the operator notes the following trend (from Time 1 to Time 6) indication on Train A and Train B of ICCM subcooling margin monitor (based on Core Exit Thermocouples):

Time 1: 15°F
Time 2: 0°F
Time 3: minus 5°F
Time 4: minus 35°F
Time 5: minus 35°F
Time 6: minus 35°F

(1) Subcooling margin indications are based on the average of the ____________________ .

(2) What is the significance of the subcooling margin monitor indications for Times 4, 5, and 6?

A. (1) 5 highest CETs
(2) Subcooling margin monitor indication is at the bottom of its scale.

B. (1) 5 highest CETs
(2) Unit conditions have stabilized.

C. (1) 40 ACC qualified CETs
(2) Subcooling margin monitor indication is at the bottom of its scale.

D. (1) 40 ACC qualified CETs
(2) Unit conditions have stabilized.

QUESTION 4

Distractor Analysis

A. **CORRECT.** The subcooling margin monitor uses the average of the 5 highest CETs in the calculation for display of subcooling margin. By design, the range of the indication only goes down to a minus 35°F; therefore steam superheated greater than 35°F will still only read minus 35°F. The operator is directed to use additional and alternate means at this point. The question is specific to using ONLY the subcooling margin monitor indication.

B. Incorrect. First part is correct. If an applicant does not recognize and recall that the monitor range only goes down to a minus 35°F, this answer appears correct and is plausible.

C. Incorrect. Using the average of the 40 qualified CETs is plausible since those instruments are considered to be highly reliable for conditions inside containment, including those of a Large Break LOCA (given in the stem). Second part is correct.

D. Incorrect. Plausibility of both parts as described above.

References:
- CNS-1553.NC-00-0001, Design Basis Specification for the Reactor Coolant (NC) System, Section 3.3.1.7.3.1, ICCM - Subcooled Margin Function, Revision 35
- OP-CN-PS-CCM, Lesson Plan for Inadequate Core Cooling Monitor, Section 2.10, "Subcooling Margin Monitor", Revision 100
- OP-CN-TA-AM, Lesson Plan for Accident Mitigation, Section 2.13, "Core Damage Recognition - Core Thermocouples", Revision 100 - for plausibility of distractors for 40 qualified CETs.

KA Match:
The applicant is presented with a Large Break LOCA and then tested on operation of the subcooling margin monitor (functional range of indication); and also tested on how subcooling margin is determined.

Cognitive Level: **High**
Involves association of multiple data points to analyze a trend of a parameter. Based on this analysis, the applicant then must make a conclusion regarding the significance of the indications.

Source of Question: **New**

Question 5
015AA1.23
RCP Malfunctions
Ability to operate and/or monitor the following as they apply to the Reactor Coolant Pump Malfunctions (Loss RC Flow):
RCP vibration

During a small break LOCA the following NCP vibration data are received for 1D NCP:

Time		Shaft Vibration (mils)	Frame Vibration (mils)
2100		5	2
2105		7	4
2110		19	6
2115		22	8

Which ONE of the following is the earliest time at which the NCP trip criteria was MET, in accordance with annunciator response procedures?

A. 2100

B. 2105

C. 2110

D. 2115

QUESTION 5

Distractor Analysis

A. Incorrect. Plausible since one of these values (Frame Vibration) does exceed the normally monitored value. (See attached graphic from the Operator Aid Computer program.) The other value (Shaft Vibration) is plausible since it is close to the high end of what is normally encountered for the reactor coolant pumps, and because the numerical value IS an alarm setpoint, but for a different parameter (Frame Vibration). At this point no vibration value requiring any action has been exceeded.

B. Incorrect. Plausible since both of these values exceed normally expected parameters for the reactor coolant pumps. At this point no vibration value requiring any action has been exceeded.

C. **CORRECT.** The NCP must be tripped if vibration exceeds: shaft 20 mils, or frame 5 mils. At 2110, NCP frame vibration has exceeded the 5 mils frame trip setpoint and is 1 mil below the 20 mils value (for pump shaft vibration) at which a manual trip is required.

D. Incorrect. Plausible: Both setpoints are exceeded at this time, but incorrect because it is not the earliest time. Action should have been already taken by this time.

References:

- OP/1/B/6100/010 G - Annunciator Panel 1AD-6, B/5, "NCP Hi-Hi Vibration", Revision 065
- OP/1/A/6150/002 A, (Reactor Coolant Pump Operation), Limits and Precaution 2.6, Revision 068
- Operator Aid Computer Graphic for Reactor Coolant Pumps

KA Match:
Applicant is provided with a timetable of vibration values for RCP components, and then tested on monitoring these parameters to determine when the RCP should be removed from service. This removal from service would then also constitute a loss of RC flow.

Cognitive Level: **High**
Higher cognitive level since applicant must evaluate multiple data points, including analysis of given parameters to arrive at a conclusion of when and if the RCP must be tripped. This is done also by recalling procedure requirements and applying that knowledge to the timetable of parameter values.

Source of Question: **Bank 611**

Question 6
022AA2.03
Loss of Rx Coolant Makeup
Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Makeup: Failures of flow control valve or controller

Given the following Unit 1 conditions:

- The Unit is at 100% power.
- Annunciator 1AD-6 E/9 (PZR LO LEVEL DEVIATION) is received.
- Pressurizer level is currently 50% and slowly decreasing.
- 1NV-294 valve demand signal indicates 100%.
- 1NV-309 is in auto.

Assuming NO operator action which ONE of the following describes the cause of this transient and what system is currently providing <u>primary</u> cooling to the NCP seals?

A. Tave input to the Pressurizer Level Control System has failed LOW.
KC system via Thermal Barrier Heat Exchanger

B. Total Sealwater Flow Transmitter output has gradually failed LOW.
NV system via Seal Injection

C. Tave input to the Pressurizer Level Control System has failed LOW.
NV system via Seal Injection

D. Total Sealwater Flow Transmitter output has gradually failed LOW.
KC system via Thermal Barrier Heat Exchanger

QUESTION 6

Distractor Analysis

A. Incorrect. Plausible because Low Tave input to the Pressurizer Level Control System causes the Pressurizer Level Setpoint to decrease from 55% to 25%, thereby reducing charging flow in an attempt to lower Pressurizer level. But failure of this input locks in a previous “good” value for Tave which results in a relatively constant Pressurizer level. Also, 1NV-294 valve demand would not indicate 100% if the system were attempting to lower pressurizer level. The second part is also incorrect, but plausible, if the applicant believes that all charging flow will be isolated in an attempt to lower pressurizer level.

B. **CORRECT.** Total Sealwater Flow directly controls the position of 1NV-309. The word “gradually” is important in that it means that the failure has not placed the controller in an alternate action. The gradual failure would cause 1NV-309 to slowly close which would isolate normal charging flow. Since 1NV-309 is downstream of the NCP seal injection line, seal cooling would continue to be supplied via the NV system.

C. Incorrect. Plausible because Low Tave input to the Pressurizer Level Control System would cause the Pressurizer Level Setpoint to decrease from 55% to 25%, thereby reducing charging flow in an attempt to lower Pressurizer level. However, failure of this input would lock in a previous “good” value for Tave which would result in relatively constant Pressurizer level. Also, 1NV-294 valve demand would not indicate 100% if the system were attempting to lower pressurizer level.

D. Incorrect. The first part is correct. Total Sealwater Flow directly controls the position of 1NV-309. The word “slowly” is important in that it means that the failure has not placed the controller in an alternate action. The slow failure would cause 1NV-309 to slowly close which would isolate normal charging flow. The second part is incorrect, but plausible, if the applicant believes that 1NV-309 (NCP Seal Injection Control Valve) is a supply valve rather than backpressure control for NCP seal injection. Thereby, closure of the valve does not isolate NCP seal injection flow.

References:

- OP-CN-PS-ILE Lesson Plan for Pressurizer Level Control Program, Revision 100, Pg. 9, & 23
- OP-CN-PS-NV Lesson Plan for Centrifugal Charging System, Revision 101, Pg. 34, 54, &,109
- OP-CN-PS-NCP Lesson Plan for Reactor Coolant Pump, Revision 100, Pg. 15
- OP/1/B/6100/010G ARP for 1AD-6, E/9, Revision 065

KA Match:
Given indications of reduced Rx Coolant makeup, the applicant is required to determine the cause of the failure and interpret the associated effect on NCP seal injection supply flow.

Cognitive Level: **High**
Applicant must evaluate a set of conditions and apply system and operational knowledge, including a failure mode of a sealwater flow transmitter to diagnose the problem. Applicant then

applies system knowledge to determine system response, including source of cooling to the reactor coolant pump seals.

Source of Question: **New**

Question 7
025AK1.01
Loss of RHR System
Knowledge of the operational implications of the following concepts as they apply to Loss of Residual Heat Removal System:
Loss of RHRS during all modes of operation

Given the following Unit 1 conditions:

- The Unit has entered a refueling outage and is in Mode 5.
- 1A Train ND is OPERABLE and secured.
- 1B Train ND is in service.
- NC temperature is 110°F.
- All S/G NR levels are 10%.
- NC system drain procedure is in progress.
- NC Wide Range level is 22%.

Subsequently:

- ND Pump 1B TRIPS.

In accordance with Technical Specifications, which ONE of the following describes:

(1) A Required Action;

(2) The associated Completion Time for that action,

A. (1) Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet SDM.
(2) Immediately

B. (1) Initiate action to restore required S/G secondary side water levels to within limits.
(2) Immediately

C. (1) Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.
(2) Within 1 hour of 1B ND pump trip

D. (1) Initiate action to restore one RHR loop to operable status and in operation.
(2) Within 1 hour of 1B ND pump trip

QUESTION 7

Distractor Analysis

A. **CORRECT.** In a loops not filled condition and Mode 5 the correct Tech Spec entry and applicability is for Tech Spec. 3.4.8 (Loops not filled) with no RHR loop in operation. Per the Tech Spec the action is correct and has an immediate completion time.

B. Incorrect. Plausible since the applicant could misinterpret the given conditions by concluding that Tech Spec 3.4.7 (Loops Filled) applies. The action is in Tech Spec 3.4.7, but it is the incorrect Tech Spec.

C. Incorrect. Plausible since the applicant could misinterpret the given conditions by concluding that Tech Spec 3.9.5 applies. This Tech Spec does include "Conditions" that match the conditions given in the stem (loss of an RHR train), but the applicability is incorrect. Though there is no "Completion Time" of 1 hour in this specification, it is plausible, since this Completion Time is extremely common throughout the Tech Specs.

D. Incorrect. Plausible since the Tech Spec is correct, AND the action is indeed one of the Required Actions for this specification, but the Completion Time is NOT 1 hour; it is "Immediately".

References:
- Tech Spec 3.4.7, RCS Loops - Mode 5, Loops Filled
- Tech Spec 3.9.5, Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level
- Tech Spec 3.4.8, RCS Loops - Mode 5, Loops Not Filled

KA Match:
The KA is matched because the applicant must determine that a loss of RHR has occurred, and then determine the operational implications of that condition by selecting which Tech Spec applies, including Required Action and Completion Time.

Cognitive Level: **High**
Higher cognitive level since the question involves numerous mental steps, including analysis of given conditions, and application of a Tech Spec involving loops filled vs. not filled conditions.

Source of Question: **Bank 1307**

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

Given the following Unit 1 conditions:

- A LOCA inside containment is occurring.
- Containment pressure peaked at 3.2 psig.
- FWST level decreased to 30%.

(1) The non-essential KC headers are automatically isolated by the _____(1)_____ signal.

(2) This isolation prevents KC pump runout due to the ________(2)________ valves receiving an OPEN signal.

Which ONE of the following completes the above statements?

A. (1) Safety Injection
(2) NDHX Inlet (1KC-56A/81B)

B. (1) Phase B
(2) NDHX Inlet (1KC-56A/81B)

C. (1) Safety Injection
(2) NDHX Outlet (1KC-57A/82B)

D. (1) Phase B
(2) NDHX Outlet (1KC-57A/82B)

QUESTION 8

Distractor Analysis

A. Incorrect. The realignment is by Phase B and for runout protection. Plausible: Safety injection with FWST level <20% isolates the non-essential headers and maximizing cooling to essential loads would be advantageous.

B. **CORRECT.** Since containment pressure peaked at 3.2 psig, this is above the ESFAS setpoint of a containment isolation (Phase B). On a Phase B actuation, the non-essential component cooling water headers to both the Containment and to the Auxiliary Building automatically isolate. Per the approved training materials, and the Design Basis Document, this design protects the KC pumps from runout.

C. Incorrect. Plausible since a Safety Injection did actuate, due to the given conditions (containment pressure). A Safety Injection with FWST level <20% DOES isolate the non-essential headers. But in this case, FWST level is at 30%.

D. Incorrect. The Phase B part is correct. Maximizing cooling to essential loads is plausible since that would be advantageous, and because at some facilities this is the reason for the automatic realignment of Component Cooling for these conditions.

References:

- OP-CN-PSS-KC, Lesson Plan for Component Cooling Water, Revision 100, Pg. 30 & 31
- OP-CN-ECCS-ISE, Lesson Plan for Engineered Safety Features Actuation System (ESFAS), Revision 100, Pg. 24
- CNS-1573.KC-00-001, Design Basis Document for Component Cooling Water, Revision 35, Pg. 30

KA Match:

The KA is matched because the applicant determines that conditions exist (containment pressure and a Phase B) that would cause an automatic realignment of Component Cooling Water, and then demonstrate knowledge of the reason for that automatic realignment.

This question was previously discussed with Chief Examiner on 07/09/13 regarding quality of the KA match. At that time it was deemed as meeting the KA.

Cognitive Level: **High**

The question is higher cognitive level since several conditions are given that require application of system knowledge to determine if an actuation has occurred - a multi-mental step process, including use of that conclusion to select the reason for the realignment.

Source of Question: **Bank 1233 - Sig Mod**

Question 9
029EK3.11
ATWS
Knowledge of the reasons for the following responses as the apply to the ATWS: Initiating emergency boration

Given the following Unit 1 conditions:

Initial:

- The Unit was at 100% power.
- A turbine trip occurred.
- The reactor did NOT trip and could NOT be tripped from the Control Room.

Current:

- Pressurizer pressure is 2350 psig.
- The crew has transitioned to EP/1/A/5000/FR-S.1 (Response to Nuclear Power Generation/ATWS).
- The crew is initiating emergency boration in accordance with Step 4 of FR-S.1.

(1) The required action is to ____________(1)____________.

(2) The reason for that action is to ensure emergency boration flow is at least ____(2)___ .

Which ONE of the following completes the above statements, in accordance with FR-S.1?

A. (1) Ensure ALL NV pumps are ON.
(2) 30 gpm

B. (1) Ensure ALL NV pumps are ON.
(2) 60 gpm

C. (1) Reduce pressurizer pressure to less than 2135 psig.
(2) 30 gpm

D. (1) Reduce pressurizer pressure to less than 2135 psig.
(2) 60 gpm

QUESTION 9

Distractor Analysis

A. Incorrect. The first part is plausible if the applicant reasons that ensuring operation of all charging pumps will improve boration flowrate. The procedure does ensure one pump is in service. The second part is correct.

B. Incorrect. The first part is plausible if the applicant reasons that ensuring operation of all high head injections pumps will improve boration flowrate. The procedure does ensure one pump is in service. The second part is plausible because 60 gpm is the minimum flow requirement for the charging pumps.

C. **CORRECT.** Step 4 (Initiate emergency boration) of FR-S.1 directs the operator to align for the boration and verify a minimum of 30 gpm boration flow. Item f of Step 4 further directs the operator to verify pressurizer pressure is < 2335 psig. This action, per the Background Document for Step 4 is to ensure adequate boration flow is possible and not hindered by high RCS pressure.

D. Incorrect. First part is correct. The second part is plausible because 60 gpm is the minimum flow requirement for the charging pumps.

References:
- EP/1/A/5000/FR-S.1, (Response to Nuclear Power Generation/ATWS), Step 4, Revision 021
- EBG/1/5000/FR-S.1, (Background Document for FR-S.1), Step 4, Revision 011
- CNS-1554.NV-00-0001 Design Basis Document for Chemical and Volume Control System, Revision 38, Pg. 162 & 163

KA Match:
The reason for emergency boration is common knowledge and potential distracters are not discriminating. The KA is matched because the applicant must diagnose that (per conditions listed in the stem) emergency boration will be precluded or significantly limited. This question tests the applicant's knowledge of the method required to establish boric acid flow during ATWS conditions, and the reason (in order to satisfy a minimum flow requirement).

Cognitive Level: **Low**

Source of Question: **Bank - 1876 - Sig Mod**

Question 10
040AK2.02
Steam Line Rupture - Excessive Heat Transfer
Knowledge of the interrelations between the Steam Line Rupture and the following: Sensors and detectors

A Unit shutdown is in progress for a refueling outage with the following conditions:

- Pressurizer pressure is 1800 psig.
- Steam line pressure is 750 psig.

Subsequently:

- A large steam break occurs upstream of 'B' MSIV and outside containment.
- 'B' steam generator completely depressurizes.

(Assume NO manual action is taken after the steam break occurs.)

Which ONE of the following describes:

(1) Which ESF actuation(s) automatically initiated?

(2) What was the initiating parameter?

A. (1) SM Isolation ONLY
(2) HIGH negative rate of "B" steam line pressure

B. (1) SM Isolation ONLY
(2) LOW "B" steam line pressure

C. (1) SI ONLY
(2) HIGH negative rate of "B" steam line pressure

D. (1) SI ONLY
(2) LOW "B" steam line pressure

QUESTION 10

Distractor Analysis

A. **CORRECT.** Safety Injection would have been blocked below P-11 (1955 psig) in order to prevent automatic actuation at the low pressurizer pressure setpoint of 1845 psig. Main Steam Isolation (MSI) would have also been blocked at P-11 in order to prevent an MSI at the low pressure setpoint of 775 psig. However, when the low pressure MSI is blocked, an MSI can still occur due to high rate of decrease (100 psig/sec or 2 psig/sec for 250 sec).

B. Incorrect. First part is correct. Second part is plausible because the applicant may not realize that pressure has previously decreased below the low S/G pressure MSI.

C. Incorrect. Plausible if the applicant realizes that S/G pressure has previously decreased below the MSI setpoint but does not realize that pressurizer low pressure SI is also below setpoint. Second part is correct.

D. Incorrect. Plausible if the applicant does not realize that S/G pressure and pressurizer pressure are below the applicable MSI and SI setpoints. Second part is plausible because the applicant may not realize that pressure has previously decreased below there is a low S/G pressure MSI.

References:
- OP-CN-ECCS-ISE, Lesson Plan for ESFAS, Revision 100, Pg. 21, 29, & 30
- CNS-1593.SM-00-0001, Design Basis Document for Main Steam, Revision 30, Pg. 32

KA Match:
The KA is matched because the applicant must analyze conditions involving a Steam Line Rupture and determine which sensor or instrument detects that condition and then initiates an ESF actuation.

Cognitive Level: **High**
Applicant must analyze unit conditions involving a steam line break, and from the given parameters and conditions determine ESF actuation initiates, including the parameter that caused the initiation.

Source of Question: **Bank - ISE-062-D**

Question 11
054AG2.4.9
Loss of Main Feedwater
Knowledge of low power / shutdown implications in accident (e.g. loss of coolant accident or loss of residual heat removal) mitigation strategies

Given the following Unit 1 conditions:

The Unit was at 4% power during a post refueling startup with 1A CFPT in service.

<u>Subsequently:</u>

The following events occur at the listed times:

- 1000 1A CFPT trips due to low oil pressure.
- 1003 An NC system leak develops.
  PZR pressure is 2220 psig and decreasing at 2 psig/min.
  PZR level is 26% and decreasing at 0.3%/minute.
- 1005 1C NCP trips on underfrequency.
- 1008 Containment pressure reaches 1.2 psig.

Which ONE of the following is the EARLIEST time at which the reactor will be tripped based on a setpoint or manual action taken by procedures?

A. 1000

B. 1003

C. 1005

D. 1008

QUESTION 11

Distractor Analysis

A. Incorrect. Plausible because AP/1/A/5500/006 requires a manual reactor trip if CF flow is lost above 5% reactor power.

B. Incorrect. Plausible because AP/1/A/5500/010 requires a manual reactor trip if pressurizer level cannot be maintained greater than 4% or pressurizer pressure is decreasing in an uncontrolled manner. The applicant should determine that the pressure and level decrease provided can be addressed by the procedure.

C. **CORRECT.** The Immediate Action step of AP/1/A/5500/004 (Loss of Reactor Coolant Pump) is to verify all control banks inserted. If not, a manual reactor trip is required.

D. Incorrect. Plausible because this is a reactor trip and safety injection setpoint. However, the reactor should have been previously tripped due to loss of RCP.

References:
- OP-CN-ECCS-ISE Lesson Plan for ESFAS, Revision 100, Pg. 20
- OP-CN-IC-IPX Lesson Plan for Reactor Protection, Revision 100, Pg. 20
- AP/1/A/5500/006 Loss of S/G Feedwater, Revision 41, Case I, Step 1
- AP/1/A/5500/010 Reactor Coolant Leak, Encl. 2, Revision 57, Step a.1.a
- AP/1/A/5500/004 Loss of Reactor Coolant Pump, Revision 15, Step 1

KA Match:
The applicant is required to apply mitigative strategies concerning proper procedure application when faced with multiple events, including a loss of coolant accident and loss of feed experienced at low power.

Cognitive Level: **High**
Multiple data points are given, requiring the applicant to analyze these, and in the context of a timetable, and then predict when the reactor trip occurs.

Source of Question: **New**

Question 12
056AA1.25
Loss of Off-site Power
Ability to operate and/or monitor the following as they apply to the Loss of Offsite Power: Main steam supply valve control switch

Given the following Unit 1 conditions:

- The Unit tripped due to a complete loss of offsite power.
- The crew completed the Immediate Actions of EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
- The crew transitioned to EP/1/A/5000/ES- 0.1 (Reactor Trip Response), and is at Step 2 RNO of ES.01 which reads as follows:

Perform the following:

a. **IF** loss of offsite power has occurred,
THEN perform the following:

__ • CLOSE all MSIVs.
__ • CLOSE all MSIV bypass valves.

(1) The basis for performing this step is that the ___________(1)____________ may OPEN due to loss of power.

(2) This step is accomplished by depressing ____________(2)_______________.

Which ONE of the following completes the above statements?

A. (1) Steam dumps
(2) Two Main Steam Isolation “Initiate” pushbuttons

B. (1) Steam dumps
(2) Four Main Steam Isolation Valve “Close” pushbuttons

C. (1) Steam drain line bypass valves to the condenser
(2) Two Main Steam Isolation “Initiate” pushbuttons

D. (1) Steam drain line bypass valves to the condenser
(2) Four Main Steam Isolation Valve “Close” pushbuttons

QUESTION 12

Distractor Analysis

A. Incorrect. The first part is plausible if the applicant misapplies the effects of a loss of power, and concludes that this de-energizes the steam dump control circuit. The second part is plausible if the applicant does not understand the effects of operating the Main Steam Isolation switch and believes this is an acceptable/easier means of accomplishing MSIV closure.

B. Incorrect. The first part is plausible if the applicant misapplies the effects of a loss of power, and concludes that this de-energizes the steam dump control circuit. The second part is correct.

C. Incorrect. First part is correct. The second part is plausible if the applicant does not understand the effects of operating the Main Steam Isolation switch and believes this is an acceptable/easier means of accomplishing MSIV closure.

D. **CORRECT**. Per the EP/1/A/5000/ES-0.1 Background Document:
"Following a loss of offsite power, the 2" steam drain line bypass valves to the condenser may fail open, and the steam supply to the MSRs may fail to isolate. These conditions may cause an excessive steam demand on the secondary side which has resulted in two safety injections at McGuire Nuclear Station, and has complicated post LOOP recovery at CNS. Closing the MSIVs at this point is designed to reduce the steam demand and allow the operators time to perform actions in the next step to limit any further cooldown without getting an S/I, or creating other conditions that may complicate recovery from the event."
The direction given by ES-0.1 is to close MSIVs. If Main Steam Initiation is preferred/allowable, specific guidance will be given (see Step 16 RNO of E-0 for reference). Main Steam Isolation would defeat automatic operation of the S/G PORVs. Since steam dumps are not available (due to loss of condenser circulating water), the only remaining means of S/G heat removal would be S/G Safety Valves and manual PORV operation.

References:
- EBG/1/5000/ES-0.1, Background Document for ES-0.1 (Reactor Trip Response), Step 2, Revision 021
- OP-CN-STM-SM, Lesson Plan for Main Steam System, Revision 100, Pg. 21
- EP/1/A/5000/ES-0.1 (Reactor Trip Response), Revision 38, Step 2 RNO
- EP/A/A/5000/E-0 (Reactor Trip or Safety Injection), Revision 41, Step 16 RNO

K/A Match
Given a scenario involving a loss of offsite power and necessity to operate Main Steam Isolation Valves, the applicant is required to determine the basis for this action. Also, the applicant is required to demonstrate knowledge of operation of the control switches for the Main Steam Isolation Valves.

Cognitive Level: **Low**

Source of Question: **New**

Question 13
062AG2.4.21
Loss of Nuclear Svc Water
Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc.

During the performance of AP/0/A/5500/020, (Loss of Nuclear Service Water), Case I, "Loss of RN Train", Step 8, the operator is directed to verify that each operating RN pump has the required minimum flow.

If not, a certain amount of flow will be directed through the _____(1)_____, not to exceed ______(2)_____ in order to avoid flow induced vibration problems.

Which ONE of the following completes the above statement?

A. (1) KC Hx
(2) 4650 gpm

B. (1) NS Hx
(2) 4650 gpm

C. (1) KC Hx
(2) 2550 gpm

D. (1) NS Hx
(2) 2550 gpm

QUESTION 13

Distractor Analysis

A. Incorrect. Plausible because normal minimum flow requirements of the RN pumps is accomplished by flow through the idle KC HX(s). Second part is correct.

B. **CORRECT.** AP/0/A/5500/020 directs operators to align flow through NS HX(s) as needed if any operating RN pump flow is less than 8600 gpm. The procedure also requires flow to be maintained below 4650 gpm in order to reduce flow induced vibration.

C. Incorrect. Plausible because normal minimum flow requirements of the RN pumps is accomplished by flow through the idle KC HX(s). The second part is plausible because 2550 gpm represents the NS HX RN outlet flow low annunciator.

D. Incorrect. The first part is correct. The second part is plausible because 2550 gpm represents the NS HX RN outlet flow low annunciator.

References:

- AP/0/A/5500/020, (Loss of Nuclear Service Water), Case I, "Loss of RN Train", Step 8, Revision 042
- OP/1/A/6100/010M Annunciator Response Procedure for 1AD-12, E/1, Revision 040
- OP-CN-PSS-RN, Lesson Plan for Nuclear Service Water, Revision 103, Pg. 27 & 28

KA Match:

The KA match may not be immediately obvious, but preserving the NS heat exchanger is important to the "CONTAINMENT" safety function. A parameter used to assess the readiness, or availability of this system is flow through the heat exchanger.

Cognitive Level: **Low**

Source of Question: **New**

Question 14
065AA2.05
Loss of Instrument Air
Ability to determine and interpret the following as they apply to the Loss of Instrument Air: When to commence plant shutdown if instrument air pressure is decreasing

Given the following plant conditions:

- Both Units are at 100% power.
- A seismic event has occurred.
- The crew is performing actions of AP/0/A/5500/022 (Loss of Instrument Air).
- All available Instrument Air Compressors are running and loaded.
- Instrument Air pressure continues to DECREASE.

In accordance with AP/22:

(1) What is the LOWEST Instrument Air pressure at which the CRS is required to direct a reactor trip?

(2) What is the reason for performing this action?

A. (1) 55 psig
(2) Loss of normal feedwater supply to S/G(s)

B. (1) 60 psig
(2) Loss of S/G heat removal capability

C. (1) 55 psig
(2) Loss of S/G heat removal capability

D. (1) 60 psig
(2) Loss of normal feedwater supply to S/G(s)

QUESTION 14

<u>Distractor Analysis</u>

A. **CORRECT.** Step 1, Enclosure 3 of AP/22 directs tripping the reactor if VI pressure is < 55 psig and decreasing. Per the AP/22 background document, the basis for this action is that the CF supply valves to the S/Gs may become erratic at 50 psig. Therefore, 55 psig was chosen as a conservative measure.

B. <u>Incorrect.</u> Plausible because step 18 of AP/22 directs action at 60 psig to align backup air cylinders to operating instrument air compressors. The basis of S/G heat removal is incorrect, but plausible since the same step that directs a reactor trip also directs closure of MSIVs. MSIVs are also air operated. Valve closure is an additional concern on lowering instrument air pressure and addressed in step 7, Enclosure 3 of AP/22. However, the stated basis for the reactor trip at 55 psig (lowering) is erratic CF Flow Control Valve operation.

A. <u>Incorrect.</u> Step 1, Enclosure 3 of AP/22 directs tripping the reactor if VI pressure is < 55 psig and decreasing. The basis of S/G heat removal is incorrect, but plausible since the same step that directs a reactor trip also directs closure of MSIVs. MSIVs are also air operated. Valve closure is an additional concern on lowering instrument air pressure and addressed in step 7, Enclosure 3 of AP/22. However, the stated basis for the reactor trip at 55 psig (lowering) is erratic CF Flow Control Valve operation.

B. <u>Incorrect.</u> Plausible because step 18 of AP/22 directs action at 60 psig to align backup air cylinders to operating instrument air compressors. The basis of losing CF supply to S/Gs is correct. Per the AP/22 background document, the basis for this action is that the CF supply valves to the S/Gs may become erratic at 50 psig. Therefore, 55 psig was chosen as a conservative measure.

<u>References</u>:

- AP/0/A/5500/022 Loss of Instrument Air, Revision 34, Step 18 and Encl. 3, Step 1
- APBG/0/5500/022 Background Document for Loss of VI, Revision 02, Encl 3, Step 1

<u>K/A Match</u>
The applicant is required to determine when a reactor shutdown is required due to decreasing instrument air pressure based on given plant conditions along with interpreting the reasoning for performing this action.

<u>Cognitive Level:</u> **Low**

<u>Source of Question:</u> **New**

Question 15
077AK3.02
Generator Voltage and Electric Grid Disturbances
Knowledge of the reasons for the following responses as they apply to Generator Voltage and Electric Grid Disturbances:
Actions contained in abnormal operating procedure for voltage and grid disturbances

Note the step below from AP/1/A/5500/037 (Generator Voltage and Electric Grid Disturbances):

- Select "MANUAL" on turbine control panel.

The above direction is given ONLY in ______(1)______ in order to ______(2)______.

Which ONE of the following completes the above statement?

A. (1) Case I (Abnormal Generator or Grid Voltage)
(2) manually lower reactor power to less than 69%

B. (1) Case I (Abnormal Generator or Grid Voltage)
(2) ensure reactor power does not exceed 100%

C. (1) Case II (Abnormal Generator or Grid Frequency)
(2) manually lower reactor power to less than 69%

D. (1) Case II (Abnormal Generator or Grid Frequency)
(2) ensure reactor power does not exceed 100%

QUESTION 15

Distractor Analysis

A. Incorrect. Case I (Abnormal Generator or Grid Voltage) is plausible because direction IS given in Case I regarding reactor power (See Step 3 RNO.b). It is not for ensuring reactor power is less than or equal to 100%. Plausible to manually lower reactor power to the point where the turbine/generator can be tripped (thinking in terms of protecting the generator) without tripping the reactor; i.e., 69%. Also plausible to manually lower reactor power (as opposed to automatically) because the NOTE just prior to Step 10.a in the abnormal procedure for Rapid Downpower (AP/09) explains that manual mode must be used for load reduction rates greater than 25 MW/Min. Since the stem conditions could be interpreted as a situation requiring a rapid load reduction, the applicant selects this answer based only on the "manually" aspect.

B. Incorrect. Second part is correct. Case I (Abnormal Generator or Grid Voltage) is plausible because direction IS given in Case I regarding reactor power (See Step 3 RNO.b). It is not for ensuring reactor power is less than or equal to 100%.

C. Incorrect. First part is correct. Plausible to manually lower reactor power to the point where the turbine/generator can be tripped (thinking in terms of protecting the generator) without tripping the reactor; i.e., 69%.

D. **CORRECT.** Per AP/37, Case II, Step 3, the operator is directed to verify reactor power is less than or equal to 100%. Since the turbine control system will attempt to maintain 1800 rpm/60.0Hz, the concern is that the turbine control valves will open, and reactor power may exceed 100%.

References:

- AP/1/A/5500/037, (Generator Voltage and Electric Grid Disturbances), Case I, Step 3 & Case II, Step 3, Revision 03
- OP-CN-AP-37, Lesson Plan for Generator Voltage and Electric Grid Disturbances, Revision 1, Pg. 9
- AP/1/A/5500/009, (Rapid Downpower), Revision 028, NOTE just prior to Step 10.a explains that any load reduction rate greater than 25 MW/Min must be performed in the manual mode

KA Match:
The KA is matched because the applicant is given a step from the procedure for Generator Voltage and Electric Grid Disturbances, and then tested on why that step is performed.

Cognitive Level: **Low**

Source of Question: **New**

Question 16
WE04EK2.2
LOCA Outside Containment
Knowledge of the operational implications of the following concepts as they apply to the (LOCA Outside Containment)
Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility

Given the following Unit 1 initial conditions:

- The Unit was at 100% power.

Subsequently:

- At 0200: The reactor tripped due to a LOCA outside containment.
- At 0210: The crew entered EP/1/A/5000/ECA-1.2, (LOCA Outside Containment).
- At 0220: The crew entered EP/1/A/5000/ECA-1.1, (Loss of Emergency Coolant Recirc).
- At 0240: The crew is at the step in ECA-1.1 for determining NC subcooling.

Current Conditions:

- NCS pressure is 1100 psig.
- 1B NC pump is running.
- 1A, 1C, and 1D NC pumps have been secured.
- Reactor Vessel D/P is 20%.
- 1A NI pump is running with flow indicated at 220 gpm.
- 1A NV pump is running with flow indicated at 385 gpm.
- Both ND pumps are OFF.
- No NS pumps are running.
- Subcooling is 35°F.

(1) What is the minimum required injection flowrate?

(2) Which, if any, pump can be secured?

Reference Provided

A. (1) 210 gpm
(2) 1A NV pump ONLY

B. (1) 210 gpm
(2) 1A NI pump ONLY

C. (1) 408 gpm
(2) 1A NI pump ONLY

D. (1) 408 gpm
(2) NEITHER pump

QUESTION 16

Distractor Analysis

A. Incorrect. Required flow is 408 gpm. Plausible: applicant misses the fact that the graph starts at 10 minutes; this is the 50 minute number.

B. Incorrect. Incorrect: required flow is 408 gpm, the NV pump is providing 385 gpm, and the NI pump may not be stopped.

C. Incorrect. First part is correct. Plausible if applicant determines incorrect flowrate required.

D. **CORRECT.** Time after trip is 40 minutes, graph starts at 10 minutes, flow required is 408 gpm.

References:
- EP/1/A/5000/ECA-1.1, Step 18, Revision 040
- EP/1/A/5000/ECA-1.1, Enclosure 4 (Minimum S/I flowrate Versus Time After Trip), Revision 040

Provide to Applicant:
- EP/1/A/5000/ECA-1.1, Step 18, Revision 040
- EP/1/A/5000/ECA-1.1, Enclosure 4 (Minimum S/I flowrate Versus Time After Trip), Revision 040

KA Match:
The KA is matched because the applicant must diagnose that a LOCA outside of containment has occurred. With that diagnosis, the applicant demonstrates knowledge of the operational implications of the condition by using a provided curve to determine a minimum required injection flowrate. An additional aspect of the KA is matched by testing knowledge of how injection pumps are to be operated for these conditions.

Cognitive Level: **High**
Applicant is presented with numerous operating parameters, and must analyze these to determine a required injection flowrate. These parameters do affect which requirement applies. Requires use and interpretation of a graph to determine required pump operation.

Source of Question: **Bank 521 - 2008 NRC exam (exact KA match)**

Question 17
WE05EK2.1
Inadequate Heat Transfer - Loss of Secondary Heat Sink
Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following:
Components and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes and automatic and manual features

Given the following Unit 2 conditions:

Initial:

- The Unit was at 100% power.

Subsequently:

- A medium break LOCA occurred inside containment.
- Containment pressure peaked at 2.7 psig and is slowly decreasing.
- The crew has implemented EP/2/A/5000/FR-H.1 (Response to Loss of Secondary Heat Sink).
- All attempts to restore flow to the S/Gs from the CA system have NOT been successful.

In accordance with FR-H.1:

(1) The next prioritized source of feedwater for restoration of flow to the S/Gs is through the CM/CF system using a ______________________(1)______________________ .

(2) The crew is FIRST required to establish bleed and feed when W/R level in at least 3 S/Gs decreases to less than ______(2)______?

A. (1) main feedwater pump
(2) 24%

B. (1) main feedwater pump
(2) 36%

C. (1) hotwell and booster pump ONLY
(2) 24%

D. (1) hotwell and booster pump ONLY
(2) 36%

QUESTION 17

Distractor Analysis

A. **CORRECT.** Per the procedure, once attempts at using CA have failed, the next attempt is made for CF pumps (assuming all conditions are met including steam supply and condenser vacuum. However it takes time, and depressurizing to allow CM to supply the S./G is quicker so they may think that this would be better. 24% is the correct % level, however with ACC numbers (had cont pressure exceeded 3 psig), then 36% would be correct.

B. Incorrect. The first part is correct. The second part is plausible because 36% is the ACC value for Feed and Bleed initiation. This would be the correct answer if containment pressure exceeded 3.0 psig.

C. Incorrect. First part is plausible because Hotwell/Booster Pumps are a valid source of feedwater used subsequently in FR-H.1 (if Main Feedwater Pumps are unsuccessful). These pumps are also required to be in operation early in FR-H.1 because they will be necessary to supply water to the Main Feedwater Pumps. Second part is correct.

D. Incorrect. First part is plausible because Hotwell/Booster Pumps are a valid source of feedwater used subsequently in FR-H.1 (if Main Feedwater Pumps are unsuccessful). These pumps are also required to be in operation early in FR-H.1 because they will be necessary to supply water to the Main Feedwater Pumps. The second part is plausible because 36% is the ACC value for Feed and Bleed initiation. This would be the correct answer if containment pressure exceeded 3.0 psig.

References:
- EP/2/A/5000/FR-H.1 (Response to Loss of Secondary Heat Sink), Steps 5, 10, & 19, Revision 041
- EBG/1/A/5000/FR-H.1 Background Document, Step 10, Revision 04

KA Match:
The KA is matched because the applicant diagnoses a Loss of Secondary Heat Sink (no Aux Feed flow is available). "Functions of safety systems" and "manual features" is matched by testing the ability to prioritize next available sources of feedwater and failure modes (NO feedwater available and initiation of bleed and feed).

Cognitive Level: **High**
Question may initially appear to be a low cog question; but it is a higher cognitive level because the applicant must discern that, based on containment pressure (non-ACC), a different requirement applies for priority of feedwater sources and initiation of bleed and feed, based on a S/G level.

Source of Question: **Bank - 1028**

Question 18
WE11EA2.2
Loss of Emergency Coolant Recirc.
Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation)
Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments

Given the following Unit 1 conditions:

- An NC system LOCA occurred on Unit 1.
- 1NI-184B and 1NI-185A (Containment Sump Isolation Valves) are CLOSED and CANNOT be opened.
- EP/1/A/5000/ECA-1.1 "Loss of Emergency Coolant Recirculation" was entered.
- All NC pumps are OFF.
- Minimum ECCS flow to remove decay heat has been established.

In accordance with ECA-1.1, the operator will increase NCS make-up flow if...

A. Reactor Vessel D/P is 12% and stable.

B. Pressurizer level is 2% and decreasing.

C. RVLIS Lower Range (LR) is 64% and stable.

D. Core Exit Thermocouples are 650°F and increasing.

QUESTION 18

Distractor Analysis

A. Incorrect. This is plausible, since it would be correct IF NC Pump 1A or 1C were on. There are NO NC pumps on, therefore, this answer is not correct.

B. Incorrect. Pressurizer level is used in determining SI reinitiation criteria in other emergency procedures; e.g., FR-I.2 (Response to Low Pressurizer Level) Step 8, but not in ECA-1.1.

C. Incorrect. RVLIS criteria for raising flow is 61%.

D. **CORRECT.** 1ECA-1.1 requires the operator to raise RCS make-up flow if either the CETCs rise or if the RVLIS Lower Range (LR) decreases to less than 61%. This is less restrictive than criteria used in other emergency procedures to raise ECCS flow because of the objective to conserve FWST water.

References:
- EP/1/A/5000/ECA-1.1, (Loss of Emergency Coolant Recirculation), Step 25, Revision 40
- EP/1/A/5000/FR-I.2, (Response to Low Pressurizer Level), Step 8, Revision 08

KA Match:
The KA is matched because ECA-1.1, Loss of Emergency Coolant Recirculation conditions exist. "Adherence to appropriate procedures and operation within the limitations...." is met by testing knowledge of the procedure guidance for adjustment of makeup flow and when that needs to be performed.

Cognitive Level: **Low**

Source of Question: **Bank - Braidwood 2009 NRC Exam - Sig Mod**

Question 19
001AK2.08
Continuous Rod Withdrawal
Knowledge of the interrelations between the Continuous Rod Withdrawal and the following:
Individual rod display lights and indications

Given the following Unit 1 conditions:

- AP/1/A/5500/015 (Rod Control Malfunction) is entered due to continuous rod movement.
- Rods have been placed in manual.
- Initial group demand was 85 steps withdrawn on Control Bank D.
- Final group demand was 101 steps withdrawn on Control Bank D.

Subsequently:

- Rod D-4 DRPI experiences a Data A Failure.
- Rod M-12 DRPI experiences a Data B Failure.

(All rods are at the same actual height and in Control Bank D.)

Rod D-4 indicates ___(1)___ steps withdrawn and rod M-12 indicates ___(2)___ steps withdrawn.

Which ONE of the following completes the above statement?

A. (1) 102
(2) 96

B. (1) 108
(2) 90

C. (1) 96
(2) 102

D. (1) 90
(2) 108

QUESTION 19

Distractor Analysis

A. Incorrect. Plausible if the applicant reverses the rod position indications provided by "A" and "B" coils.

B. Incorrect. The first part is plausible if the applicant miscalculates the difference in actual rod height and next available coil (108 – 101 steps) or believes that the rod will be seen by the next available coil which is 7 actual steps away. The second part is plausible if the applicant does not understand that the next available data coil should see the rod at a difference of one step away.

C. **CORRECT.** Data A failures indicate only in multiples of 12 starting with 12. (12,24,36..). Data B failures indicate only in multiples of 12 starting with 6. (6, 18, 30..) Accuracy is -10, +4 when in half accuracy due to data failures.

D. Incorrect. Plausible if the applicant reverses the rod position indications provided by "A" and "B" coils and applies the same logic stated in Answer B distractor analysis.

References:

- OP-CN-IC-EDA, Lesson Plan for Digital Rod Position Indication, Revision 100, Pg. 17 and 42
- AP/1/A/5500/015 (Rod Control Malfunction), Revision 14, Case II, Step 1

KA Match:
The question involves a Continuous Rod Withdrawal and subsequent failure. The KA is also matched by then testing knowledge of how that affects the expected rod display indications.

Cognitive Level: **High**
This is a higher cognitive level question because recall of alarm functions for control rod position indicating systems is applied to determine the impact and expected indication, based on the alarm condition. More than one mental step is involved, therefore, this is a higher cognitive level question.

Source of Question: **Bank - 4516**

Question 20
036AK1.02
Fuel Handling Accident
Knowledge of the operational implications of the following concepts as they apply to Fuel Handling Incidents: SDM

Given the following Unit 1 conditions:

- For a planned refueling outage, the Unit entered Mode 3 at 2120 on 08/12/2013.

Current Conditions:

- The Unit is in Mode 6.
- NC boron concentration is 2780 ppm.
- At 1915 on 08/15/2013 a fuel bundle has been placed in the upender for transport to Spent Fuel Pool storage.

In accordance with ____________(1)____________ , the Required Action is to ______________(2)_____________ immediately.

A. (1) SLC 16.9-17, Refueling Operations - Decay Time
(2) suspend core alterations

B. (1) SLC 16.9-17, Refueling Operations - Decay Time
(2) restore boron concentration to within COLR limits

C. (1) Tech. Spec. 3.9.1, Boron Concentration
(2) suspend core alterations

D. (1) Tech. Spec. 3.9.1, Boron Concentration
(2) restore boron concentration to within COLR limits

QUESTION 20

Distractor Analysis

A. **CORRECT.** The information given in the stem meets the requirement for refueling boron concentration of Tech. Spec. 3.9.1. However, the given time since shutdown of 69 hours and 55 minutes violates SLC 16.9-17 requirement of 72 hours. The required action of this commitment is to suspend movement of irradiated fuel in the reactor vessel.

B. Incorrect. The first part is correct. The second part is plausible because this is one of the required actions of Tech. Spec. 3.9.1 (along with suspend core alterations).

C. Incorrect. The first part is plausible because Tech. Spec. 3.9.1 is related to refueling and actually contains the correct required action. The applicant may not know the required refueling concentration. The second part is correct.

D. Incorrect. The first part is plausible because Tech. Spec. 3.9.1 is related to refueling and actually contains the correct required action. The applicant may not know the required refueling concentration. The second part is plausible because this is one of the required actions of Tech. Spec. 3.9.1 (along with suspend core alterations).

References:

- Technical Specification 3.9.1 Refueling Boron Concentration, Pg. 1
- Selected License Commitment 16.9-17 Refueling Operations-Decay Time, Revision 0, Pg. 1
- Core Operating Limit Report, Unit 1, Cycle 21, Revision 0, Pg. 28

KA Match:

The KA is matched because conditions involve a fuel handling incident; i.e., placing a fuel bundle in the incorrect location AND prior to when allowed, is a fuel handling incident.

The Shutdown Margin implications aspect of this KA was a challenge to match with an operationally valid question. The "operational implications of SDM" is met because it tests what is operationally required, and, though the question does not specifically ask WHY, it is inherent in the specification itself; i.e., to address shutdown margin requirements.

Cognitive Level: **High**

Involves analysis of conditions to determine if a Tech. Spec. entry is required. Applicant must recognize the significance of the time since Mode 3 entry, and the determine the effect that has on which guidance applies. Once that determination is made, the applicant must recall the Required Action.

Source of Question: **New**

Question 21
037AA1.02
Steam Generator Tube Leak
Ability to operate and/or monitor the following as they apply to the Steam Generator Tube Leak: Condensate exhaust system

Given the following Unit 1 conditions:

- Unit 1 is at 100% power.
- 1A S/G has developed a 200 GPD tube leak.
- 1EMF-33 (CSAE Discharge) Trip 2 light is LIT.
- The following annunciator is alarming:
  - 1RAD-1, B/1, 1EMF-33 CSAE EXHAUST HI RAD

For the above conditions, and PRIOR TO any operator action, which ONE of the following describes whether the as-found configuration of the control switch and indication in the photo above is CORRECT and why or why not?

A. INCORRECT configuration. The VA light should be LIT due to automatic swapover caused by 1EMF-33 reaching its Trip 2 setpoint.

B. INCORRECT configuration. The switch should have already been in AUTO, to enable CSAE exhaust automatic swapover to Aux. Bldg. (VA) filtered exhaust immediately upon 1EMF-33 reaching its Trip 2 setpoint.

C. CORRECT configuration. Swapover of the CSAE exhaust to Aux. Bldg. (VA) filtered exhaust will ONLY occur when the operator OPENS 1ABF-D-11 and 1ABF-D-4.

D. CORRECT configuration. Swapover of the CSAE exhaust to Aux. Bldg. (VA) filtered exhaust will ONLY occur when the operator takes the switch to the AUTO position.

QUESTION 21

Distractor Analysis

A. Incorrect. It is plausible for an applicant to misunderstand the function of the control and indicating light, by reasoning that a high radiation condition in the CSAE exhaust stream is of such importance (due to environmental release concerns) that the high radiation would override the existing normal switch configuration.

B. Incorrect. It is plausible to believe the normal position for this control switch would be in the AUTO position, so that automatic and immediate swapover of the CSAE exhaust from the Unit Vent (directly to atmosphere) to a filtered and monitored flowpath would occur upon a high radiation signal from the radiation monitor in the normal CSAE exhaust flowpath. However, the normal operating position for this switch is to maintain it in the UNIT VENT position. Ensuring it gets placed to AUTO upon a high radiation is controlled as an Immediate Action in the Annunciator Response Procedure for high radiation in the CSAE normal exhaust flowpath.

C. Incorrect. Plausible, since the switch and light configuration are correct (in the as expected state). In this case, the applicant has incorrectly applied a correct Immediate Action from the Annunciator Response Procedure and incorrectly concluded that the damper repositioning is what completes the required operation to reroute the CSAE exhaust to the Auxiliary Building filtered exhaust unit.

D. **CORRECT.** This switch, though it has an AUTO position, is normally maintained in the UNIT VENT position, which ensures that the CSAE (Condenser Steam Air Ejector) exhaust is normally routed to the main Unit Vent stack. If high radiation is detected in the CSAE exhaust by radiation monitor 1EMF-33, and the Trip 2 setpoint is reached, the annunciator response procedure directs the operator to immediately place the switch to the AUTO position. With the standing Trip 2 signal from 1EMF-33, the CSAE exhaust will swap to the Auxiliary Building filtered exhaust unit as soon as the switch is repositioned to AUTO.

References:

- AP/1/A/5500/010, (Reactor Coolant Leak), Case I, "Steam Generator Tube Leak", Step 12, including RNO, Revision 057
- 1RAD-1, B/1, 1EMF-33 CSAE Exhaust Hi Rad (alarm response), Revision 064

KA Match:

The K/A is matched because the applicant is presented with a photo of the MRSS controls and tested on the ability to evaluate if the configuration of the control is correct for the given plant conditions, and why it is correct. In testing the applicant in this manner, the K/A is further met as follows: Though this switch has an auto feature, the applicant must know that it is normally maintained in UNIT VENT position, and that this is done so that the operators, when directed by Immediate Actions in the procedure, will operate the control for the auto feature to realign the exhaust through a filtered path.

Cognitive Level: **High**

This is a high cognitive level question because it involves more than one mental step to arrive at the correct answer. There is recognition involved (of switch position), but the applicant must go beyond that and apply understanding of the function of each position of the pictured control, and then determine if the configuration is correct for the given plant conditions, and why.

Source of Question: **Bank - CNS 2010 NRC Exam**

Question 22
051AK3.01
Loss of Condenser Vacuum
Knowledge of the reasons for the following responses as they apply to the Loss of Condenser Vacuum:
Loss of steam dump capability upon loss of condenser vacuum

Given the following Unit 1 condition:

- The reactor tripped from 100% power due to a loss of off-site power.
- The Backup Diesel VI Compressor has been placed in operation.

NC system heat removal will be via the ________(1)________, because ___________________(2)_____________________ .

Which ONE of the following completes the above statement?

A. (1) S/G PORVs
(2) C-9 functions to prevent overpressurizing the main condenser.

B. (1) S/G Safeties
(2) Loss of power will prevent operation of other heat removal capabilities.

C. (1) Condenser Dumps
(2) The plant trip controller provides the most precise temperature control.

D. (1) S/G PORVs
(2) Steam dump control power will be lost.

QUESTION 22

Distractor Analysis

A. **CORRECT.** The S/G PORVs operate at a lower setpoint than S/G safeties but require an air supply to operate automatically. On a loss of offsite power, the instrument air compressors may be powered from the blackout buss but require manual start. Also, the S/G PORVs may be operated via a backup Nitrogen supply (but this requires the operator to place the control mode in manual and manually adjust valve position). Therefore, the additional bullet stating that the Backup Diesel Instrument Air Compressor has been placed in service informs the applicant that a motive force is available and removes confusion concerning which operator actions have been taken.

B. Incorrect. The lift setting of S/G safeties (1175 psig) is greater than that of S/G PORVs (1125 psig). Plausible if the applicant does not know the lift set points and/or does not understand that S/G PORVs do not require offsite power to operate.

C. Incorrect. Loss of offsite power will inhibit the interlock (C-9) required for condenser dump operation. Plausible if the applicant does not understand that the loss of offsite power translates into a loss of condenser circulating water pumps which prevents the C-9 interlock from being satisfied.

D. Incorrect. Steam Dump controllers have battery backup. Plausible if applicant is unaware of controller power supply.

References:

- OP-CN-STM-IDE Lesson Plan for Steam Dump, Revision 100, Pg. 9 & 15
- OP-CN-STM-SM Lesson Plan for Main Steam, Revision 100, Pg. 12 & 14

KA Match:

The KA is matched because the question establishes conditions in which a loss of condenser vacuum and loss of steam dump capability would occur. The loss of offsite power would de-energize all condenser circulating water pumps resulting in a loss of vacuum. Condenser steam dump operation would be inhibited by permissive C-9 (which requires at least one condenser circulating water pump breaker closed and 2/3 condensers greater than 15” Hg). Atmospheric steam dump operation would be inhibited by the control circuitry which blocks operation with a reactor trip. Reactor trip would have been caused by a loss of reactor coolant pumps upon loss of offsite power. This question tests the applicant’s ability to determine which component(s) (i.e. steam dumps) would still function with a loss of condenser vacuum resulting from a loss of power. The question also tests the applicant’s knowledge of the reason for prohibited steam dump operation for the conditions listed.

Cognitive Level: **High**

Involves several system knowledge applications, including the effect of the loss of power on condenser vacuum, and that effect on a permissive function for use of S/G PORVs, and is therefore, a higher cognitive level question.

Source of Question: **New**

Question 23
059AA2.02
Accidental Liquid RadWaste Rel.
Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release:
The permit for liquid radioactive-waste release

Given the following LWR (Liquid Waste Release) Permit Report excerpt for a planned release of Recycle Monitor Tank "A":

See Attached Liquid Waste Release Permit Report excerpt (1 page)

(1) In accordance with SLC 16.11-2, Radioactive Liquid Effluent Monitoring Instrumentation, which item on the provided LWR excerpt will require that additional sampling be performed prior to the release?

(2) If the concentration of radioactive material released to unrestricted areas exceeds the limits specified on the Liquid Waste Discharge Permit Report and in SLC 16.11-1 (Liquid Effluents) the concentration must be restored to within limits _________(2)_________ discovery.

Which ONE of the following completes the above statements?

A. (1) "Setpoint Data"
   (2) within one hour of

B. (1) "Setpoint Data"
   (2) immediately upon

C. (1) "RL Pump Data"
   (2) immediately upon

D. (1) "RL Pump Data"
   (2) within one hour of

QUESTION 23

Distractor Analysis

A. Incorrect. EMF-49 is the correct reason. "Within one hour of discovery" is plausible since there are many Completion Times throughout the Selected Licensee Commitments and Tech. Specs. with that Completion Time.

B. **CORRECT.** Per SLC 16.11-1, if the concentration of radioactive material released in liquid effluents to Unrestricted Areas is not within limits the required action is to restore concentration to within limits immediately. SLC 16.11-2 requires that EMF-49 be functional for the release. If it is not, two independent samples are required prior to the release.

C. Incorrect. The Completion Time is correct. "RL Pump Data" is plausible since there are normally more than one RL pumps in service for most plant conditions, AND because there is one item in SLC 16.11-2 directly related to the RL system: item 3.c. But this item is for a flow interlock, and not the number of RL pumps assigned to the release.

D. Incorrect. Plausibility of first part is described in "A" above. Second part described in "C" above.

E.

References:

- Selected Licensee Commitment 16.11-1, Liquid Effluents, Condition A, Revision 0
- Selected Licensee Commitment 16.11-2, Radioactive Liquid Effluent Monitoring Instrumentation, Table 16.11-2-1, Items 1.a and 3.c, Revision 3

K/A Match

The KA is matched because the applicant is provided with an excerpt from an actual Liquid Waste Release permit and required to interpret the significance of two of the items on the permit: status of the Low Pressure Service Water System (RL) and determine whether that presents a problem, and on the section titled "Setpoint Data".

Cognitive Level: **High**

Requires more than one mental step: must interpret a part of a Liquid Waste Release permit to determine the significance of a radiation monitor status and associated trip setpoint values (i.e., N/A) and also evaluate the status of a dilution water system and evaluate whether that presents a problem, and then apply the requirements of Selected Licensee Commitment to determine a required action completion time.

Source of Question: **New**

RETDAS v3.5.1 <DPCCNS Rev.4.0> CANBERRA

LIQUID WASTE RELEASE PERMIT REPORT

LWR Number: 2012095

=== RL PUMP DATA ===
RL pumps assigned to release.................................... 1.00

=== RECOMMENDED RELEASE RATE ===
Allowable release rate (gpm).................................... 2.57E+02
Recommended release rate (gpm).................................. 1.00E+02 100

=== SETPOINT DATA ===
EMF49L in Service .... .No
EMF49L Background (cpm)...................................... ......NA

Cs-137 Equivalence (uCi/ml).................................. ......NA
Expected CPM... ......NA
Trip 1 setpoint (cpm).. ......NA
Trip 2 setpoint (cpm).. ......NA

=== SPECIAL INSTRUCTIONS FOR RELEASE ===
EMF 49 INOPERABLE
Do NOT use this LWR after EMF is declared OPERABLE.
* RL flow interlock must be greater than or equal to 19,000 GPM *

Performed by: [signature] Date: 12.14.12
Verified by: Jadrica D. Moore Date: 12/4/12

Question 24
069AK3.01
Loss of CTMT Integrity
Knowledge of the reasons for the following responses as they apply to the Loss of Containment Integrity:
Guidance contained in EOP for loss of containment integrity

Which ONE of the following describes an action, including the reason for the action, in accordance with EP/1/A/5000/FR-Z.1 (Response to High Containment pressure)?

A. Initiate ND Auxiliary Spray, if containment pressure exceeds 5 psig 50 minutes following Rx Trip, in order to reduce the challenge to containment integrity due to high pressure.

B. Isolate faulted steam generators in order to reduce the challenge to containment integrity due to high pressure.

C. Secure ND Auxiliary Spray when containment pressure decreases below 3 psig in order to reduce the challenge to containment integrity due to low pressure.

D. Energize Hydrogen igniters if concentration exceeds 6% in order to reduce explosion hazards.

QUESTION 24

Distractor Analysis

A. Incorrect. FR-Z.1 does align ND spray if containment pressure exceeds 15 psig (Step 11.b). Plausible if applicant does not know setpoint.

B. **CORRECT.** Step 9 of FR-Z.1 isolates feed flow to faulted S/Gs.

C. Incorrect. FR-Z.1 will direct ND spray to be isolated when containment pressure decreases below 1 psig (Step 12). Plausible if applicant is not aware of setpoint.

D. Incorrect. FR-Z.1 directs H2 ignitors to be energized if H2 concentration is <6% (Step 13.c). Plausible if applicant is not aware of setpoint.

References:
- OP-CN-EP-FRZ Lesson Plan for FRZ, Revision 100, Pg. 16
- EP/1/A/5000/FR-Z.1, (Response to High Containment Pressure), Step 9, Revision 13

KA Match:
The KA is matched because the applicant must demonstrate knowledge of the guidance contained in FR-Z.1, an EOP that addresses containment integrity and high pressure, and then select the correct reason for that guidance.

Cognitive Level: **Low**

Source of Question: **New**

Question 25
WE03EK2.1
LOCA Cooldown - Depress.
Knowledge of the operational implications of the following concepts as they apply to the (LOCA Cooldown and Depressurization)
Components and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes and automatic and manual features

Given the following Unit 1 initial conditions:

- The Unit is at 100% power.

<u>Subsequently:</u>

- A small break LOCA occurs.
- The crew is performing EP/1/A/5000/ES-1.2 (Post LOCA Cooldown and Depressurization).
- All NC pumps are secured.

(1) What is the NC cooldown rate specified in this procedure?

(2) Which method is the first choice for the NC system depressurization for the given conditions?

A. (1) As close as possible without exceeding 100°F in an hour
(2) NV auxiliary spray

B. (1) At the maximum rate
(2) NV auxiliary spray

C. (1) As close as possible without exceeding 100°F in an hour
(2) NC PORV

D. (1) At the maximum rate
(2) NC PORV

<u>Distractor Analysis</u>

A. <u>Incorrect.</u> Cooldown rate is correct.
NV aux spray is plausible because normal spray is preferred but is not available, and normal spray may be confused with Aux spray. Also, using the PORV results in a loss of more inventory and so it may not appear to be the better choice.

B. <u>Incorrect.</u> Maximum rate is plausible because cooldown is performed at the maximum rate when dumping steam for a SGTR.
NV aux spray is plausible because normal spray is preferred but is not available, and normal spray may be confused with Aux spray. Also, using the PORV results in a loss of more inventory and so it may not appear to be the better choice.

C. **CORRECT.** Step 13 of ES-1.2 specifies a cooldown rate based on NC T-colds as close as possible without exceeding 100 F in an hour. Step 16 depressurizes the NC system to refill the PZR using normal pressurizer spray, if available. If spray is unavailable, a PZR PORV is used. If no PORVs are available, then NV aux spray is used. Since all NC pumps have been secured, depressurization is performed with the NC PORV.

D. <u>Incorrect.</u> Maximum rate is plausible because cooldown is performed at the maximum rate when dumping steam for a SGTR.
The second part is correct since NC PORV will be the first choice for depressurization.

<u>References</u>:
- EP/1/A/5000/ES-1.2, (Post LOCA Cooldown and Depressurization), Revision 31, Step 13 & 16
- EP/1/A/5000/E-3 (Steam Generator Tube Rupture), Revision 43, Step 10.f

<u>KA Match:</u>
The KA is matched because conditions are given involving Post-LOCA Cooldown and Depressurization. The applicant is required to apply knowledge of the function and control of safety systems, including PORVs and auxiliary spray, in the context of these conditions.

<u>Cognitive Level:</u> **High**
The question may at first appear to be low cog, since it asks for guidance out of a procedure. But it is a higher cog question since more than one mental step is involved: the applicant must analyze the effect of given conditions (particularly the loss of NC pumps), and the effect that has on the plant; and from that, determine the method for NC depressurization.

<u>Source of Question:</u> **Bank - 1623**

Question 26
WE06EG2.4.20
Degraded Core Cooling
Knowledge of the operational implications of EOP warnings, cautions and notes

Given the following:

- Unit 1 has experienced a small break LOCA.
- The crew has completed applicable steps of EP/1/A/5000/E-0 (Reactor Trip or Safety Injection) and entered EP/1/A/5000/E-1(Loss of Reactor or Secondary Coolant).
- 1B NCP has been secured due to #1 seal failure.

Subsequently:
- 1A, 1C, & 1D NCPs are in service.
- Core Exit Thermocouples: 706°F and slowly increasing.
- RVLIS Level: 60% and slowly decreasing.
- 1C NCP Motor Stator Temp: 315°F and slowly increasing.
- Subcooling: -5°F.
- The crew has transitioned to FR-C.2, (Response to Degraded Core Cooling).

How will the crew address immediate operation of the NCPs (trip vs. leave running), in accordance with FR-C.2?

	1A NCP	1C NCP	1D NCP
A.	leave running	trip	leave running
B.	leave running	trip	trip
C.	trip	trip	trip
D.	**leave running**	**leave running**	**leave running**

QUESTION 26

Distractor Analysis

A. Incorrect. Plausible because 1C NCP exceeds the normal trip criteria for motor stator temperature of 311°F.

B. Incorrect. Plausible if the applicant believes that at least some PZR spray capability should be maintained, yet also address degraded conditions for operation of NCPs.

C. Incorrect. Plausible because E-0 provides instruction to secure NCPs due to loss of subcooling. This guidance does not apply when C.2 is entered. The NCPs may be secured per C.2 at the end of the procedure (depending on flowpath). Therefore, immediately securing NCPs would not be correct.

D. **CORRECT**. A note at the beginning of EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling) states "Normal conditions for running NC pumps are desired, but NC pumps should not be tripped if normal conditions cannot be established or maintained." The ERG Basis document provides the following additional information "If the NC pumps are running, they will continue to provide forced single or two- phase flow through the core to keep it cool. Tripping the NC pumps may cause an inadequate core cooling condition. The operator should not trip the NC pumps until this procedure instructs him to do so. Therefore, the NC pump trip criteria do not apply."

References:

- EP/1/A/5000/FR-C.2, (Response to Degraded Core Cooling), NOTE prior to Step 1, Revision 022
- EBG/1/A/5000/FR-C.2 (Background Document for FR-C.2), Revision 12, Step 1
- EP/1/A/5000/E-0 (Reactor Trip or Safety Injection), Revision 41, Step 2
- OP-CN-PS-NCP Lesson Plan for Reactor Coolant Pump, Revision 100, Pg. 30

K/A Match
The applicant is required to apply operational knowledge of a note contained within C.2, (Degraded Core Cooling).

Cognitive Level: **High**
This is a high cognitive question because it requires more than one mental step to determine the correct answer. First, the applicant must evaluate the given information in order to determine the correct procedure flowpath. The applicant must then apply a note from memory contained in that procedure.

Source of Question: **New**

Question 27
WE15EA2.1
Ability to operate and / or monitor the following as they apply to the (Containment Flooding)
Facility conditions and selection of appropriate procedures during abnormal and emergency operations

During a large break LOCA, the following conditions are given:

- The ECCS suctions have been swapped to the Cold Leg Recirculation alignment.
- NS suction has been swapped to the containment sump.
- 1A NS is in service.
- FWST level = 4%.
- Containment Sump level is off scale high.
- Containment pressure = 7 psig and slowly decreasing.
- CETs = 560°F.
- RVLIS Level is 57% and slowly decreasing.
- PZR level is 0%.

Which ONE of the following describes:

(1) The implications of the above conditions.

(2) Which procedure entry conditions are met?

A. (1) Containment sump level is higher than would be expected due to a damaged RN or KC pipe.
(2) EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling)

B. (1) The level of water in the core region has been reduced such that the core has become uncovered.
(2) EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling)

C. (1) Containment sump level is higher than would be expected due to a damaged RN or KC pipe.
(2) EP/1/A/5000/FR-Z.2 (Response to Containment Flooding)

D. (1) The level of water in the core region has been reduced such that the core has become uncovered.
(2) EP/1/A/5000/FR-Z.2 (Response to Containment Flooding)

QUESTION 27

Distractor Analysis

A. Incorrect. The first part is correct. The second part is plausible due to a loss of reactor vessel level. However, the indications do not meet the FR-C.2 entry conditions (CETs >700°F or RVLIS level <41% along with loss of subcooling).

B. Incorrect. The first part is plausible due reduced level in the reactor vessel, but greater than 54% (which represents the top of the core). The second part is plausible due to a loss of reactor vessel level. However, the indications do not meet the FR-C.2 entry conditions (CETs >700°F or RVLIS level <41% along with loss of subcooling).

C. **CORRECT.** Water level greater than design basis flood level represent an indication that water volumes other than those expected (reactor coolant, FWST, accumulators) have entered containment. Most likely sources are service water and component cooling water. Entry conditions for FR-Z.2 are met due to containment pressure between 3 and 15 psig, NS is service, and high containment sump level.

D. Incorrect. The first part is plausible due reduced level in the reactor vessel, but greater than 54% (which represents the top of the core). The second part is correct.

References:
- EP/1/A/5000/F-0 (Critical Safety Function Status Trees), Revision 8, Pg. 4 & 9
- EBG/1/A/5000/FR-Z.2 (Background Document for FR-Z.2), Revision 2, Pg. 2
- OP-CN-PS-CCM Lesson Plan for Inadequate Core Cooling Monitor, Revision 100, Pg. 50

KA Match:
The KA is matched because conditions in the stem involve containment flooding. The applicant is required to determine the appropriate procedure entry for these conditions.

Cognitive Level: **High**
Applicant analyzes given conditions to arrive at a conclusion regarding the significance of those conditions. Multiple mental steps are involved including analysis of containment sump level and reactor vessel level in relation to potential core uncovery.

Source of Question: **Bank - 693**

Question 28
003K4.02
Reactor Coolant Pump
Knowledge of RCPS design feature(s) and/or interlock(s) which provide for the following: Prevention of cold water accidents or transients

Given the following:

TIME	NC Tcold Temperatures	S/G Water Temperatures
0600	202°F	273°F
0700	204°F	264°F
0800	206°F	255°F
0900	208°F	246°F

What is the EARLIEST time at which an NCP may be started, in accordance with Tech. Spec. 3.4.6, RCS Loops - Mode 4?

A. 0600

B. 0700

C. 0800

D. 0900

QUESTION 28

Distractor Analysis

A. Incorrect. Per TS 3.4.6 no RCP shall be started with any RCS cold leg temperature less than or equal 210 F unless secondary side water temperature of each S/G is less than or equal to 50 F above each of the RCS cold leg temperatures. Plausible if applicant is unaware of requirement.

B. Incorrect. Per TS 3.4.6 no RCP shall be started with any RCS cold leg temperature less than or equal 210 F unless secondary side water temperature of each S/G is less than or equal to 50 F above each of the RCS cold leg temperatures. Plausible if applicant is unaware of requirement.

C. **CORRECT**. Secondary side water temperature is within the required 50 F.

D. Incorrect. Secondary side water temperature is within the required 50 F but the listed time is not the earliest time at which the requirement is met. Plausible if the applicant is unaware of requirement.

References:

- Tech. Spec. 3.4.6, RCS Loops - Mode 4
- OP/1/A/6150/002 A, (Reactor Coolant Pump Operation), Limits and Precautions 2.7, Revision 068

KA Match:

This KA discussed with Lead Examiner on 04/17/13 due to lack of specific design feature/interlock associated with RCPs. It was agreed that testing the intent of administrative controls designed to prevent PTS concerns would meet the intent of the KA.

Cognitive Level: **High**

Involves associating multiple data points for RCS and S/G temperatures, and then applying the requirements of a Tech. Spec. to predict an outcome (when a reactor coolant pump may be started).

Source of Question: **New**

Question 29
004A4.04
Chemical and Volume Control
Ability to manually operate and/or monitor in the control room:
Calculation of boron concentration changes

Given the following Unit 1 conditions:

- The Unit is at 100% power.
- NC boron concentration is 760 ppm.
- FWST boron concentration is 2748 ppm.
- BAT boron concentration is 7410 ppm.
- A 350 gallon makeup to the VCT is required.

Which ONE of the following completes the statement below?

If the operator performs a blended VCT makeup using **33 gallons** of boric acid and 317 gallons of makeup water, the boron concentration of the blended makeup will be ____________________________ .

Formula Provided Below

A. as desired.

B. 61 ppm LOWER than desired.

C. 500 ppm LOWER than desired.

D. 514 ppm HIGHER than desired.

$$Boric\ Acid\ gal = \frac{Vf * (Cf - Cw)}{(Ca - Cw)}$$

Vf = total makeup volume desired
Cf = desired boron concentration
Cw = current RMWST boron concentration (Cw may be considered “0” when the desired concentration is greater than 100 ppm)
Ca = current BAT boron concentration

QUESTION 29

Distractor Analysis

A. Incorrect. Should be 36 gallons of boric acid. Plausible, if applicant believes this value of boric acid volume is within a tolerance band of what is actually correct; i.e., plus or minus 10%.

B. **CORRECT.** This formula is normally used to determine how many gallons of boric acid is required for a desired concentration. This question tests the knowledge of the KA in a new way, by requiring the applicant to not just plug and chug, but to understand and interpret the formula. In this case, the applicant will need to know that we are evaluating what concentration would be obtained for a quantity of boric acid (33 gallons), and how that would affect the desired concentration of the blend.

C. Incorrect. Applicant uses the incorrect value for Ca in the formula by using the boron concentration for the FWST instead of the correct one for BAT.

D. Incorrect. Applicant confuses use of the formula and uses the following values:

Vf = 350 gallons
Cf = 2748 ppm (this is wrong, but plausible if applicant thinks the "desired" boron concentration to use is from the FWST, instead of the correct value of maintaining the SAME boron in the RCS; i.e., 750 ppm)
Ca = 7410 ppm (this is the correct value; i.e., the BAT)

Calculation using the above values will yield 129 gallons of boric acid to add in the blended makeup. With this much boron, the concentration of the blended makeup will be 1274 ppm - approx. 514 ppm too high.

Vf = total makeup volume desired
Cf = desired boron concentration
Cw = current RMWST boron concentration (Cw may be considered “0” when the desired concentration is greater than 100 ppm)
Ca = current BAT boron concentration

References:
- OP-CN-PS-NV, Lesson Plan for Chemical and Volume Control System, Section 7.3, "Manual Makeup", Revision 101

Provide to Applicant: Formula for boron calculation

KA Match:
The KA is matched because the applicant is required to perform a calculation that will determine how much of a boron concentration change results from the given conditions.

Cognitive Level: **High**

Involves a calculation, but it is more than just a "plug and chug." The applicant must recognize that the provided formula must be used in a different way in order to predict an outcome (what the effect is on blended makeup boron concentration).

Source of Question: **New**

Question 30
004K5.30
Chemical and Volume Control
Knowledge of the operational implications of the following concepts as they apply to the CVCS:
Relationship between temperature and pressure in CVCS components during solid plant operation

Given the following:

- Unit 1 is in Mode 5.
- Plant heatup is in progress in preparation for drawing a PZR bubble.
- NC pressure is being manually controlled via 1NV-135 (ND flow to Letdown HX) and 1NV-294 (NV Pumps Disch Flow Controller).

[Note: Consider each action of (1) and (2) above separately.]

(1) In order to maintain constant <u>letdown flow</u> as the NC system heat-up continues, 1NV-135 will be throttled______(1)______.

(2) In order to maintain <u>NC pressure</u> at the desired value as the heat-up continues, 1NV-294 will be throttled ______(2)______.

A. (1) Closed
(2) Open

B. (1) Closed
(2) Closed

C. (1) Open
(2) Open

D. (1) Open
(2) Closed

QUESTION 30

Distractor Analysis

A. Incorrect. The first part is correct. The higher upstream pressure (caused by the increased specific volume of the water) will require the letdown flow control valve to be throttled closed in order to maintain constant flow. The second part is incorrect, but plausible if the applicant does not understand how temperature changes affect pressure while solid and the associated changes in valve flow characteristics.

B. **CORRECT.** The higher upstream pressure (caused by the increased specific volume of the water) will require the letdown flow control valve to be throttled closed in order to maintain constant flow. The increased primary system pressure will require the charging flow control valve to be throttled closed in order to prevent further increasing system pressure.

C. Incorrect. Plausible if the applicant does not understand how temperature changes affect flow and pressure while solid and the associated changes in valve flow characteristics.

D. Incorrect. The first part is incorrect, but plausible if the applicant does not understand how temperature changes affect pressure while solid and the associated changes in valve flow characteristics. The second part is correct.

References:
- OP-CN-PS-NV Lesson Plan for Chemical and Volume Control System, Revision 101, Pg. 15
- OP-CN-PS-ND Lesson Plan for Residual Heat Removal, Revision 100, Pg. 26

KA Match:
The KA is matched because for solid plant operations, the applicant demonstrates knowledge of both pressure and temperature response to changes resulting from a plant heatup from solid plant operations.

Cognitive Level: **High**
Involves application of system and operational knowledge to predict an expected outcome regarding letdown flow and RCS pressure, and in the context of a plant heatup.

Source of Question: **New**

Question 31
005A2.03
Residual Heat Removal
Ability to (a) predict the impacts of the following malfunctions or operations on the RHRS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
RHR pump/motor malfunction

Given the following Unit 1 conditions:

- The Unit is in Mode 5 following core reload.
- 1A ND Pump is operating.
- ND system flow is 3100 gpm.
- NC system level is at 6.7%.

Subsequently:

- NC system level remains stable at 6.7%.
- Core Exit T/Cs are stable at 115°F.
- 1A ND pump flow and discharge pressure begin to oscillate.

In accordance with AP/1/A/5500/019 (Loss of Residual Heat Removal System), Case IV, "Loss of ND in Mid Loop" the operator is first required to initiate containment evacuation, containment closure, and then to ______________________________ .

A. manually trip 1A ND pump.

B. place 1B ND train in service.

C. attempt to mitigate 1A ND pump conditions by raising NC level to greater than 25%.

D. attempt to mitigate 1A ND pump conditions by reducing ND flow to less than 1000 gpm.

QUESTION 31

Distractor Analysis

A. Incorrect. Plausible since this is an action required by AP/19 (Loss of RHR). This action comes a few steps later in the procedure, AFTER the operator has attempted to mitigate the conditions causing the 1A ND pump conditions, by reducing system flow.

B. Incorrect. Plausible since this is an action required by AP/19 (Loss of RHR)..This action comes a few steps BEFORE the direction to reduce flow, but placing an ND standby train in service would be performed only if there is NO ND (RHR) pump running at the time the operator comes to this step. In our case, there IS a pump running (even though it is in distress), and the operator goes on past the step for placing a standby ND train in service (since the conditions for that are NOT met), and continues to the step for reducing system flow to mitigate the running pump's conditions.

C. Incorrect. Plausible since raising the level in the RCS would provide a higher suction head value to the operating RHR pump. An applicant could select this choice since this seems like a prudent action for alleviating a pump which is cavitating. See AP/019, Enclosure 9, Step 2.c (for plausibility of 25% NC system level).

D. **CORRECT** Per AP/19, Case IV, Step 5, the operator is directed to leave the 1A ND pump running. Because the pump is in distress (cavitating), the operator does NOT shut it off first, but attempts to mitigate the condition by reducing system flow. If this is NOT successful, the operator is directed to stop the affect ND pump.

References:

- AP/1/A/5500/019, (Loss of Residual Heat Removal System), Case IV, "Loss ND in Mid Loop), Steps 2, 3, and 5, Revision 58
- AP/019, Enclosure 9 (Core Exit T/Cs Not Available), Step 2.c (for plausibility of 25% NC system level in distractor "C".)
- OP-CN-AP-19, Lesson Plan for AP-19: Loss of Residual Heat Removal System, Section 1.3.2, "Loss of ND Mitigating Strategy", page 12 of 106, Revision 1

KA Match:

The KA is matched because the stem gives conditions involving a malfunction of the RHR pump, in this case, it is cavitating. The applicant must **predict the impacts** of the given pump conditions (flow and discharge pressure) on the RHR system and the pump by determining that the pump is cavitating.

This determination then is used to select which step of the procedure applies; i.e., is the impact of the given conditions on the pump such that I need to TRIP it? or place the alternate one in service? or am I to take action to keep the pump running by impacting the RHR system by throttling down on system flow? Adequate understanding of these concepts will enable the applicant to **select the correct required procedure action**.

Cognitive Level: **High**

Requires numerous mental steps to diagnose the conditions and determine what the pump is experiencing, and then to apply knowledge of the procedure mitigating strategy to select which required action will mitigate the conditions.

Source of Question: **New**

Question 32
006K6.05
Emergency Core Cooling
Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: HPI/LPI cooling water

Given the following plant conditions:

Initial:

- Unit 1 is at 100% power.
- Unit 2 is in Mode 6.
- 1B NV pump is running.
- 1A NV pump is OFF.

Subsequently:

- KC cooling flow to the Unit 1 NV pumps is lost.
- The crew enters AP/1/A/5500/021, (Loss of Component Cooling) and has dispatched an operator to align backup cooling to an NV pump.
- The crew is performing Enclosure 5, "Maximize NV Pump Run Time".

(1) The crew dispatched the operator to align alternate cooling to ____(1)____ NV pump(s).

(2) While the alternate cooling alignment is being performed, the operating pump will be ____________(2)____________ .

A. (1) ONLY 1A
(2) Secured immediately.

B. (1) ONLY 1A
(2) Operated for a maximum of 10 minutes.

C. (1) 1A and 1B
(2) Secured immediately.

D. (1) 1A and 1B
(2) Operated for a maximum of 10 minutes.

QUESTION 32

Distractor Analysis

A. Incorrect. The first part is correct. The second part is plausible because the operating NV pump is expected to reach high temperature conditions in 15 minutes with not cooling water (per Loss of Component Cooling Water AP).

B. **CORRECT.** Step 2 of AP/21 verifies at least one KC pump is ON AND that flow to KC loads exists. The stem gives conditions that KC flow to the NV pumps has been lost. Therefore, the RNO requires that alternate cooling be aligned to the NV pump. 1A is the only one with this capability. 1B NV pump does not have this feature.

With the operator dispatched to perform the alternate cooling alignment for 1A NV pump, the stem says that the crew is now performing Enclosure 5, "Maximize NV Pump Run Time." This enclosure provides a means of maintaining the NV pump function while alternate cooling is pursued. To do that, the first step is to record the time at which KC was lost to the NV pumps. The next step is to ensure 1B NV pump is ON. In the initial conditions of the stem 1A NV pump is running, and 1B is OFF. This enclosure requires the operator to start 1B and then secure 1A. Once the alternate cooling alignment is complete, the operator will then operate 1A and secure 1B, but until then the crew is in a "do loop" of alternating between 1B and 1A pumps, running each no more than 10 minutes at a time. This time restriction is a characteristic of these pumps, and is required in order to prevent damage to the pump.

C. Incorrect. The first part is plausible if the applicant is unaware of which pump allows alignment of alternate cooling water. The second part is plausible because the operating NV pump is expected to reach high temperature conditions in 15 minutes with not cooling water (per Loss of Component Cooling Water AP).

D. Incorrect. The first part is plausible if the applicant is unaware of which pump allows alignment of alternate cooling water. The second part is correct.

References:

- AP/1/A/5500/021, (Loss of Component Cooling), Revision 42, Encl. 5, Step 2 RNO note, and Encl. 5, Step 2 & 3
- OP-CN-PS-NV Lesson Plan for Chemical and Volume Control System, Revision 101, Pg. 31

KA Match:

The KA is matched because conditions involve a loss of cooling water to high pressure injection pumps (NV - high head injection). The applicant must demonstrate knowledge of the effect of this loss on operation of components of the ECCS by selecting both: how the alternate cooling alignment is to be performed, and the effects of that on the operating pump.

Cognitive Level: **Low**

Source of Question: **New**

Question 33
007A3.01
Pressurizer Relief/Quench Tank
Ability to monitor automatic operation of the PRTS, including:
Components which discharge to the PRT

Given the following component designators:

- 1NC-54A (Nitrogen to PRT Containment Isolation)
- 1NC-56B (RMW Pump Discharge Containment Isolation)
- 1NC-107 (PRT to NCDT Pumps Suction)
- 1WG-225 (PRT to WG Compressor Isolation)

_______(1)_________ will receive an automatic isolation signal if containment pressure exceeds 1.2 psig.

________(2)_________ will receive an automatic isolation signal if PRT pressure exceeds 8.0 psig.

A. (1) ONLY 1NC-54A
(2) ONLY 1WG-225

B. (1) 1NC-54A and 1NC-56B
(2) ONLY 1WG-225

C. (1) ONLY 1NC-54A
(2) 1WG-225 and 1NC-107

D. (1) 1NC-54A and 1NC-56B
(2) 1WG-225 and 1NC-107

QUESTION 33

Distractor Analysis

A. Incorrect. The first part is plausible is the applicant is unaware that both containment isolation valves listed receive an isolation signal. The second part is correct.

B. **CORRECT.** 1NC-54A and 1NC-56B both receive an automatic isolation signal upon a Phase A containment isolation. 1WG-225 isolates the suction of the Waste Gas Compressor from the PRT upon high PRT pressure of 8 psig.

C. Incorrect. The first part is plausible is the applicant is unaware that both containment isolation valves listed receive an isolation signal. The second part is plausible if the applicant is unaware that 1NC-107 does not receive an automatic isolation signal.

D. Incorrect. The first part is correct. The second part is plausible if the applicant is unaware that 1NC-107 does not receive an automatic isolation signal.

References:

- OP-CN-PS-PRT, Lesson Plan for Pressurizer Relief Tank, Section 4, "System Interrelationships", Revision 100
- OP-CN-PS-PRT, Figure 10.1, Simplified PRT Overview

KA Match:
KA is matched since applicant must evaluate a list of several components, including components which discharge into the PRT. Conditions are given which must be diagnosed as a Phase A actuation, and then determine which components are affected automatically by this signal, along with high PRT pressure, and its effect on the Waste Gas System.

Cognitive Level: **High**
More than one mental step is involved to arrive at the correct answer. Applicant applies system and operational knowledge to determine that containment isolation Phase A conditions apply, and then apply system knowledge of the effect of that signal on various components related to the PRT.

Source of Question: **New**

Question 34
007K3.01
Pressurizer Relief/Quench Tank
Knowledge of the effect that a loss or malfunction of the PRTS will have on the following: Containment

Given the following Unit 2 conditions:

- From 100% power, a reactor trip occurred.
- The crew is performing EP/2/A/5000/E-0 (Reactor Trip or Safety Injection).
- ONE PZR safety valve has stuck partially open.
- PRT pressure rises to approximately 50 psig and then rapidly decreases.
- Containment pressure is NEGATIVE 0.2 psig and increasing at 0.1 psig per minute.

Which ONE of the following describes:

(1) How the PRT rupture discs operated.

(2) What is the LEAST amount of time it will be before the Containment pressure Tech Spec upper limit is reached?

A. (1) At least one PRT rupture disc operated EARLIER than designed.
(2) 1 minute

B. (1) At least one PRT rupture disc operated EARLIER than designed.
(2) 5 minutes

C. (1) The PRT rupture discs operated as designed.
(2) 1 minute

D. (1) The PRT rupture discs operated as designed.
(2) 5 minutes.

QUESTION 34

Distractor Analysis

A. Incorrect. First part is correct. The second part is plausible if the applicant is unaware of the containment pressure limit or miscalculates time required to reach the limit.

B. **CORRECT.** The PRT rupture discs ruptures at 100 psig to protect the PRT. According to Technical Specification LCO 3.6.4, the upper Technical Specification Containment Pressure limit is 0.3 psig. Since initial pressure was negative (-0.2 psig), and Containment pressure is rising at .1 psig, the limit will be reached in 5 minutes.

C. Incorrect. First part is plausible because operations is required to notify engineering for evaluation if PRT pressure exceeds 50 psig. The second part is plausible if the applicant is unaware of the containment pressure limit or miscalculates time required to reach the limit.

D. Incorrect. First part is plausible because operations is required to notify engineering for evaluation if PRT pressure exceeds 50 psig. The second part is correct.

References:

- Technical Specification 3.6.4 (Containment Pressure), Pg. 1
- OP-CN-PS-PRT Lesson Plan for the Pressure Relief Tank, Revision 100, Pg. 9
- OP/2/A/6150/004, (Pressurizer Relief Tank), Revision 26, Pg. 2

KA Match:
The KA is matched because the operator must have knowledge (i.e. TS Pressure Limit) of the effect that a loss or malfunction of the PRTS (i.e. Rupture Disc operates early) will have on the Containment.

Cognitive Level: **High**
Involves application of system and operational knowledge and comparison to given conditions to evaluate whether a rupture disc operated per design. Then, a prediction is required on the effect of this on the containment.

Source of Question: **Bank 1560**

Question 35
008K1.01
Component Cooling Water
Knowledge of the physical connections and/or cause-effect relationships between the CCWS and the following systems:
SWS

Which ONE of the following describes the NORMAL and BACKUP makeup supplies to the KC Surge Tank?

	NORMAL	BACKUP
A.	YF	RN
B.	YM	YD
C.	**YM**	**RN**
D.	YF	YD

QUESTION 35

Distractor Analysis

A. Incorrect. The first part is plausible because YF (Filtered Water) is used as a makeup source/cooling medium for several plant systems (i.e. Auxiliary Building Cooling Water, Main Vacuum, Auxiliary Steam). The second part is correct.

B. Incorrect. The first part is correct. The second part is plausible because YD (drinking water) supplies backup cooling to NV Pump 1A and 2A.

C. **CORRECT.** Normal makeup to the KC Surge Tanks is supplied by the YM (Demineralized Water) system. The assured (backup) source of water is supplied by the RN system.

D. Incorrect. The first part is plausible because YF (Filtered Water) is used as a makeup source/cooling medium for several plant systems (i.e. Auxiliary Building Cooling Water, Main Vacuum, Auxiliary Steam). The second part is plausible because YD (drinking water) supplies backup cooling to NV Pump 1A and 2A.

References:
- OP-CN-PSS-KC, Lesson Plan for Component Cooling System, page 12, Revision 100
- OP-CN-MT-ZM, Lesson Plan for Main Vacuum, page 8, Revision 23
- OP-CN-SS-AS, Lesson Plan for Aux. Steam, page 10, Revision 25
- OP-CN-PSS-VA, Lesson Plan for Auxiliary Bldg. Ventilation, page 25, Revision 100
- OP-CN-PS-NV, Lesson Plan for Chemical and Volume Control System, page 31, Revision 101

KA Match:
KA is matched since it tests knowledge of physical connections between Component Cooling Water and other systems, including Service Water.

Cognitive Level: Low

Source of Question: Bank - 86

Question 36
010A2.01
Pressurizer Pressure Control
Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Heater failures

Given the following Unit 1 conditions:

- The Unit was at 60% power prior to a steam leak in the turbine building.
- The crew has isolated the leak per AP/1/A/5500/028 (Secondary Steam Leak).
- The crew is responding to low Pressurizer pressure per AP/1/A/5500/011 (Pressurizer Pressure Abnormalities).

Subsequently:
- Pressurizer pressure is at 2140 psig and slowly increasing.
- 1C Pressurizer Heater trips OFF.
- 1A and 1B Pressurizer Heaters automatically ENERGIZE.
- 1D Pressurizer Heater is DE-ENERGIZED.

(1) At this Pressurizer pressure, ______________(1)_____________ Pressurizer PORV operation is BLOCKED.

(2) To address Backup Heater status, the Required Action and Completion Time of ________________________ will be implemented.

A. (1) Automatic AND Manual
   (2) SLC 16.7-9 (Standby Shutdown System - SSS)

B. (1) ONLY Automatic
   (2) Tech Spec 3.4.9 (Pressurizer)

C. (1) Automatic AND Manual
   (2) Tech Spec 3.4.9 (Pressurizer)

D. (1) ONLY Automatic
   (2) SLC 16.7-9 (Standby Shutdown System - SSS)

QUESTION 36

Distractor Analysis

A. Incorrect. Plausible, since there is a block signal for PORV operation when PZR pressure is $\leq$ 2177 psig; but it is for the automatic operation of the PORVs, and manual is not affected. 2nd part is correct.

B. Incorrect. 1st part is correct. 2nd part plausibility is described in "C" below.

C. Incorrect. Plausible, as described in "A" above. 2nd part (Tech Spec 3.4.9) is plausible because this specification does control PZR heaters, but it is the A and B (safety grade powered) heaters, and not D heater.

D **CORRECT.** The required action in AP/11 (PZR Pressure Abnormalities) is to "verify all PZR heaters - ENERGIZED." 1C Heater is normally the only heater ON, and controls PZR pressure at 2220-2250 psig. In this question it has tripped OFF for some reason (a malfunction). To control pressure, the backup heaters (A,B,D) should automatically energize at 2210 psig. A and B Heaters functioned as designed, but D heater did NOT (another malfunction).

With Pressurizer pressure at a low value of 2140 psig, the PORVs will not open in automatic, since there is a DCS (Distributed Control System) block signal to the PORVs when PZR pressure is below 2177 psig.

1C Heater is not controlled by a Tech Spec or a SLC (Selected Licensee Commitment); but 1D Heater is. 1D Heater is required for the operability of the Standby Shutdown Facility (SSS) - See Lesson Plan IPE, top of page 13.

References:

- Selected Licensee Commitment (SLC) 16.7-9, Standby Shutdown System (SSS), Condition A and T.R. 16.7-9-21, Revision 7
- Tech Spec 3.4.9, Pressurizer, LCO 3.4.9.b
- AP/1/A/5500/028 (Secondary Steam Leak), Step 9, Revision 7
- AP/1/A/5500/011 (Pressurizer Pressure Abnormalities), Case I (Pressurizer Pressure Decreasing), Step 3, Revision 022

KA Match:
KA is matched because applicant is presented with conditions involving heater failure, and then tested on the effect of that failure on the PZR PORVs. The remainder of the question tests on the ability to use a procedure (Selected Licensee Commitment) to control or mitigate the condition.

Cognitive Level: **High**
From conditions involving multiple parameters and PZR heater status, the applicant must predict how these affect the PZR pressure control system, including Tech. Spec. / SLC entry.

Source of Question: **New**

Question 37
010K6.02
Pressurizer Pressure Control
Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: PZR

Given the following Unit 2 conditions:

- The Unit is at 100% power.
- 2B Pressurizer heaters are manually energized to promote mixing following unit start-up.
- A fault causes breaker 2LXH-6C (2B NC PZR Heater Power Panel PHP2B Feeder) to OPEN.

(1) How will the output of the pressurizer master control change?

(2) What is the system's response to the loss of heat input?

A. (1) Increase
(2) Pressurizer Spray Valves will close.

B. (1) Decrease
(2) Pressurizer Spray Valves will close.

C. (1) Increase
(2) "A" and "D" Pressurizer Heaters will energize.

D. (1) Decrease
(2) "A" and "D" Pressurizer Heaters will energize.

Distractor Analysis

A. Incorrect. The first part is incorrect, but plausible, if the applicant does not understand the pressurizer pressure control system output response. The second part is correct.

B. **CORRECT.** The master controller lowers the output signal to raise pressure in response to loss of heaters (with spray valves open). The spray valves will close prior to reaching the setpoint for energizing other backup heaters.

C. Incorrect. First part is incorrect as described in answer A. The second part is also incorrect, but plausible, if the applicant believes that the pressure decrease will energize backup heaters prior to spray valve closure.

D. Incorrect. The first part is correct. The second part is incorrect as described in answer C.

References:
- OP-CN-PS-IPE, Lesson Plan for Pressurizer Pressure Control, Pg. 9,10, and Pressurizer DCS graphic, Revision 101

KA Match:
KA is matched because applicant is presented with a failure of a component of the Pressurizer (heaters), and then tested on knowledge of the effect of this failure on the Pressurizer master pressure control, including spray valve and heater response.

Cognitive Level: **High**
This is a higher cog question because the applicant must analyze conditions involving loss of a component and predict the response of the system's control signal and component response.

Source of Question: **New**

Question 38
012K5.01
Reactor Protection
Knowledge of the operational implications of the following concepts as they apply to the RPS: DNB

In accordance with Technical Specifications, which ONE of the following reactor trips is required to be OPERABLE to provide protection against Departure from Nucleate Boiling (DNB) from Mode 2 to 100% power?

A. Pressurizer low pressure

B. OPDT

C. Low NC loop flow

D. OTDT

QUESTION 38

Distractor Analysis

A. Incorrect. Plausible because this trip does provide DNB protection, but is only active above 10% power. The unit exits Mode 2 into Mode 1 at 5% power.

B. Incorrect. Plausible because this trip is active in Mode 2, but provides protection from excessive fuel temperature vs. DNB.

C. Incorrect. Plausible because this trip does provide DNB protection, but is only active above 10% power. The unit exits Mode 2 into Mode 1 at 5% power.

D. **CORRECT.** This trip provides DNB protection and is instated in Mode 2.

References:

- Tech. Spec. 3.3.1, Reactor Trip System (RTS) Instrumentation, page 19, page 20
- Tech. Spec. 1.1, page 7
- OP-CN-IC-IPX, Lesson Plan for Reactor Protection, page 25, 26, 27, 30, Revision 100

KA Match:
KA is matched because the question requires the applicant to demonstrate knowledge of a feature of the RPS that provides protection against DNB, including the operational implications of this protective feature; i.e., the Mode it is required to be operable in for protection from DNB.

Cognitive Level: **Low**

Source of Question: **Bank - 1338**

Question 39
013G2.2.39
Engineered Safety Features Actuation
Knowledge of less than or equal to one hour Technical Specification action statements for systems

Given the following Unit 1 conditions:

- The Unit is at 100%.
- Testing has revealed that ONE channel of Auxiliary Feedwater Auto-Start logic on Trip of ALL Main Feedwater Pumps will NOT actuate within the acceptance criteria.
- The channel is declared INOPERABLE at time 0415.

In accordance with T.S. 3.3.2, ESFAS Instrumentation, the required action is to place the channel in ________________________________ .

A. trip no later than 0515.

B. bypass no later than 0515.

C. trip no later than 0445.

D. bypass no later than 0445.

QUESTION 39

Distractor Analysis

A. **CORRECT.** T.S. 3.3.2 requires the channel to be placed in trip within one hour.

B. Incorrect. Plausible if the applicant is unaware of the required T.S. action. Certain T.S. actions contain direction to bypass inoperable channels (i.e. other T.S. 3.3.2 conditions).

C. Incorrect. Plausible if the applicant is unaware of the required T.S. completion time. Certain T.S. actions contain a 30 minute completion time (i.e. T.S. 3.2.2, T.S. 3.4.2).

D. Incorrect. Described in answers B & C.

References:
- TS 3.3.2, Condition K (One Main Feedwater Pumps trip channel inoperable.)
-

KA Match:
KA is matched because it tests knowledge of a less than one hour Tech Spec required action for ESFAS Instrumentation.

Cognitive Level: **High**
Higher cognitive level since it involves a calculation of a completion time and determination of requiring a trip of the ESFAS channel or a bypass.

Source of Question: **New**

Question 40
022G2.4.11
Containment Cooling
Knowledge of abnormal condition procedures

Given the following Unit 1 conditions:

Initial:
- The Unit is at 80% power.
- Lower Containment Ventilation Units (LCVUs) 1A, 1B, 1C are operating in LOW speed with MAX cooling.
- Upper Containment Ventilation Unit (UCVU) 1B is operating in NORM.

Subsequently:
- Containment temperature, pressure, and humidity are slowly increasing.
- Containment radiation levels are normal.

In accordance with AP/1/A/5500/028, (Secondary Steam Leak), the required operation for LCVU 1D is to start it in _____(1)_____ speed, and place it in _____(2)_____ cooling.

A. (1) HIGH
(2) NORM

B. (1) HIGH
(2) MAX

C. (1) LOW
(2) NORM

D. (1) LOW
(2) MAX

QUESTION 40

Distractor Analysis

A. Incorrect. Plausibility of LCVU in high speed is described in "B" below. Plausibility for ALL Lower units in norm cooling is described in "C" below.

B. Incorrect. Selecting LCVUs to high speed is plausible since it would provide additional cooling, but the Abnormal Procedure is clear in specifying that LCVUs will be operated in LOW. Further, there is a restriction on operating the LCVUs in high speed, as detailed in the References section below for OP/1/A/56450/001 for Containment Ventilation Systems. Operating them in high speed for more than 24 hours can result in bearing problems.

C. Incorrect. First part is correct. Operating all lower units in NORM cooling means that additional units were started. Applicant could easily reason that this provides adequate additional cooling, but that the condition is not severe enough to warrant MAX cooling. They may think this because stem conditions list temperature and pressure as "slowly" increasing, making SOME, as opposed to ALL, additional cooling plausible.

D. **CORRECT.** AP/28, (Secondary Steam Leak), Step 9 is the step to identify and isolate the leak. Part of that step is to check for normal containment conditions. If they are NOT normal, the operators are directed to align the containment cooling system as follows:

Start all lower containment ventilation units in low speed.
Start all upper containment ventilation units.
Place all upper and lower containment ventilation units in "MAX" cooling.

From the initial conditions, the operations required to achieve the above is in choice "D".

References:
- AP/1/A/5500/028, (Secondary Steam Leak), Step 9, Revision 7
- CNS-1576.VV-00-0001, Design Basis Specification for Containment Ventilation and Chilled Water System, Revision 24
- OP/1/A/6450/001, (Containment Ventilation Systems), Enclosure 4.11, "LCVU Additional Cooling" CAUTION prior to Step 3.2, Revision 039
- OP-CN-CNT-VV, Lesson Plan for Containment Ventilation System, Section 2.1.1, "Lower Containment Ventilation System" under "LCVU Instrumentation and Controls", Revision 100

KA Match:
KA is matched because applicant must evaluate conditions involving containment cooling components and worsening containment parameters, conditions which require implementation of an abnormal procedure. Catawba does not have an abnormal procedure for containment cooling directly, but the AP for Secondary Steam Leak contains guidance regarding use of the containment cooling system. In this question the applicant must select the appropriate required procedure direction.

Cognitive Level: **Low**

Source of Question: Bank - CNS 4340 2012 NRC Exam. Previously discussed with Chief Examiner on 07/09/13: modified the question so that it is not an exact duplication of the previous question. Initial power level, bullet format containing containment parameters, LCVUs and UCVUs initially in service all have been changed.

Question 41
025K6.01
Ice Condenser
Knowledge of the effect of a loss or malfunction of the following will have on the ice condenser system:
Upper and lower doors of the ice condenser

Given the following Unit 1 conditions:

- The Unit is in Mode 4.
- 1AD-9 / A5 (ICE COND LOWER INLET DOORS OPEN) alarm is LIT.
- The lower inlet door position display panel indicates that a door is open.
- The door is confirmed to be cracked opened, and cannot be closed.
- No other alarms related to the ice condenser, NF system or AHUs are lit.

Which, if any, of the following is REQUIRED to be entered based on the current plant conditions?

1. Tech Spec 3.6.13 Ice Condenser Doors
2. Tech Spec 3.6.12 Ice Bed

A. 1 ONLY

B. 2 ONLY

C. 1 and 2

D. No Tech. Spec. entry required.

QUESTION 41

Distractor Analysis

A. **CORRECT.** Per TS 3.6.13 (Ice Condenser Doors), the ice condenser inlet doors, intermediate deck doors, and top deck doors shall be operable and closed while in Modes 1, 2, 3, and 4.

B. Incorrect. Plausible if the applicant believes that only the ice bed should be declared inoperable because ice bed temperature could be affected by the open door.

C. Incorrect. Plausible if the applicant correctly believes that inlet doors should be declared inoperable but also believes that the ice bed should be declared inoperable because ice bed temperature could be affected by the open door.

D. Incorrect. Plausible if the applicant is not aware that the listed technical specifications are applicable in Mode 4.

References:
- Tech Spec 3.6.13, Ice Condenser Doors
- Tech Spec 3.6.12, Ice Bed

KA Match:
The applicant is given a condition where an Ice Condenser Door is opened and is asked to determine the effect that this malfunction will have on the Ice Condenser system (i.e. the applicability of Tech Specs).

Cognitive Level: **High**
This is a higher cognitive level question because it requires more than one mental step. First, the applicant must analyze the conditions given to determine the condition of the ice condenser system. The applicant must then compare that analysis to the Tech Specs listed and determine which apply based on the condition of the ice condenser system.

Source of Question: **Bank - 3231 MNS 2010 NRC Exam**

Question 42
026K1.01
Containment Spray
Knowledge of the physical connections and/or cause-effect relationships between the CSS and the following:
ECCS

In order to align “1A” train ND to supply containment spray, 1NS-43A (ND Pump A to NS Spray Header Containment Isolation Valve) must be opened.

(1) In order to open this valve, _____________(1)____________must be open.

(2) Once aligned, spray will be directed through ____________(2)______________.

A. (1) 1NS-18A (NS Pump A Suct from Cont Sump)
(2) ND system spray rings.

B. (1) 1NS-18A (NS Pump A Suct from Cont Sump)
(2) NS system spray rings.

C. (1) 1NI-185A (ND Pump 1A Cont Sump Suct)
(2) ND system spray rings.

D. (1) 1NI-185A (Containment Sump Isolation)
(2) NS system spray rings.

Distractor Analysis

A. Incorrect. Plausible if the applicant believes that ND uses the NS containment sump suction. Also, 1NS-18A does have an interlock associated with 1FW-27A (ND Pump 1A Suct from FWST). Second part is correct.

B. Incorrect. See answer A for description of first part. Second part is also incorrect, but plausible, if the applicant believes that the ND spray system uses the same spray rings as NS.

C. **CORRECT.** 1NI-185A must be open in order to satisfy an interlock to open 1NS-43A for ND spray. When used, ND spray has its own dedicated spray rings.

D. Incorrect. First part is correct. Second part is incorrect, but plausible, if the applicant believes that the ND spray system uses the same spray rings as NS.

References:

- OP-CN-ECCS-NS, Lesson Plan for Containment Spray System, Section 2.3, "Containment Spray Headers and Nozzles", Revision 101
- OP-CN-PS-ND, Lesson Plan for Residual Heat Removal System, Pg. 77, 78, Revision 100

KA Match:
KA is matched because knowledge is tested of the physical connection of how an ECCS system (ND - RHR) can supply the containment spray system. A cause-effect relationship is also tested by testing on a valve interlock between the two systems.

Cognitive Level: **Low**

Source of Question: **New**

Question 43
026K2.02
Containment Spray
Knowledge of bus power supplies to the following:
MOVs

Which Motor Control Center provides power to 1NS-20A (NS Pump 1A Suct from FWST)?

A. 1EMXA

B. 1EMXB

C. 1MXC

D. 1MXD

QUESTION 43

Distractor Analysis

A. **CORRECT.** 1NS-20A receives power from 1EMXA-F01D.

B. Incorrect. Plausible because 1EMXB is an essential bus power supply. However, the applicant should recognize that this is a "B" train power supply.

C. Incorrect. Plausible because 1MXC is an "A" train supply. However, the applicant should recognize that this is a "unit" power supply rather than essential.

D. Incorrect. Plausible because 1MXD is an essential bus power supply. However, the applicant should recognize that this is a "B" train power supply.

References:

- AP/1/A/5500/007, (Loss of Normal Power), Case I (Loss of Normal Power to an Essential Train), Step 11 & Encl. 2, Step 1, Revision 070

KA Match:

KA is matched because applicant must select the power supply to a MOV associated with the Containment Spray System.

Cognitive Level: **Low**

Source of Question: **New**

Question 44
039A3.02
Main and Reheat Steam
Ability to monitor automatic operation of the MRSS, including:
Isolation of the MRSS

In order to protect the Main Turbine from overspeed following a loss of generator load, the ________(1)_________ will close at a maximum of _____(2)____ of rated speed.

A. (1) Intercept Valve
(2) 103%

B. (1) Intercept Valve
(2) 105%

C. (1) Reheat Stop Valve
(2) 103%

D. (1) Reheat Stop Valve
(2) 105%

QUESTION 44

Distractor Analysis

A. **CORRECT.** The load drop anticipator attempts to prevent a turbine overspeed trip on loss of load by fast closure of Intercept valves and control valves at 103% speed.

B. Incorrect. The first part is correct. The second part is incorrect, but plausible, because 105% is the setpoint used when testing the turbine electrical overspeed trip.

C. Incorrect. The first part is incorrect. The Intercept Valve and Reheat Stop Valve are distinct parts of one component which operate independently. This is plausible if the applicant does not know which of these components operate to limit turbine overspeed. The second part is correct.

D. Incorrect. See answers B & C for description.

References:
- OP-CN-GEN-EHC, Lesson Plan for Digital Turbine Control System, Section 2.14, Revision 101

KA Match:
KA is matched because the question tests on automatic operation and isolation of valves associated with the Main and Reheat Steam System.

Cognitive Level: **Low**

Source of Question: **New**

Question 45
039K3.05
Main and Reheat Steam
Knowledge of the effect that a loss or malfunction of the MRSS will have on the following:
RCS

Given the following Unit 1 conditions:

- Reactor power is 8%.
- Steam Dumps are in MANUAL.
- Preparations are being made to place the Main Turbine online.

Subsequently:

- 1SV-21 (1A S/G Safety No. 2) fails OPEN and cannot be isolated.

The FIRST effects of this failure will be seen as a decrease in NC _____(1)_____. Assuming no operator action, reactor power will stabilize at _____(2)_____.

A. (1) Thots
(2) 10.5%

B. (1) Thots
(2) 13%

C. (1) Tcolds
(2) 10.5%

D. (1) Tcolds
(2) 13%

QUESTION 45

Distractor Analysis

A. Incorrect. Plausible if the applicant does not understand the dynamics of increased steam demand on primary temperature. Also, Thots are normally associated with S/G PORV operation in Emergency Procedure operations (i.e. when Thots start to increase dump steam to stabilize). The second part is plausible because a S/G PORV provides approximately 2.5% steam flow.

B. Incorrect. Plausible if the applicant does not understand the dynamics of increased steam demand on primary temperature. Also, Thots are normally associated with S/G PORV operation in Emergency Procedure operations (i.e. when Thots start to increase dump steam to stabilize). The second part is correct.

C. Incorrect. The first part is correct. The second part is plausible because a S/G PORV provides approximately 2.5% steam flow.

D. **CORRECT.** The first effects of increased steam flow will be seen as a decrease in Tcolds since this is directly downstream of the point at which the heat is being removed (S/G). Each S/G safety valve is rated for approximately 5% steam flow capacity. The failure would add approximately 5% reactor power to the existing 8% equaling 13% power.

References:
- OP-CN-STM-SM, Lesson Plan for Main Steam System, Pg. 12 & 14, Revision 100

KA Match:
KA is matched because the question tests knowledge of the effect of a failure of a component of the Main and Reheat Steam System and the effect of that failure on the RCS, specifically the initial effects on RCS temperature, and then of reactor power.

Cognitive Level: **High**
Higher cognitive level since analysis of conditions must be performed to predict the response of reactor power.

Source of Question: **New**

Question 46
059K1.03
Main Feedwater
Knowledge of the physical connections and/or cause-effect relationships between the MFW and the following systems:
S/GS

(1) For **Unit 2**, a S/G Hi Hi Level (P-14) signal is generated when S/G level first increases to ______(1)______ .

(2) The purpose of this P-14 signal is to prevent an overfill of the S/G and avoid ____________(2)_________________ .

A. (1) 83%
(2) an undesired insertion of positive reactivity.

B. (1) 77%
(2) an undesired insertion of positive reactivity.

C. (1) 83%
(2) challenging Main Steam piping and supports due to excess weight.

D. (1) 77%
(2) challenging Main Steam piping and supports due to excess weight.

QUESTION 46

Distractor Analysis

A. Incorrect. The first part is plausible because 83% is the P-14 setpoint for Unit 1. The second part is plausible because it is the reason for the low temperature feedwater isolation upon Rx trip (P-4) which would likely occur as a result of a P-14. However, this is not the specific reason for the P-14 signal.

B. Incorrect. The first part is correct. The second part is plausible because it is the reason for the low temperature feedwater isolation upon Rx trip (P-4) which would likely occur as a result of a P-14. However, this is not the specific reason for the P-14 signal.

C. Incorrect. The first part is plausible because 83% is the P-14 setpoint for Unit 1. The second part is correct.

D. **CORRECT.** The unit 2 value for S/G Hi Hi Level is 77%. The reason for the associated P-14 signal is to prevent increased dead weight placed on steam lines and their supports.

References:

- OP-CN-CF-CF, Lesson Plan for Feedwater System, Section 8.6, "Hi Hi S/G Level (P-14)", Revision 100
-

KA Match:
KA is matched because it matches the cause-effect relationship between Main Feedwater and the S/Gs, specifically an interlock/permissive (P-14) that trips the Main Feedwater pumps on a Hi Hi level in the S/Gs.

Cognitive Level: **Low**

Source of Question: **New**

Question 47
061K5.01
Auxiliary/Emergency Feedwater
Knowledge of the operational implications of the following concepts as they apply to the AFW: Relationship between AFW flow and RCS heat transfer

Given the following Unit 1 initial conditions:

- The Unit was at 100% power.
- The 1C S/G secondary manway failed resulting in a reactor trip and safety injection.

<u>10 minutes later:</u>

- Containment pressure is 3.2 psig and slowly decreasing.
- S/G parameters are as follows:

S/G	1A	1B	1C	1D
NR Level	14%	8%	5%	16%
CA Flow	110 gpm	130 gpm	120 gpm	100 gpm

- All NC Tcolds are 445°F and decreasing.
- All NC Thots are 475 °F and decreasing.
- All MSIVs are OPEN and will NOT close.
- The crew has entered EP/1/A/5000/ECA-2.1 (Uncontrolled Depressurization of All Steam Generators).

(1) How will the crew respond to step 6 to "Control feed flow…" in EP/1/A/5000/ECA-2.1?

(2) Which temperature indication is used to initiate dumping steam and evaluating changes to CA flow for stabilizing NC temperature in this procedure?

A. (1) Reduce flow to 0 gpm each in 1A and 1D S/Gs and maintain at least 75 gpm in 1B and 1C S/Gs.
(2) NC Thots

B. (1) Reduce flow to 75 gpm each in all four S/Gs.
(2) NC Thots

C. (1) Reduce flow to 0 gpm each in 1A and 1D S/Gs and maintain at least 75 gpm in 1B and 1C S/Gs.
(2) NC Tcolds

D. (1) Reduce flow to 75 gpm each in all four S/Gs.
(2) NC Tcolds

QUESTION 47

Distractor Analysis

A. Incorrect. First part is plausible if the applicant is unaware that ACC conditions are present. This would be the correct answer if containment pressure was less than 3.0 psig. Second part is correct.

B. **CORRECT.** Per, ECA-2.1 flow must be maintained greater than 75 gpm to any S/G less than required level (29% due to ACC conditions). Flow must then be reduced TO 75 gpm due to cooldown rate greater than 100° (as listed in stem). Following feed flow reduction, Thots are checked to ensure they are not increasing. Procedure directs that feed flow and steam flow are used to stabilize Thots.

C. Incorrect. First part is plausible if the applicant is unaware that ACC conditions are present. This would be the correct answer if containment pressure was less than 3.0 psig. Second part is plausible because Tcolds are used to monitor RCS cooldown rate.

D. Incorrect. First part is correct. Second part is plausible because Tcolds are used to monitor RCS cooldown rate.

References:

- EP/1/A/5000/ECA-2.1, (Uncontrolled Depressurization of All Steam Generators), Step 6, Revision 36
-

KA Match:
This question matches the KA by evaluating the applicant's knowledge of the method used to balance feeding S/Gs with Aux. Feed for RCS heat removal, maintaining S/G tubes covered, and minimizing RCS cooldown. Also, the question requires knowledge of the parameter monitored for RCS temperature changes related to core cooling vs. PTS concern.

Cognitive Level: **High**
Multiple data points of unit parameters are given which require the applicant to evaluate and determine how flow is to be controlled. Involves more than one mental step to perform this evaluation and determination.

Source of Question: **Bank - 1199**

Question 48
062A4.01
AC Electrical Distribution
Ability to manually operate and/or monitor in the control room:
All breakers (including available switchyard)

Which ONE of the following breaker operations can be performed from the control room given the accompanying condition?

A. CLOSE 1ETA-2 (Alternate Feeder to 1FTA) with
1FTA-1 (Alternate Incoming Breaker from 1ETA) OPEN.

B. CLOSE PCB-15 (Unit Tie PCB) with
PCB 14 (Unit Tie PCB) CLOSED.

C. CLOSE GEN PCB 1B while
MOD lever is in the SAFE position.

D. CLOSE 1HTA-5 (1HTA and 2HTA Tie breaker) with
1HTA-1 (Incoming Feeder from XFMR 1ATE) and 2HTA-4 (Incoming Feeder from XFMR 2ATE) CLOSED.

QUESTION 48

Distractor Analysis

A. Incorrect. Plausible if the applicant is not aware of the interlock (or misapplies the interlock) preventing operation of 1ETA-2 with 1FTA-1 open.

B. **CORRECT.** Unit Tie Breakers may be closed in any order.

C. Incorrect. Plausible because GEN PCB operation is allowed locally when MOD is in Safe Mode.

D. Incorrect. Plausible is the applicant is not aware of the interlock preventing operation of the HTA Tie Breaker with both Incoming Feeders closed.

References:
- OP-CN-EL-EPA, Lesson Plan for Main Power Distribution 230KV, 22KV, Pg. 27, 28, Revision 101
- OP-CN-EL-EPC, Lesson Plan for Essential Auxiliary Power Distribution: 4160V Essential, 4160V Blackout, 600V Essential, 600V Blackout, Pg. 18, Revision 100
- OP-CN-EL-EPM, Lesson Plan for 13.8KV Normal Auxiliary Power, Pg. 10, Revision 100

KA Match:
KA is matched because it tests knowledge of the operation from the control room of switchyard breakers.

Cognitive Level: **Low**

Source of Question: **New**

Question 49
063A1.01
DC Electrical Distribution
Ability to predict and/or monitor changes in parameters associated with operating the DC electrical system controls including:
Battery capacity as it is affected by discharge rate

(1) Auxiliary Control Power Batteries 1CBA and 1CBB are capable of powering their associated loads for at least ____(1)____ without any manual load shedding of DC loads.

(2) Manual DC load shedding is performed so that battery capacity is maintained at a value of no less than _____(2)____ , as indicated on 1CDA and 1CDB voltage indication on 1MC-8.

In accordance with EP/1/A/5000/ECA-0.0 (Loss of All AC Power), Enclosure 23, (DC Loads to be Shed During Loss of All AC Power), which ONE of the following completes the above statements?

A. (1) 2 hours
(2) 100 volts

B. (1) 2 hours
(2) 105 volts

C. (1) 4 hours
(2) 100 volts

D. (1) 4 hours
(2) 105 volts

QUESTION 49

Distractor Analysis

A. Incorrect. First part (2 hours) is correct. 100 volts is plausible because if applicant misapplies the guidance in TS 3.8.4, S.R. 3.8.4.9 "Verify DC channel and DG battery capacity is $\geq$ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test." 80% of 125 volts = 100 volts.

B. **CORRECT.** Each battery is sized to carry the following continuous emergency loads for a two hour period: Its own vital buss and the loads of another battery. An emergency would be a complete loss of AC power or a battery charger failure. The two-hour period is the conservative estimate of the time required to restore power to the battery chargers under the most adverse conditions. Each battery is also capable of supplying the anticipated momentary loads during this two-hour period.

From ECA-0.0, Step 26
WHEN the large non-vital DC loads are removed, **THEN** notify operator to open additional breakers to maintain the required voltage on the following "DIST CTR VOLTS" meters (1MC-8). **REFER TO** Enclosure 23 (DC Loads to be Shed During Loss of All AC Power), Step 2:
- 1CDA greater than 105 volts
- 1CDB greater than 105 volts

C. Incorrect. 4 hours is plausible if the applicant misapplies the following from the Background Document for Step 41 of ECA-0.0 (Loss of All AC Power): This step recovers the nonessential vital loads that were shed earlier so that sufficient capacity exists to electrically operate the required breakers to restore emergency AC power 4 hours after the event. This is required to meet the requirements of the Station Blackout Rule.

D. Incorrect. Plausibility of 4 hours is described in "C" above. Second part is correct.

References:
- OP-CN-EL-EPF, Lesson Plan for 125 VDC and 240/120 VAC Auxiliary Control Power System), Revision 101, Pg. 9
- EP/1/A/5000/ECA-0.0, (Loss of All AC Power), Revision 47, Steps 26
- EBG/1/A/5000/ECA-0.0 (Background Document for ECA-0.0), Step 41, Revision 013
- Technical Specification 3.8.4 DC Sources – Operating, SR 3.8.4.9

KA Match:
This question matches the KA by testing the applicant's knowledge of auxiliary control power batteries design capacity. The question also requires the applicant to know a specific voltage at which the battery's discharge rate will greatly change (due to cell reversal).

Cognitive Level: **Low**

Source of Question: **New**

Question 50
063K4.04
DC Electrical Distribution
Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following:
Trips

In order to prevent blowing inverter input fuses, the Static Inverter must be ________(1)____________ prior to closing the __________(2)__________.

A. (1) Synchronized
(2) DC Input Breaker.

B. (1) Synchronized
(2) AC Output Breaker.

C. (1) Pre-charged
(2) DC Input Breaker.

D. (1) Pre-charged
(2) AC Output Breaker.

QUESTION 50

<u>Distractor Analysis</u>

A. <u>Incorrect.</u> The first part is plausible because the static inverter does have a synchronizing circuit which allows the power supply to be swapped without power interruption. The second part is correct.

B. <u>Incorrect.</u> The first part is plausible because the static inverter does have a synchronizing circuit which allows the power supply to be swapped without power interruption. The second part is plausible if the applicant confuses the inverter with most station battery chargers which each have a shunt trip of the AC input breaker.

C. **CORRECT.** Static inverters must be "Pre-charged" prior to closing the DC input breaker. Once the "Pre-charge" button is released, the "Battery Input" breaker must be closed immediately to prevent blowing the inverter input fuses.

D. <u>Incorrect.</u> The first part is correct. The second part is plausible if the applicant confuses the inverter with most station battery chargers which each have a shunt trip of the AC input breaker.

<u>References</u>:

- OP-CN-EL-EBH, Lesson Plan for 230 KV Switchyard 125 VDC and 480/208/120 VAC System, Section 2.1, "Battery Chargers - Protective Relaying", Revision 100
- OP-CN-EL-EPL, Lesson Plan for 125 VDC/120 VAC Vital Instrumentation and Control Power System, Section 2.6, "Static Inverters", Revision 100

<u>KA Match:</u>

KA is matched because the question tests a system design feature which requires specific operator action in order to prevent blowing a fuse in the inverter on the DC system.

<u>Cognitive Level:</u> **Low**

<u>Source of Question:</u> **New**

Question 51
064K2.03
Emergency Diesel Generator
Knowledge of bus power supplies to the following:
Control power

Given the following conditions:

- Unit 1 is at 100% power when the following alarm is received:

  1AD-11, B/7, D/G A PANEL TROUBLE

- An NLO is dispatched and confirms that the power supply to the 1A D/G Battery Charger is de-energized.

A loss of which ONE of the following power supplies is the cause for these conditions?

A. 1EDE

B. 1EMXE

C. 1EADA

D. 1VADA

QUESTION 51

Distractor Analysis

A. Incorrect. Plausible because 1EDE supplies control power to the 1A D/G sequencer.

B. **CORRECT.** Battery Charger 1DGCA power is supplied from 1EMXE.

C. Incorrect. Plausible because 1EADA is a power supply to 1EDE which supplies control power to 1A D/G sequencer.

D. Incorrect. Plausible because 1VADA is a load from the 1A D/G Battery and is a power supply to 1EDE which supplies control power to 1A D/G sequencer.

References:

- OP-CN-DG-EPQ, Lesson Plan for 125 VDC Diesel Auxiliary Power, Section 1.3, "General System Description", Revision 100
-

KA Match:
KA is matched because the applicant must recognize the correct power supply a battery charger on the D/G. The battery charger is on the DC system which supplies control power to the D/G.

Cognitive Level: **Low**

Source of Question: **Bank - TM DG1-038-D**

Question 52
073K3.01
Process Radiation Monitoring
Knowledge of the effect that a loss or malfunction of the PRM system will have on the following: Radioactive effluent releases

Given the following Unit 1 conditions:

Initial:

- A containment air release (VQ) is in progress.
- 1EMF-39 (Containment Gas) Trip 2 setpoint is set to 1300 counts per minute (cpm) per the gas waste release permit.
- 1EMF36 (Unit Vent Gas) is operable.

Subsequently:

- A small reactor coolant leak develops around an instrument line.
- The crew has determined that Safety Injection initiation is not warranted.
- 1EMF-39 countrate is 1000 cpm and increasing.

Current:

- 1EMF-38/39 sample pump has tripped off due to breaker failure.
- 1RAD-1 D/4, 1EMF-38/39 Containment Loss of Flow alarm is LIT.

Which ONE of the following describes the effect of the above conditions?

A. The VQ release will continue until manual operator action is taken to secure it.

**B. 1EMF-36 detects the activity released and stops the VQ release.
No Sh signal is initiated.**

C. 1EMF-39 loss of flow alarm actuates a containment ventilation isolation (Sh) signal. The Sh signal stops the VQ release.

D. 1EMF-36 detects the activity released and actuates a containment ventilation isolation (Sh) signal.
The Sh signal stops the VQ release.

QUESTION 52

Distractor Analysis

A. Incorrect. This is a required action if 1EMF-36 were inoperable. The VQ release will be stopped by 1EMF-36.

B. **CORRECT.** 1EMF-36 is a backup monitor and stops the VQ by directly closing VQ-10.

C. Incorrect. As the controlling EMF, the trip setpoints generate an "Sh" containment ventilation isolation if the sample flow was not lost.

D. Incorrect. 1EMF-36 generates a direct closure of VQ-10, which stops the release, not an Sh signal.

References:
- OP-CN-CNT-VQ, Lesson Plan for Containment Air Release, Page 18 and 19, Revision 100
- OP-CN-WE-EMF, Lesson Plan for Radiation Monitoring System, Page 93, Revision 102

KA Match:
KA is matched because the conditions involve a failure of a process radiation monitor during a planned radioactive gaseous effluent release. Knowledge of the effect of the failure on the release is tested by predicting whether the release will continue.

Cognitive Level: **High**
Higher cognitive level because it involves analysis of given conditions, and application of system and operational knowledge to predict an effect.

Source of Question: **CNS 450 - used on 2005 NRC exam**

Question 53
076A1.02
Service Water
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including:
Reactor and turbine building closed cooling water temperatures

Given the following Unit 2 conditions:

- The Unit is at 100%.
- ‘B’ Train KC is in service.
- 2A RN train is in operation for testing.
- The RN trains are split with 2RN-48B (RN Supply X-Over Isol) closed.
- 2B RN pump flow is indicating 2700 gpm.

<u>Subsequently:</u>

- 2RN-351 (2B KC HX Outlet Throttle) is positioned to a value of 100%.

Which ONE of the following describes the component that will stabilize at a LOWER value?

A. Containment temperature

B. NCP stator temperatures

C. NCP motor bearing temperatures

D. Letdown Heat Exchanger temperature

QUESTION 53

Distractor Analysis

A. Incorrect. Plausible because the RN system provides backup containment cooling. However, normal cooling is supplied by the YV system through an RN containment penetration. Therefore, a change in RN flow would not affect containment temperature.

B. Incorrect. Plausible because the RN system provides backup cooling. However, normal cooling is supplied by the YV system through an RN containment penetration. Therefore, a change in RN flow would not affect NCP stator temperature.

C. **CORRECT.** The action in the stem of the question results in maximum flow to the 2B KC heat exchanger. With "B" Train KC in service, KC temperatures will significantly decrease. NC Pump bearing oil coolers are being supplied by the "B" Train KC and result in the associated decrease in bearing temperatures.

D. Incorrect. Letdown Heat Exchanger temperature remains unaffected since the temperature sensor controls KC-132 and regulates the amount of cooling so that ≅105° F is maintained.

Plausible because the Letdown Heat Exchanger is supplied by KC and temperature would initially decrease with the increased KC flow. But in the long term, the temperature controller will throttle KC-132 to return Letdown Heat Exchanger temperature to 105°F.

References:

- OP-CN-PS-NCP, Lesson Plan for Reactor Coolant Pumps, page 26, Revision 100
- OP-CN-PS-NV, Lesson Plan for the Chemical and Volume Control System, page 22, Revision 101
- OP-CN-CNT-VV, Lesson Plan for the Containment Ventilation System, page 20, Revision 100

KA Match:

The KA is matched because the question specifies a change in the service water system flowrate through the heat exchanger of a closed loop cooling system and requires the applicant to predict associated changes. The stem of the question informs the applicant that RN (Nuclear Service Water) flow through the KC (Component Cooling Water) HX has changed from 2700 gpm to maximum flow (~9000 gpm) due to the RN outlet throttle valve being positioned to full open. The applicant is required to predict specific component temperature changes due to the change is cooling water flow though this HX.

Cognitive Level: **High**

This is a higher cognitive level question because the applicant must analyze multiple alarms and equipment configurations and then predict which parameter will change and how it changes.

Source of Question: **Bank - 3082**

Question 54
078A3.01
Instrument Air
Ability to monitor automatic operation of the IAS, including:
Air pressure

Given the following Unit 1 conditions:

- The VI system on Unit 1 has become heavily contaminated with oil and debris.
- The VI Air Dryer begins to rapidly clog.

(1) VI header pressure will decrease until 1VI-670 (VI Auto Dryer Bypass) automatically opens at ____(1)____ .

(2) If 1VI-670 FAILS and does NOT automatically open, AP/0/A/5500/022, (Loss of Instrument Air), directs the operators to ______(2)_______ the air dryers locally.

A. (1) 80 psig
(2) bypass

B. (1) 85 psig
(2) bypass

C. (1) 80 psig
(2) swap

D. (1) 85 psig
(2) swap

Distractor Analysis

A. **CORRECT.** A bypass line has been installed around the entire dryer package to be used in the event of any failure on the dryer unit that could result in restriction of air flow to the supply headers. An automatic control valve (VI-670) will automatically bypass the entire dryer package upon low air pressure of 80 psig downstream of the dryer unit. VI-670 must be manually closed when restoring the system. The automatic bypass valve also has a manual bypass around it.

B. Incorrect. First part is plausible because the Dryer Purge Exhaust Muffler Isolations close at 85 psig. The second part is correct.

C. Incorrect. The first part is correct. The second part is plausible because the annunciator response procedure for Dryer Trouble contains direction to swap dryers.

D. Incorrect. First part is plausible because the Dryer Purge Exhaust Muffler Isolations close at 85 psig. The second part is plausible because the annunciator response procedure for Dryer Trouble contains direction to swap dryers.

References:

- AP/0/A/5500/022, (Loss of Instrument Air), Step 6, Revision 034
- 1AD-8, F/3, "VI Dryer Bypass Vlv Open", Revision 076
- 1AD-8, E/3, "VI Dryer F Trouble"
- OP-CN-SS-VI, VS & VB, Section 2.4, "Instrument Air Dryers E and F", and Section 3.5, “Automatic Actions on Increasing or Decreasing VI Pressure, Revision 100

KA Match:

KA is matched because it provides conditions involving automatic opening of the air dryer bypass valve on the Instrument Air System. The applicant then must evaluate / monitor when this will occur and selection an action to take if it does not occur.

Cognitive Level: **Low**

Source of Question: **Bank 3112 - Sig Mod**

Question 55
103A1.01
Containment
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the containment system controls including: Containment pressure, temperature and humidity

Given the following Unit 1 conditions:

- Unit 1 was at 100% power.
- At 1000, a secondary steam leak occurred in Unit 1 containment.
- The crew has started a controlled shutdown per AP/1/A/5500/009 (Rapid Downpower).

Containment pressure and temperature trends indicate:

Time	Temperature	Pressure
1000	113°F	0.15 psig
1005	117°F	0.28 psig
1010	119°F	0.42 psig
1015	122°F	0.48 psig
1020	126°F	0.65 psig
1025	129°F	0.91 psig

Assuming NO manual operator actions have occurred, which ONE of the following is the EARLIEST time period at which the Lower Containment Ventilation Units (LCVUs) cooling water bypass valves (full flow valves) automatically OPEN?

A. Between 1005 and 1010

B. Between 1010 and 1015

C. Between 1015 and 1020

D. Between 1020 and 1025

QUESTION 55

Distractor Analysis

A. Incorrect. Plausible because 0.35 psig is a containment pressure (CPCS signal) which causes and automatic action (secures Containment Air Return Fans).

B. Incorrect. Plausible if the applicant believes that the LCVU bypass valve operates based on temperature (120F is the TS limit for containment temperature).

C. **CORRECT.** The LCVU bypass valve opens at 0.5 psig.

D. Incorrect. Plausible because 0.9 psig is a containment pressure (CPCS signal) that is required for Containment Air Return Fan operation.

References:
- OP-CN-CNT-VX, Lesson Plan for Hydrogen Skimmer, Containment Air Return System and Containment Hydrogen Sample and Purge System, pg 13, Revision 100
- OP-CN-CNT-VV, Lesson Plan for Containment Ventilation System, pg 12, Revision 100

KA Match:
The applicant is required to monitor changes in containment pressure and apply knowledge of controls designed to prevent exceeding design limits.

Cognitive Level: **High**
Higher cognitive level, since by the nature of the KA, analysis of multiple data points to predict an outcome is required.

Source of Question: **Bank 1755 (2009 CNS NRC Exam)**

Question 56
002K5.16
Reactor Coolant
Knowledge of the operational implications of the following concepts as they apply to the RCS:
Reason for automatic features of the Feedwater control system during total loss of reactor coolant flow

Given the following Unit 1 conditions:

- The Unit was at 8% power.
- Turbine warming was in progress.

<u>**Subsequently:**</u>
- 1A and 1C NCPs tripped due to “A” train power supply fault.
- A fast transfer on the associated 6900V busses did NOT occur.

(1) DNB protection from the low flow condition will be accomplished via a(n) ____(1)____ reactor trip signal.

(2) As NC temperature decreases below 564°F (following the reactor trip), an automatic ________(2)________signal will minimize NC system cooldown.

Which ONE of the following completes the above statements?

A. (1) Automatic
(2) Turbine Trip

B. (1) Automatic
(2) Feedwater Isolation

C. (1) Manual
(2) Turbine Trip

D. (1) Manual
(2) Feedwater Isolation

QUESTION 56

Distractor Analysis

A. Incorrect. The first part is plausible if the applicant is not aware that there is no automatic low RCS flow protection below 10% power. The second part is plausible because a turbine trip does limit cooldown, but actuates on Reactor trip (not 564°).

B. Incorrect. The first part is plausible if the applicant is not aware that there is no automatic low RCS flow protection below 10% power. The second part is correct.

C. Incorrect. The first part is correct. The second part is plausible because a turbine trip does limit cooldown, but actuates on Reactor trip (not 564°).

D. **CORRECT.** A manual reactor trip would be required for low RCS flow below 10% power. The two loop low flow trip will be instated by P-7 at 10% power. The feedwater isolation actuates at 564° with P-4 (Reactor trip) in order to minimize reactor coolant system cooldown.

References:
- OP-CN-IC-IPX, Lesson Plan for Reactor Protection System, pg 32, Revision 100
- OP-CN-EP-E0, Lesson Plan for E-0 Series, pg 18, Revision 100
- OP-CN-ECCS-ISE, Lesson Plan for Engineered Safety Features Actuation System (ESFAS), pg 27, Revision 100

KA Match:
The applicant is required to apply the basis for an automatic feedwater isolation following a reactor trip on loss of RCS flow.

Cognitive Level: **Low**

Source of Question: **New**

Question 57
015A1.03
Nuclear Instrumentation
Ability to predict and/or monitor changes in parameters to prevent exceeding design limits) associated with operating the NIS controls including:
NIS power indication

Given the following:

Steam Dump Valve 1SB-3 (Main Steam Bypass to Condenser Control Valve #3) fails open during a plant startup. No operator action has been taken. Pressurizer pressure and reactor power trends (Power Range) indicate:

Time	PZR Pressure (psig)	N-41 %	N-42 %	N-43 %	N-44 %
0835	1950	8	10	8	9
0836	1910	9	10	9	9
0837	1870	9	10	10	9
0838	1830	10	11	10	9

What is the EARLIEST time at which an automatic Reactor Trip signal will be generated?

A. 0835

B. 0836

C. 0837

D. 0838

QUESTION 57

Distractor Analysis

A. Incorrect. Plausible because the listed value of pressurizer pressure is below the value of P-11 (allows block of pressurizer low pressure safety injection).

B. Incorrect. Plausible because the listed value of pressurizer pressure is below the "At Power" low pressure trip of 1945 psig. However, in order for this trip to be instated two Nis must be equal to or greater than 10%.

C. **CORRECT.** Two Nis equal to or greater than 10% instates the "At Power" low pressure trip of 1945 psig.

D. Incorrect. Plausible because the listed value of pressurizer pressure is below the low pressure trip/safety injection setpoint which is active at all power levels.

References:
- OP-CN-IC-IPX, Lesson Plan for Reactor Protection System, pg 109, 111, Revision 100

KA Match:
The applicant is required to monitor changes in RCS pressure and power levels and apply knowledge of automatic actions associated with the NIS designed to prevent exceeding limits.

Cognitive Level: **High**
This is a higher cognitive level question because it involves multiple data points for NI indications, and a point for PZR pressure. Requires the applicant to analyze and trend these values, and apply system knowledge to make a determination on which an automatic signal will be generated for reactor trip.

Source of Question: **New**

Question 58
016A3.01
Non-nuclear Instrumentation
Ability to monitor automatic operation of the NNIS, including:
Automatic selection of NNIS inputs to control systems

As Unit 1 power increases above 20%, ____(1)____ input(s) into the anticipatory circuit of narrow range S/G level response. This is due to a(n) ____(2)____ transfer within the S/G water level control system.

A. (1) Steam Flow and Feed Flow
(2) Manual

B. (1) Steam Flow and Feed Flow
(2) Automatic

C. (1) Wide Range S/G Level
(2) Manual

D. (1) Wide Range S/G Level
(2) Automatic

QUESTION 58

Distractor Analysis

A. Incorrect. The first part is correct. At approximately 20% power (increasing) the S/G water level control system transfers to the High Power Controller. This transfer is performed automatically based on feed flow. The High Power Controller uses Steam/Feed Flow mismatch as an anticipatory feature to predict narrow range level. The second part is incorrect, but plausible because a manual nozzle swap is performed at approximately 15% power. The nozzle swap interlock is also based on feed flow.

B. **CORRECT.** At approximately 20% power (increasing) the S/G water level control system transfers to the High Power Controller. This transfer is performed automatically based on feed flow. The High Power Controller uses Steam/Feed Flow mismatch as an anticipatory feature to predict narrow range level.

C. Incorrect. The first part is incorrect, but plausible because WR S/G level is used as an anticipatory circuit at power below 20%. The second part is also incorrect, but plausible because a manual nozzle swap is performed at approximately 15% power. The nozzle swap interlock is also based on feed flow.

D. Incorrect. The first part is incorrect, but plausible because WR S/G level is used as an anticipatory circuit at power below 20%. The second part is correct.

References:

- OP-CN-CF-IFE, Lesson Plan for Steam Generator Water Level and Feedwater Pump Speed Control, Pg. 22, Revision 102

KA Match:
KA is matched because it tests monitoring of the inputs to the narrow range S/G water level control system by providing a power level (20%) and then testing on how the inputs to the control system change automatically.

Cognitive Level: **Low**

Source of Question: **New**

Question 59
027K2.01
Containment Iodine Removal
Knowledge of bus power supplies to the following:
Fans

Unit 1 was initially at 100% power when the following sequence of events occurred:

- A Loss of Offsite Power occurred.
- The reactor tripped.
- When 1A D/G attempted to load 1ETA, 87G (Generator Differential) relay actuated.
- Just after the reactor trip, a large break LOCA inside containment developed.
- Containment pressure quickly increased to 3.0 psig and continues to slowly increase.

Which ONE of the following describes the status of the VE (Annulus Ventilation) fans?

A. ONLY 1B VE fan is running.

B. 1A AND 1B VE fans are running.

C. ONLY 1B VE fan will start after a 9 minute time delay.

D. 1A AND 1B VE fans will start after a 9 minute time delay.

Distractor Analysis

A. **CORRECT.** Power is unavailable to 1A VE fan due to the lockout of bus 1ETA. The 87G relay actuation causes the D/G output breaker to 1ETA (safety bus) to trip open, and 1A D/G to shutdown. Power continues to be available to 1B VE fan, since 1B D/G started and loaded per design. With containment pressure at 3.1 psig, 1B VE fan will be operating, since a Safety Injection signal (Ss) initiated when containment pressure rose to > 1.2 psig.

B. Incorrect. Plausible if the applicant does not understand that the 87G relay locks out the 1A D/G, and therefore no power is available to safety bus 1ETA, and consequently no power is available to 1A VE fan. With containment pressure at 3.1 psig, 1B VE fan will be operating, since a Safety Injection signal (Ss) initiated when containment pressure rose to > 1.2 psig.

C. Incorrect. Plausible because only 1B VE fan has power to start and run. However, the applicant must understand that the VE fans start immediately upon receipt of a Safety Injection signal, which also generates a Phase A signal. It is plausible for an applicant to misunderstand Phase A vs. Phase B time delays.

D. Incorrect. Plausible if the applicant does not understand that the 87G relay will lockout the 1D/G and therefore no power will be available to 1ETA and consequently no power is available to 1A VE fan. Also the applicant must understand that the VE fans start immediately upon receipt of a Safety Injection signal, with NO time delay. A time delay of 9 minutes is plausible, since the Air Return Fans start after 9 minutes.

References:
- DBD for Annulus Ventilation, Section 2.3.2
- OP-CN-DG-DG3, Lesson Plan for Emergency Diesel Generator, Page 16, Revision 102
- OP-CN-CNT-VX, Lesson Plan for Hydrogen Skimmer, Page 13, Revision 100

KA Match:
KA is matched because question tests (at a higher cognitive level) knowledge of power supplies to the iodine removal fans.

Cognitive Level: **High**
Even though this is often a lower cognitive level KA, the question involves a higher cognitive level thought process to: analyze given conditions, and based on knowledge of power supplies, predict an outcome of fan status.

Source of Question: **Bank - 4312**

Question 60
033A2.03
Spent Fuel Pool Cooling
Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Abnormal spent fuel pool water level or loss of water level

Given the following:

- Unit 1 is in Mode 6 with core unload in progress.
- 1A KF pump is running.
- An RP Technician in the Spent Fuel Pool (SFP) building reports that level in the SFP is DECREASING.
- The fuel assembly most recently removed from the core is currently in the reactor building manipulator crane.

(1) If the level in the Spent Fuel Pool decreases to 38.7 ft. and stabilizes, the operators are required to ____ .

(2) In accordance with AP/1/A/5500/026 (Loss of Refueling Canal Level) the fuel assembly in the reactor building manipulator crane is REQUIRED to be placed _______________________________________ .

A. (1) Stop 1A KF pump.
(2) Into the upender and lowered to the fully down position.

B. (1) Stop 1A KF pump.
(2) Fully down in the core or the deep end of the canal.

C. 1) Enter Tech. Spec. 3.7.14, Spent Fuel Pool Water Level.
(2) Into the upender and lowered to the fully down position.

D. (1) Enter Tech. Spec. 3.7.14, Spent Fuel Pool Water Level.
(2) Fully down in the core or the deep end of the canal.

QUESTION 60

Distractor Analysis

A. Incorrect. The first part is correct. The second part is plausible, because this action would be directed if the most recently removed assembly was in the upender.

B. **CORRECT.** Anytime the SFP level is less than 39 ft. the operators are directed to stop any operating KF pumps. The SFP and refueling canal are physically connected. If AP/41 is entered, the first step will direct the crew to AP/26 without performing any action. The procedure directs placing the fuel assembly down into the core or into the deep end of the cavity if in the manipulator crane.

C. Incorrect. The first part is incorrect, but plausible, because lowering SFP level is a valid concern for an LCO entry. The actual specification is for > 23 ft. above the top of the fuel, which equates to 37.6 ft. The question stem states that level has stabilized almost a foot higher than that. The second part is plausible, because this action would be directed if the most recently removed assembly was in the upender.

D. Incorrect. The first part is incorrect, but plausible, as described in "C" above. The second part is correct.

References:

- Tech. Spec. 3.7.14, Spent Fuel Pool Water Level
- AP/1/A/5500/041, (Loss of Spent Fuel Cooling or Level), Case II "Loss of Spent Fuel Pool Level" Step 8, Revision 07
- OP-CN-FH-KF, Lesson Plan for Spent Fuel Pool Cooling System, Section 3.6, "Setpoints and Alarms", Revision 100

KA Match:

KA is matched because conditions involving an abnormal spent fuel pool level are given. The applicant is then tested on the impacts of this abnormal level (equipment operation/possible Tech. Spec. entry), including knowledge of how the procedure is used to mitigate the condition.

Cognitive Level: **High**

Higher cognitive level because analysis of given conditions, including comparing a given level to a setpoint (pool level), is performed in order to predict an effect, and a required action, based on the effect.

Source of Question: **Bank 1693 - 2009 NRC Exam - Sig Mod**

Question 61
034K6.02
Fuel Handling Equipment
Knowledge of the effect of a loss or malfunction on the following will have on the Fuel Handling System:
Radiation monitoring systems

Which ONE of the following describes the effect of 1EMF-15, Spent Fuel Building Refueling Bridge Monitor losing power?

A. Fuel movement in the Spent Fuel Pool must be stopped immediately.

B. SFP Ventilation System automatically swaps to filter mode.

C. New fuel elevator cannot be operated in the UP direction.

D. The Auxiliary Hoist cannot be raised.

QUESTION 61

Distractor Analysis

A. Incorrect. SLC 16.7-10, Condition E Required Action does contain some direction to suspend all operations involving fuel movement in the fuel building, but the Completion Time is NOT Immediately.

B. Incorrect. Supplementary Action #2 of the alarm response for 1EMF-15 actuation (1RAD-3, tile C/5) provides guidance to:

"...ensure Spent Fuel Pool Ventilation System filters in filter mode per OP/1/A/6450/004 (Fuel Pool Ventilation System), if required."

There is nothing in the stem to indicate conditions requiring the Spent Fuel Pool ventilation to be in filter mode. This adds plausibility to this distractor, since there is guidance regarding Filter Mode. Also, there are other radiation monitors which DO automatically place the VF (Spent Fuel Pool Ventilation System) in Filter Mode; e.g., 1EMF-35, Unit Vent Particulate Monitor, 1EMF-36L, Unit Vent Gas Monitor, etc., as explained in the Lesson Plan for EMF.

C. **CORRECT.** If 1EMF-15 loses power, it processes a Trip 2 signal which, for this monitor, prevents the New Fuel Elevator from being operated in the UP direction. (See 1RAD-3, C/5 for documentation.)

D. Incorrect. Plausible, since 1EMF-15 DOES prevent a lifting device from operating to raise its load; but it is for the New Fuel Elevator. The Auxiliary Hoist is used in refueling operations, including movement of fuel assemblies, and the radiation monitor signal could be misapplied.

References:

- OP/1/B/6100/010 Z, Annunciator Response for Radiation Monitoring Panel 1RAD-3, C/5 Automatic Actions, and Supplementary Action #2, Revision 024
- OP-CN-WE-EMF, Lesson Plan for Radiation Monitoring Systems, Section 5.4, 1EMF15 - Spent Fuel Building Refueling Bridge, Revision 102
- Selected Licensee Commitment (SLC) 16.7-10, Radiation Monitoring for Plant Operations, Table 16.7-10-1, Item 3, and Condition E, Revision 5
- AP/1/A/5500/025, Damaged Spent Fuel, Section B. Symptoms, Case II, Revision 016
- OP-CN-FH-FHS, Lesson Plan for Fuel Handling System, Section 2.2, Fuel Building Overhead Crane Bridge, Revision 101 for plausibility of distractor D

KA Match:
KA is matched because the question tests knowledge of the effect of a loss of power to a radiation monitor associated with fuel handling.

Cognitive Level: **High**
Higher cognitive level because it involves application of failure mode of a radiation monitor and the effect of that on a fuel handling component.
Source of Question: **New**

Question 62
071K3.05
Waste Gas Disposal
Knowledge of the effect that a loss or malfunction of the Waste Gas Disposal System will have on the following:
ARM and PRM systems

Given the following:

- Waste Gas Decay Tank **<u>"C"</u>** is aligned for a planned release.
- 1WG-107 (Waste Gas Decay Tank **<u>"D"</u>** Sample) is experiencing <u>valve seat leakage</u>.
- Waste Gas Decay Tank **<u>"D"</u>** pressure is decreasing.
- 1WG-251 (Waste Gas Decay Tank **<u>"E"</u>** Drain and Flush Isolation) is experiencing a <u>packing leak</u> on the valve body.
- Waste Gas Decay Tank **<u>"E"</u>** pressure is decreasing.

(1) Leakage from valve ______(1)______ will cause 1EMF-36L to close 1WG-160 (WG Disch Flow Control).

(2) Leakage from valve ______(2)______ will cause a 1EMF-6 (Waste Gas and Spent Resin Area Monitor) Trip 2 Alarm.

<u>See Provided Drawing</u>

A. (1) 1WG-107
(2) 1WG-251

B. (1) 1WG-107
(2) 1WG-107

C. (1) 1WG-251
(2) 1WG-251

D. (1) 1WG-251
(2) 1WG-107

QUESTION 62

Distractor Analysis

A. **CORRECT.** Leakage past the valve seat of 1WG-107 is likely to cause the release activity to exceed the setpoints of the waste gas and/or unit vent EMF resulting in termination of the release. Leakage from the valve packing of 1WG-251 into the Auxiliary Building will likely cause the area monitor to alarm.

B. Incorrect. The first part in correct. Seat leakage would result in the activity released being contained in the pipe. Therefore, not likely to cause an actuation of an area radiation monitor.

C. Incorrect. Packing leakage would result in increased activity in the area of the valve instead of the process piping. The second part is correct.

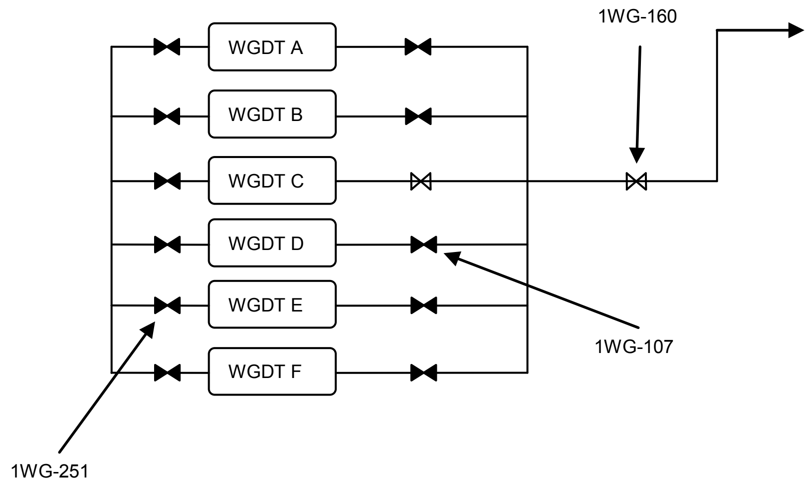
D. Incorrect. See answers B & C for description.

References:
- OP-CN-WE-EMF, Lesson Plan for Radiation Monitoring System, Pg. 11, 74, Revision 102
- DBD for EMF (Radiation Monitoring), page 50, Revision 37

KA Match:
KA is matched because conditions are given involving a malfunction (leaking valves) on the Waste Gas Decay Tanks, while a planned release on another tank is in progress. The applicant must then determine from these conditions what the various effects of the various malfunctions are on the radiation monitoring system; i.e., how the radiation monitors will respond to the malfunctions (leaking valves).

Cognitive Level: **High**

Source of Question: **New**


1WG-160
WGDT A
WGDT B
WGDT C
WGDT D
WGDT E
WGDT F
1WG-107
1WG-251

Question 63
072A4.02
Area Radiation Monitoring
Ability to manually operate and/or monitor in the control room:
Major components

Given the following Unit 1 initial conditions:

- The Unit is at 100% power.
- 1A1 Cont Floor & Equip Sump Pump has automatically started due to normal operational leakage.

Subsequently:

- 1EMF-53A, (Containment Hi Range) loses power.

(Note the following component designators):

1WL-825A, (Cont Smp Pumps Disch Cont Isol)
1WL-827B, (Cont Smp Pumps Disch Cont Isol)

Which ONE of the following describes the status of the components listed below?

	1WL-825A	1WL-827B	Pump 1A1
A.	OPEN	OPEN	ON
B.	CLOSED	CLOSED	OFF
C.	**CLOSED**	**OPEN**	**OFF**
D.	CLOSED	OPEN	ON

QUESTION 63

Distractor Analysis

A. Incorrect. Plausible if the applicant is not aware that a loss of EMF power will have the same effect as a Trip 2 actuation, or is not aware of the automatic actions of 1EMF-53A.

B. Incorrect. Plausible if the applicant believes that actuation of 1EMF-53A will close associated “A” and “B” train valves.

C. **CORRECT.** Radiation Monitors EMF-53A/B are Area Radiation Monitors that measure dose rates in lower containment in the area between the biological shield wall and crane wall**.** A Trip 2 output signal (hi radiation) causes the following to automatically occur:

Failure of a power supply to a radiation monitor causes a Trip 2 signal output; any automatic actions associated with that output WILL occur.

A Trip 2 signal output from 1EMF-53A causes the following automatic actions:

- Closure of 1WL-825A, (Containment Sump Pumps Discharge Containment Isolation)
- Closure of 1WL-867A, (VUCDT Containment Isolation) Note: VUCDT = Ventilation Unit Condensate Drain Tank

The "B" valves; i.e., 1WL-827B and 1WL-869B auto close on a Trip 2 signal from 1EMF-53**B**. Therefore, these valves are not affected.

The Containment Floor and Equipment Sump Pump trips when either of the containment sump discharge isolation valves CLOSE.

D. Incorrect. Plausible if the applicant is not aware that the Containment Floor and Equipment Sump Pump will automatically secure either Discharge Containment Isolation Valve is closed.

References:

- From OP-CN-WE-EMF, Lesson Plan for Radiation Monitoring, Section 6.23, "1(2) EMF53A & B-Containment Train A(B), Revision 102
- CNS-1565.WL-00-0001, Liquid Waste (WL) System, Section 3.3.2 (Controls), 3.3.2.1.5, (Containment Floor and Equipment Sump Pumps), Revision 35

KA Match:

The "major components of the Area Radiation Monitoring" system aspect of this KA is challenging to match, since there are really no "major" components of the Area Radiation Monitoring System. This is ONE interpretation of the intent of this KA. Another interpretation is being addressed by this question: "major components" are components affected or controlled by the area radiation monitoring system; i.e., valves, pumps, etc.

This question matches the KA because components which can be monitored in the control room are presented in the context of conditions involving the response of the area radiation monitoring system to a loss of power to the Containment Hi Range (ARM) radiation monitor. The applicant must select what is expected to be the indicated state of the listed components.

Cognitive Level: **High**
Higher cognitive level because application of system knowledge, including a failure mode, is required in order to predict the effect on other components.

Source of Question: **New**

Question 64
079K4.01
Station Air
Knowledge of SAS design feature(s) and/or interlock(s) which provide for the following: Cross-connect with IAS

Which ONE of the following statements describes an interlock provided for the cross-connect of the Instrument Air (VI) and Station Air (VS) systems?

As (VI) system pressure decreases,________________________________.

A. 1VI-500 (VI to VS Supply Isolation) CLOSES at 85 psig.

B. 1VI-500 (VI to VS Supply Isolation) CLOSES at 76 psig.

C. 1VS-78 (VS Auto Backup to VI) OPENS at 80 psig.

D. 1VS-78 (VS Auto Backup to VI) OPENS at 76 psig.

QUESTION 64

Distractor Analysis

A. Incorrect. Plausible because 1VI-477 and 1VI-488 (Dryer Purge Exhaust Mufflers) close at 85 psig.

B. Incorrect. Plausible because 1VI-500 closes in order to isolate VI supply to VS on decreasing pressure. However, the setpoint for valve operation is 80 psig.

C. Incorrect. Plausible because 1VS-78 opens in order to supply VI from the VS system on decreasing pressure. However, the setpoint for valve operation is 76 psig.

D. **CORRECT.** 1VS-78 opens at a setpoint of 76 psig in order to supply the VI system from VS on decreasing VI system pressure.

References:

- OP-CN-SS-VI, VS & VB, Lesson Plan for Air Systems - VI, VS, and VB, Page 12, Revision 100
-

KA Match:

The applicant is required to apply knowledge of the interlocks associated with the two cross-connections between the Instrument Air and Station Air systems. The applicant is also required to recall the setpoint for these interlocks.

Cognitive Level: **Low**

Source of Question: **New**

Question 65
086K1.02
Fire Protection
Knowledge of the physical connections and/or cause-effect relationships between the Fire Protection System and the following systems:
Raw service water

If normal cooling has been lost to the "E" and "F" VI compressors, the ____(1)____ System can be aligned to supply cooling water to the "E" and "F" VI compressors with the discharge aligned to the _____(2)_____ System.

A. (1) RF
(2) RN

B. (1) RF
(2) RL

C. (1) RL
(2) RN

D. (1) RN
(2) RL

QUESTION 65

Distractor Analysis

A. Incorrect. The first part is correct. The second part is plausible because RN supplied backup compressor cooling in the original plant design.

B. **CORRECT.** The RF system can be manually aligned to “E” & “F” VI compressors. Discharge must be manually aligned to the RL header.

C. Incorrect. The first part is plausible because the cooling water discharge is aligned to RL. The second part is plausible because RN supplied backup compressor cooling in the original plant design.

D. Incorrect. The first part is plausible because RN supplied backup compressor cooling in the original plant design. The second part is correct.

References:

- OP-CN-SS-VI, VS, & VB Lesson Plan for Air Systems – VI, VS, and VB, Section 4.3, “Loss of Normal Cooling Water Supply”, Revision 100

KA Match:
The applicant is required to apply knowledge of the system interrelations between the Low Pressure Water System and the Fire Protection System. Specifically, the supply of backup cooling water to “E” & “F” VI Compressors by the Fire Protection System and lake return via the Low Pressure Water System.

Cognitive Level: **Low**

Source of Question: **New**

Question 66
G2.1.15
Conduct of Operations
Knowledge of administrative requirements for temporary management directives such as standing orders, night orders, Operations memos, etc.

In accordance with SOMP 01-13 (Operations Work List, Routine Task List, and OPS Guides) which ONE of the following describes:

(1) An example of appropriate information to be communicated to the shifts by use of an OPS Guide?

(2) Who is required to be informed when an OPS Guide is added or removed?

A. (1) Notification that engineering has determined a Tech Spec inoperability may exist under certain conditions due to new analyzed failure scenarios.
(2) Control Room Supervisor

B. (1) OSM direction to verify 1A D/G Lube Oil Temp two times per shift due to an annunciator failure.
(2) Control Room Supervisor

C. (1) Notification that engineering has determined a Tech Spec inoperability may exist under certain conditions due to new analyzed failure scenarios.
(2) Operations Superintendent

D. (1) OSM direction to verify 1A D/G Lube Oil Temp two times per shift due to an annunciator failure.
(2) Operations Superintendent

QUESTION 66

Distractor Analysis

A. **CORRECT.** This answer meets the criteria listed in SOMP 01-13 (i.e. engineering guidance document). The second part is also correct. Section 9.1.12 of SOMP 01-13 states that the CRS will be informed when an OPS guide is added or removed.

B. Incorrect. Plausible because this answer meets the criteria for creation of an Increased Surveillance (not OPS Guide) per OMP 2-31. The second part is correct.

C. Incorrect. The first part meets the criteria listed in SOMP 01-13 (i.e. engineering guidance document). The second part is plausible because the Operations Superintendent is specifically mentioned in numerous places throughout the SOMPs and OMPs as having numerous authorities, duties, and responsibilities. However, Section 9.1.12 of SOMP 01-13 states that the CRS will be informed when an OPS guide is added or removed.

D. Incorrect. Plausible because this answer meets the criteria for creation of an Increased Surveillance (not OPS Guide) per OMP 2-31. Section 9.1.12 of SOMP 01-13 states that the CRS will be informed when an OPS guide is added or removed.

References:

- OMP 2-31 (Control Room Instrumentation Status), page 3, Revision 30
- SOMP 01-13 (Operations Work List, Routine Task List, and OPS Guides), pages 10 & 11, Step 9.1.12, Revision 000

K/A Match

Applicant is required to demonstrate knowledge of temporary management directive. Specifically OPS Guides which are used to communicate important information to shift personnel.

Cognitive Level: **Low**

Source of Question: **New**

Question 67
G2.1.29
Conduct of Operations
Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc.

In accordance with SOMP 02-01, (Safety Tagging and Configuration Control):

(1) An individual performing Independent Verification (IV) ______(1)______ required to follow the sequence of the tagout enclosure.

(2) When more than ______(2)_____ Tag Sticker(s) is/are required for a control panel switch, a controlling sticker shall be placed on the switch and the Tag Sticker(s) will be placed in the Control Room Sticker Logbook.

Which ONE of the following completes the above statements?

A. (1) IS
(2) One

B. (1) IS
(2) Two

C. (1) IS NOT
(2) One

D. (1) IS NOT
(2) Two

Distractor Analysis

A. First part is plausible because the person actually executing the tagout is required to follow the sequence. The second part is plausible if the applicant is unaware of the requirement to use the Sticker Log for more than two Tag Stickers.

B. First part is plausible because the person actually executing the tagout is required to follow the sequence. Second part is correct.

C. First part is correct. The second part is plausible if the applicant is unaware of the requirement to use the Sticker Log for more than two Tag Stickers.

D. **CORRECT.** Per SOMP 02-01, the individual performing IV is not required to follow the tagout sequence. The SOMP also allows two Tag Stickers to be placed on a control panel switch/device without using the Control Room Sticker Log.

References:

- SOMP 02-01, (Safety Tagging and Configuration Control), Revision 16, Sections 7.7.3.A, 8.3.6, and Attachment 13.1 (25)

KA Match:

KA is matched because knowledge of procedure requirements for conducting a lineup for a tagout, including verification process, and use of tag stickers and sticker log entries.

Cognitive Level: **Low**

Source of Question: **New**

Question 68
G2.1.44
Conduct of Operations
Knowledge of RO duties in the control room during fuel handling, such as responding to alarms from the fuel handling area, communication with the fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation.

Given the following Unit 1 conditions:

- The Unit is in Mode 6.
- Unlatching of control rod drive shafts is in progress.
- The BOP is performing PT/1/A/4600/002 F, (Mode 6 Periodic Surveillance Items), Enclosure 13.1, Periodic Surveillance Items Data.

IF the Reactor Vessel Water Level Acceptance Criteria is NOT met, **THEN** the unlatching of control rod drive shafts __________(1)__________ because __________(2)__________ .

Note: SLC 16.9-21, (Refueling Operations - Storage Pool Water Level)
LCO 3.9.6, (Refueling Cavity Water Level)

A. (1) must be stopped
(2) of the requirements of LCO 3.9.6.

B. (1) must be stopped
(2) of the requirements of SLC 16.9.21.

C. (1) may continue
(2) SLC 16.9-21 does not apply during unlatching.

D. (1) may continue
(2) LCO 3.9.6 does not apply during unlatching.

QUESTION 68

Distractor Analysis

A. Plausible because Tech. Spec. 3.9.6 requires suspension of core alterations under these conditions, but does not apply to rod latching/unlatching.

B. Plausible because SLC 16.9.21 requires suspension of fuel movement within the fuel pool under these conditions, but only applies to the Spent Fuel Pool.

C. The first part is correct, but for the wrong reason. Plausible if the applicant is unaware that SLC 16.9.21 applies to the spent fuel pool (i.e. not rod latching).

D. **CORRECT.** The Applicability section for Tech Spec 3.9.6 applies to CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts. Therefore, even if the specification is not met (which it is NOT), the unlatching does not have to be stopped.

Also, with the given conditions (unlatching control rods), the transfer tube between the refueling cavity and the spent fuel pool would be open, and any degradation of the level in one side will affect the other, which means also that the requirements of Tech Spec 3.7.14 and SLC 16.9-21 are NOT being met. The Required Action for these specs do not require stopping the latching/unlatching of control rods.

References:
- SLC 16.9-21, Refueling Operations - Storage Pool Water Level, Revision 0
- Tech Spec 3.9.6, Refueling Cavity Water Level
- Tech Spec 3.7.14, Spent Fuel Pool Water Level
- PT/1/A/4600/002 F, (Mode 6 Periodic Surveillance Items), Enclosure 13.1, Periodic Surveillance Items Data, Item 16, Revision 089

KA Match:
KA is matched because stem conditions involve the performance of RO duties in the control room:

- Mode 6 surveillance during fuel handling
- Monitoring of reactor vessel water level

and how the results of the control room duties affect the performance of the fuel handling.

Cognitive Level: **High**
Higher cognitive level because it involves analysis of given conditions and a prediction of whether an evolution may continue, based also on application of knowledge of Tech. Spec. applicability.

Source of Question: **New**

Question 69
G2.2.22
Equipment Control
Knowledge of limiting conditions for operations and safety limits

With Unit 1 in Mode 3, which ONE of the following describes the MAXIMUM NC system pressure and the MAXIMUM time allowed to restore compliance per Technical Specifications?

A. 2735 psig
1 hour

B. 2735 psig
5 minutes

C. 2750 psig
1 hour

D. 2750 psig
5 minutes

QUESTION 69

A. Incorrect. Part 1 is correct. Part 2 is plausible since this is the action for Mode 1 or 2.

B. **CORRECT.** Per Tech Spec. 2.1.2: In Modes 1,2,3,4, and 5, the RCS pressure shall be maintained $\leq$ 2735 psig. For Mode 3 conditions (given in the stem), the time to restore is 5 minutes.

C. Incorrect. Plausible if psia/psig are confused in the context of the specification. Part 2 is plausible because this would be the action for Mode 1 or 2.

D. Incorrect. Plausible if psia/psig are confused in the context of the specification. Part 2 is correct.

References:

- Tech. Spec 2.1 (SLs), and 2.2 (SL Violations)

KA Match:

KA is matched because knowledge of the safety limit for RCS pressure is tested, including completion time to restore compliance.

Cognitive Level: **Low**

Source of Question: **Bank 2970**

Question 70
G2.2.43
Knowledge of the process used to track inoperable alarms

With both Units at 100% power the following alarm will not function.

- 1AD-13, A/5, Main Fire Pump A Ctrl Pwr Trouble

To identify the status of this annunciator, a ________________________________ will be placed on or near the annunciator window in the Control Room.

A. distinctive GREEN flag

B. distinctive RED flag

C. WHITE deficiency sticker

D. YELLOW Restricted sticker

QUESTION 70

Distractor Analysis

A. Incorrect. Plausible because OMP 2-31 directs placement of GREEN flags on "blocked" bistable windows in the Control Room.

B. Incorrect. Plausible because OMP 2-31 directs placement of RED flags on "strapped" bistable windows in the Control Room.

C. **CORRECT.** White deficiency stickers are used on the control boards in lieu of deficiency tags (used in the plant) for equipment issues.

D. Incorrect. Plausible because a “Restricted” tag (yellow) is used to indicate a device that is not working properly or conforming to specifications, but it is for M&TE equipment, not for alarms.

References:

- OP-CN-ADM-NSO5, Lesson Plan for Nuclear System Directives, Site Directives, Operations Management Procedures #5, Shift Activities, Section 12.3, "Annunciator Status Log," Revision 101
- OP-CN-ADM-GI, Lesson Plan for General Instrumentation, Section 2.2.C, "Restricted", Revision 02 -- for plausibility of distractor "D"
- NSD 406, "Control of Measuring and Test Equipment", Section 406.4.1.3, "Calibration", Revision 13 -- for plausiblity of distractor "D"
- NSD 503, "Station Label and Sign Standards", Section 503.6, "Specific Labeling and Signage Guidance" Item 1. a. 2) Caution signs -- for plausibility of distractor "C", Revision 9

KA Match:
KA is matched because conditions involve an inoperable alarm. The applicant must select from a list of identification stickers/flags which method is used to track the inoperable alarm.

Cognitive Level: **Low**

Source of Question: **New**

Question 71
G2.3.11
Radiation Control
Ability to control radiation releases

Consider the following separate conditions relating to planned radiation releases:

1. EMF-49 (Liquid Waste Discharge Monitor) at Trip 2
2. EMF-50 (WG Disch Monitor - Waste Gas) at Trip 2
3. RL discharge total flow decreases to below setpoint
4. Turbine Building Sump release exceeds EMF-31 (Turbine Building Sump) pre-set level

In accordance with the applicable procedures, which ONE of the following describes which of the above conditions allow re-initiating the release at least once without resampling?

A. 1 ONLY

B. 1 or 2 ONLY

C. 2 or 3 ONLY

D. 4 ONLY

QUESTION 71

Distractor Analysis

A. Incorrect. Re-initiation following EMF-49 Trip 2 is allowed. Plausible if the applicant is unaware that it is also allowed following EMF-50 Trip 2.

B. **CORRECT.** Re-initiation is allowed following two High Rad discharge trips for both EMF-49 and EMF-50.

C. Incorrect. Re-initiation following EMF-50 Trip 2 is allowed. Plausible if the applicant is unaware that it is not allowed following low dilution flowrate trip.

D. Incorrect. Plausible because other EMFs allow re-initiation following Trip 2 actuation.

emf-49 trip 2	yes
emf-50 trip 2	yes
RL discharge total flow decreases below setpoint	no
turb bldg sump release emf-31 pre-set level exceeded	no

References:
- OP/0/A/6500/018, Limits and Precautions 2.6, Revision 044
- OP/0/B/6500/113, Limits and Precautions 2.3, 2.4, and 2.5, Revision 007

KA Match:
This is a generic KA, and the scope of the question meets that aspect by testing on an assortment of several release paths and associated unacceptable conditions. The "control" aspect is met by testing on whether a release has to be re-sampled before re-initiating.

Cognitive Level: **Low**

Source of Question: **New**

Question 72
G2.3.12
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.

Given the following Unit 1 conditions:

- The Unit has just entered Mode 5 in preparation for refueling.
- The missile shield has not been removed.
- A lower containment entry is planned for the next shift.
- The on-duty crew will perform purge of containment in preparation for the containment entry.
- Currently the VP system is secured with all fans off and containment purge and exhaust valves closed.

For this planned containment purge:

(1) The NORMAL-REFUEL SELECTOR switch is placed in the _____(1)____ position.

(2) This alignment is used in order to ________________(2)___________________ .

Which ONE of the following completes the above statements, in accordance with OP/1/A/6450/015 (Containment Purge System)?

A. (1) NORM
(2) Prevent overpressurization of upper containment and an unmonitored release path.

B. (1) NORM
(2) Prevent opening the ice condenser doors and to ensure air flow is routed through clean up filters.

C. (1) REFUEL
(2) Prevent overpressurization of upper containment and an unmonitored release path.

D. (1) REFUEL
(2) Prevent opening the ice condenser doors and to ensure air flow is routed through clean up filters.

QUESTION 72

Distractor Analysis

A. **CORRECT.** The Normal-Refuel Selector would be in the "Norm" position because the missile shield has not been removed (which is a requirement to place the switch in "Refuel"). If the switch were improperly placed in "Refuel" mode the balance of air flow would be uneven causing over pressurization and a possible unmonitored release.

B. Incorrect. The first part is correct. The second part is plausible because this is a precaution listed for inadvertent operation of Containment Air Return Fans.

C. Incorrect. The first part is plausible because this switch position will be selected for refueling. However, the missile shield must be removed prior to selecting this mode. The second part is correct.

D. Incorrect. This The first part is plausible because this switch position will be selected for refueling. However, the missile shield must be removed prior to selecting this mode. The second part is plausible because this is a precaution listed for inadvertent operation of Containment Air Return Fans.

References:

- OP-CN-CNT-VP, Lesson Plan for Containment Purge System, Revision 100, Pg. 17
- OP/1/A/6450/015 (Containment Purge System), Limits and Precautions 2.1, Revision 51
- OP/1/A/6450/010 (Containment Hydrogen Control Systems), Limits and Precautions 2.3, Revision 43

KA Match:

KA is matched by meeting the "aligning filters" aspect. Conditions are given involving a Mode 5 containment entry and how a licensed operator duty is performed for alignment of ventilation/filtration for the entry. The "radiation control" / "radiological safety" aspect is met by why a particular alignment is used; i.e., to prevent overpressurizing containment and an unmonitored release path.

Cognitive Level: **Low**

Source of Question: **Bank 3519**

Question 73
G2.4.22
Emergency Procedures/Plans
Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations

Given the following Unit 1 conditions:

- The crew is performing a S/G depressurization in accordance with EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling) due to an ORANGE Path on SPDS.
- While in FR-C.2 the crew receives a RED Path for NC Integrity.

The crew ________(1)_________ transition to EP/1/A/5000/FR-P.1 (Response To Imminent Pressurized Thermal Shock Condition) because ____________(2)________________ .

A. (1) should
(2) Pressurized Thermal Shock is a higher priority concern because of the potential challenge to reactor vessel integrity.

B. (1) should
(2) during the performance of an ORANGE path procedure, if any RED condition arises, then the RED condition is addressed first.

C. (1) should NOT
(2) Core Cooling is a higher priority concern and should be completed prior to performing a lower priority procedure.

D. (1) should NOT
(2) transition to this procedure could cause further degradation of core cooling.

QUESTION 73

Distractor Analysis

A. Incorrect. Plausible since PTS is a high priority condition. The applicant could be confused by the aspect that PTS directly relates to a fission product barrier (reactor vessel) and believes that should be addressed first, and then address cooling. Further, they could misapply one element of PTS (overcooling) and believe that more cooling would not be the priority over the PTS condition.

B. Incorrect. Plausible, since the crew IS performing an ORANGE path; and it is true that a RED path takes priority over ORANGE. It is also true that OMP 1-7 states that if an ORANGE path is being performed and a RED path conditions occurs, that the RED path will be addressed first. But this guidance is misinterpreted here, since Step 13 of FR-C.2 (a specific condition) requires the crew to soak the thermal shock condition; i.e., finish the procedure before going to FR-P.1.

C. Incorrect. Plausible, since the decision is correct. The basis is plausible, but incorrect, because in the hierarchy of critical safety functions, Core Cooling is higher than Integrity. In this particular case, the guidance FR-C.2, Step 13 takes precedence, as explained in "D" below.

D. **CORRECT.** Step 13 of FR-C.2 (Degraded Core Cooling) directs the operator as follows:

"IF AT ANY TIME a red path on NC Integrity occurs while in this procedure, THEN do not implement EP/1/A/5000/FR-P.1 (Response To Imminent Pressurized Thermal Shock Condition) until this procedure is completed."

The Background Document for FR-C.2 for the above step explains the basis for why the operator is directed to allow the thermal shock condition to soak PRIOR to transitioning to FR-P.1

References:
- EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling), Step 13, Revision 22
- OMP 1-7, (Emergency/Abnormal Procedure Implementation Guidelines), Section 7.3, "Functional Recovery or Critical Safety Function Procedures," Item E, Revision 039
- EBG/1/5000/FR-C.2, (Background Document for FR-C.2), Step 13, Revision 12

KA Match:
The question matches the KA by testing knowledge of the procedure guidance in OMP 1-7, (Emergency/Abnormal Procedure Implementation Guidelines); specifically the hierarchy of Critical Safety Functions and success paths. The question requires the applicant to apply this guidance by selecting the appropriate success path, including why it is correct.

Cognitive Level: **High**
Involves multiple mental steps as follows:
1. Applicant analyzes given conditions.
2. Applicant recalls and then applies guidance of a procedure for implementation of emergency procedures.

3. Applicant also selects the basis for the correct hierarchy/success path based on comprehension of the event in progress, and the relative hierarchy of challenges to critical safety functions.

Source of Question: **Bank 4567**

Question 74
G2.4.29
Emergency Procedures/Plans
Knowledge of the emergency plan

In accordance with RP/0/A/5000/007, (Natural Disaster & Earthquake):

(1) The earthquake with the lowest severity level is the _________(1)__________ .

(2) If this type of earthquake occurs, one of the required actions is to ________(2)________ .

A. (1) Operational Basis Earthquake (OBE)
(2) terminate any VQ release

B. (1) Operational Basis Earthquake (OBE)
(2) shutdown both Units

C. (1) Safe Shutdown Earthquake (SSE)
(2) terminate any VQ release

D. (1) Safe Shutdown Earthquake (SSE)
(2) shutdown both Units

QUESTION 74

Distractor Analysis

A. Incorrect. First part is correct. Second part is plausible because this is a required action of RP/07. However, it is required for a tornado, not earthquake.

B. **CORRECT.** OBE (0.08G Horizontal, 0.053G Vertical) is of a lower severity than SSE (0.15G Horizontal, 0.1G Vertical). RP/07 requires both units to be placed in Hot Standby immediately if the OBE annunciator is actuated and the earthquake is felt.

C. Incorrect. First part is plausible if the applicant is unaware of the setpoints/level of severity of the Earthquake actuations. Second part is plausible because this is a required action of RP/07. However, it is required for a tornado, not earthquake.

D. Incorrect. . First part is plausible if the applicant is unaware of the setpoints/level of severity of the Earthquake actuations. Second part is correct.

References:
- RP/0/A/5000/007, (Natural Disaster and Earthquake), Revision 038
- Alarm Response 1AD-4, B/8 (OBE Exceeded), Revision 039
- OP-CN-IC-IEE, Lesson Plan for Seismic Monitoring System, Section 2.4, "Operational Basis Earthquake", Section 11. IEE System Notes, Safe Shutdown Earthquake, Revision 101

KA Match:
Matching this KA at the RO level can be challenging. This question meets that KA by testing knowledge of what is in the emergency plan for an earthquake. Catawba uses a series of RP designated procedures that are part of the Emergency Plan. RP/007 is for Natural Disaster & Earthquake.

Cognitive Level: **Low**

Source of Question: **New**

Question 75
G2.4.3
Emergency Procedures/Plans
Ability to identify post-accident instrumentation

Which ONE of the following is a Post Accident Monitoring Instrument, AND is controlled by Tech. Spec. 3.3.3, Post-Accident Monitoring (PAM) Instrumentation?

A. Containment Humidity

B. SG Water Level Wide Range

C. 1EMF-36L, Unit Vent Gas Monitor

D. 1EMF-38L, Containment Monitor - Particulate

QUESTION 75

Distractor Analysis

A. Incorrect. Containment humidity is plausible as a parameter which would be monitored during post accident conditions, and therefore the indicator for this parameter to be designated as a Post Accident Monitoring instrument. This indicator is located in the Control Room on control board MC9, and is NOT designated as a PAM instrument.

B. **CORRECT.** This is a PAM designated instrument and is required by Tech Spec 3.3.3, in Table 3.3.3-1, item 21 (Steam Generator Water Level - Wide Range).

C. Incorrect. Instrument 1NIP5320, Containment H2 Analyzer, is identified on control board MC7 in the Control Room as a PAM designated instrument. Tech Spec 3.3.3, Post Accident Monitoring (PAM) Instrumentation, Table 3.3.3-1 does NOT include this instrument as required by the specification. Plausible that it would be controlled by Tech. Specs. since containment hydrogen is an important parameter which is monitored post-accident.

D. Incorrect. It is plausible that a radiation monitor titled, "Containment Monitor - Particulate" would be used as a PAM instrument AND controlled by Tech Specs. In fact, it is controlled by a Tech Spec, but it is Tech Spec 3.4.15, (RCS Leakage Detection Instrumentation).

References:

- OP-CN-TA-AM, Lesson Plan for Accident Mitigation, Section 2.11, (PAM Instrumentation), Revision 100
- Tech. Spec. 3.4.15, RCS Leakage Detection Instrumentation
- Tech. Spec. 3.3.3, Post-Accident Monitoring (PAM) Instrumentation, Table 3.3.3-1

KA Match:
KA is matched by testing which of a given list of instrumentation is a PAM instrument and controlled by the associated Tech. Spec.

Cognitive Level: **Low**

Source of Question: **New**