

Final Submittal
(Blue Paper)

FINAL RO
WRITTEN EXAMINATION

NORTH ANNA MAY/JUNE 2006-301 EXAM
05000338/2006301 & 05000339/2006301

WEEKS OF MAY 22 & JUNE 5, 2006 (OP TEST)
JUNE 14, 2006 (WRITTEN)

**Site-Specific RO Written Examination
Cover Sheet**

**U.S. Nuclear Regulatory Commission
Site-Specific RO Written Examination**

Applicant Information

Name:

Date:

Facility/Unit: North Anna Units 1 & 2

Region: I II III IV

Reactor Type: W X CE BW GE

Start Time:

Finish Time:

Instructions

Use the answer sheets provided to document your answers. Staple this cover sheet on top of the answer sheets. To pass the examination, you must achieve a final grade of at least 80.00 percent. Examination papers will be collected 6 hours after the examination begins.

Applicant Certification

All work done on this examination is my own. I have neither given nor received aid.

Applicant's Signature

Results

Examination Value _____ Points

Applicant's Score _____ Points

Applicant's Grade _____ Percent

Name: _____

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1. The purpose of the Control Rod Drive System is to _____.
- A. ensure adequate shutdown margin is maintained at all times
 - B. position control rods by changing direction of rotation of the CRDMs
 - C. ✓ control reactor subcriticality in conjunction with the CVCS
 - D. accomodate 40% of the design basis load rejection

DISTRACTOR ANALYSIS:

- A INCORRECT Shutdown margin is ensured by controlling RCS boron concentration AND positioning control rods, not by positioning control rods alone. Plausible because control rods can affect shutdown margin.
- B INCORRECT Control rods are positioned by operation of movable grippers, not by changing rotation of the CRDMs. Plausible because some reactors use a lead screw type arrangement.
- C CORRECT IAW Reference 1, "Together with the CVCS, the control rods are positioned to control reactor subcriticality."
- D INCORRECT Control rods only accomodate 10% of the design basis load rejection. Plausible because steam dumps accomodate 40% of the DBLR.

REFERENCES:

- 1. NCRODP-65-NA, "Rod Control System," Page 1 & 2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Control Rod Drive System; Knowledge of system purpose and or function.

K/A MATCH:

- Question was written to the "purpose" part of this K/A.

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2.

The following conditions exist prior to starting the 1-RC-P-1A Reactor Coolant Pump (RCP).

- 1 The associated cold leg and hot let loop stop valves are fully open
- 2 Panel C-F1, RCP 1A OIL RES HI-LO LEVEL annunciator is LIT
- 3 The handswitch for the 1-RC-P-1A1, A RCP BEARING LIFT PUMP was placed in START 1 minute and 45 seconds ago and the red indicating light above the switch is lit
- 4 The white light above the 1-RC-P-1A1 control switch is not LIT

Using the above, which ONE of the following would prevent the 1-RC-P-1A RCP from starting when its handswitch is placed in the START position?

- A. 1 ONLY
- B. 1 AND 2
- C. 3 AND 4
- D✓ 4 ONLY

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DISTRACTOR ANALYSIS:

- A INCORRECT This condition satisfies one of the 4 starting interlocks.
- B INCORRECT Neither of these would prevent the RCP from automatically starting. If the RCP 1A OIL RES HI-LO LEVEL annunciator was LIT, then, procedurally, the operator could start the pump after obtaining permission from the Superintendent of Operations or the Operations Manager On Call.
- C INCORRECT This distractor is plausible in that the operator might confuse this time with the 2 minutes required by step 5.1.17 of 1-OP-5.2 to run the Bearing Lift Pump prior to starting the associated RCP. However, there is no Bearing Lift Pump run time from which the RCP will then automatically start.
- D CORRECT Once Bearing Lift Pump discharge pressure has increased to greater than 700 psig, this light will be LIT and is one of the 4 RCP starting interlocks which must be satisfied in order for the RCP to automatically start when its handswitch is positioned to START.

REFERENCES:

1. NCRODP-38-NA, "Reactor Coolant System," pages 18,19,20,43,45,46,65,A-3, fig 38-26, and fig 38-12.
2. 1-OP-5.2, "Reactor Coolant Pump Startup and Shutdown," pages 19,21,24, and 25.

K/A CATALOGUE QUESTION DESCRIPTION:

- Reactor Coolant Pump System (RCPS); Ability to monitor automatic operation of the RCPS, including: RCP lube oil and bearing lift pumps.

K/A MATCH:

- Question was written to test the applicant's ability to monitor plant indications associated with the RCPS to determine if the a RCP would automatically start if an attempt to start the pump was made and based on his/her observations, determine if the plant responded appropriately.

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3.

The following plant conditions exist:

- Unit 2 is operating at 100% power.
- Component Cooling Water Pump 2-CC-P-1B is undergoing emergent repairs and will not be available for an estimated 2 hours.
- Component Cooling Water Pump 2-CC-P-1A is in operation.
- Power is lost to the 2J 4160V bus.
- The 2J Emergency Diesel Generator starts automatically but fails to load.

Which ONE of the following statements is correct concerning subsequent operation of the RCPs?

- A. The RCPs must be tripped or the motor windings will be damaged.
- B. ✓ The RCPs can be run indefinitely provided seal injection flow is maintained.
- C. Component Cooling Water Pump 2-CC-P-1A will trip and lockout.
- D. Component Cooling Water Pump 2-CC-P-1A will trip, then automatically re-start 15 seconds after power is restored to the 2J bus.

DISTRACTOR ANALYSIS:

- A INCORRECT This would be correct if Component Cooling Water Pump 2-CC-P-1B had been the running pump with the Component Cooling Water Pump 2-CC-P-1A initially out of commission.
- B CORRECT The Component Cooling Water Pump 2-CC-P-1A is powered from the 2H Stub bus so its operation will be unaffected by the loss of the 2J bus..
- C INCORRECT This answer would have been correct if the Component Cooling Water Pump 2-CC-P-1B had been the running pump.
- D INCORRECT If the loss of power had occurred to the 2H bus and the pump had tripped due to an electrical fault (phase or ground overcurrent) this answer would be correct.

REFERENCES:

1. NCRODY-51-NA, "Component Cooling System," pages 24,26,27,30,31,32, Table 51-3, Table 51-4.
2. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," page 2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Reactor Coolant Pump System (RCPS); Knowledge of bus power supplies to the following: CCW pumps.

K/A MATCH:

- The K/A implies that the applicant have a understanding of the bus power supplies to the CCW pumps and the interrelationship between the CCW pumps and the RCPS. With that implication understood, although the running pump is not affected by the loss of the bus in this situation, the applicant must have that knowledge to arrive at the correct answer.

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4.

The following plant conditions exist:

- Unit 1 is operating at 100% power.
- Unit 1 VCT pressure is being increased.

Given the above information, which ONE of the following is correct?

If _____, then VCT hydrogen could exceed a maximum of _____.

- A. ✓ PVC-1118, Hydrogen Pressure Control Valve failed open; 4.0% concentration
- B. PVC-1118, Hydrogen Pressure Control Valve failed open; 0.1% by volume
- C. PVC-1119, Nitrogen Pressure Control Valve failed open; 4.0% concentration
- D. PVC-1119, Nitrogen Pressure Control Valve failed open; 0.1% by volume

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DISTRACTOR ANALYSIS:

- A CORRECT At power, PVC-1118 is in service and set to maintain a pressure of 16 psig in the VCT. The explosive limit for hydrogen is 4% concentration or 1% by volume.
- B INCORRECT Hydrogen should be at least 1% by volume.
- C INCORRECT During power operation, this valve is isolated. If it failed shut under this condition, it would have no impact at all. This distractor is plausible in that it would be correct if the plant were shut down and the applicant might confuse the method in which each is operated. The 4% concentration is correct. A possible alternate distractor that might be used in place of this one: SOV-1258, VCT Vent Isolation, fails open. This would vent the nitrogen blanket while PVC-1118 attempted to maintain 16 psig hydrogen pressure.
- D INCORRECT The nitrogen pressure control valve (PCV-1119) is isolated during normal plant operation, but is supplied to the VCT from the LP nitrogen header via PCV-1119 during shutdown conditions to degassify the VCT. It is set to maintain VCT pressure at 16 psig when in service. Since the plant is operating at 100% power, this answer is incorrect. This answer is also incorrect in that hydrogen must be at least 1% by volume.

REFERENCES:

1. NCRODP-41-NA, Chemical and Volume Control System, pages 20, 62, and fig 41-5-NA.
2. NCRODP-20-NA, Compressed Gas System, pages 5, 6, 11, 25, A-4, fig 20-1-NA.

K/A CATALOGUE QUESTION DESCRIPTION:

- Chemical and Volume Control System; Knowledge of the operational implications of the following concepts as they apply to the CVCS: Explosion hazard associated with hydrogen containing systems.

K/A MATCH:

- This question addresses the "hydrogen containing systems" in that the VCT contains hydrogen gas. The question then presents a list of operational failures that, given the correct plant conditions, create implications related to hydrogen reaching explosive limits.

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5.

Unit 1 is on RHR in Mode 5.

- RCS level is 14 inches above loop centerline.
- 1-RH-FC-1605, RHR System Flow Controller failed, causing FCV-1605, RHR HEAT EXCHANGER BYPASS FLOW VALVE to fully open.
- All attempts at closing the valve have failed.
- RHR pump amps and flow are fluctuating
- RHR flow is greater than designed flow rate

Given these conditions, which ONE of the following describes the impact on RCS temperature and the actions the crew must take?

RCS temperature will _____. The crew should _____ Heat Exchanger Flow Control Valve, HCV-1758, to stabilize RHR pump conditions.

- A. increase open
- B. decrease close
- C. ✓ increase close
- D. decrease open

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DISTRACTOR ANALYSIS:

- A INCORRECT Operators should close the valve.
- B INCORRECT Wrong direction on both.
- C CORRECT With FCV-1605 in the full open position, more RHR flow bypasses the RHR heat exchanger without being cooled which causes RCS temperature to increase. Step 7 of 1-AP-11, Loss of RHR, directs operators to reduce flow (using FCV-1605 or HCV-1758) if RHR flow is greater than the design flow (which it will be).
- D INCORRECT Temperature will increase.

REFERENCES:

1. NCRODP-40-NA, Residual Heat Removal System, pages 2, 9, 11, 17, 18, 25, fig 40-1-NA.
2. 1-AP-11, Loss of RHR, page 1, step 7 on page 7.

K/A CATALOGUE QUESTION DESCRIPTION:

- Residual Heat Removal System (RHRS); 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 valve malfunction.

K/A MATCH:

- This question addresses the K/A in that in order for the applicant to determine the correct action to mitigate the malfunction, the impact on both the RHR system must be determined/predicted.

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6.

The Crew for Unit 1 just commenced the 5 minute warmup period associated with placing the RHR system in service as part of a plant cooldown. Plant conditions are as follows:

- RCS pressure is 400 psig
- RCS Temperature is 320 degrees
- RHR HEAT EXCHANGER 1A is on service
- RHR Pump 1A is running
- FCV-1605, RHR HEAT EXCHANGER BYPASS FLOW VALVE, was just placed in AUTO after completing the 5 minute warmup

About 2 minutes later the crew receives the following alarm:

- RHR HX CC OUTLET HI TEMP / HI FLOW:

The crew observes the following:

- RHR Heat Exchanger CC Outlet Temperature is 200 °F
- RHR Heat Exchanger CC Outlet Flow is approximately 1000 gpm

Which ONE of the following describes the actions the crew should take to clear the alarming condition?

- A. ✓ Throttle open MOV-100A, RHR HEAT EXCHANGER CC RETURN VALVE, by pressing its open pushbutton until the desired valve position is reached, and then releasing the button.
- B. Throttle open MOV-100A, RHR HEAT EXCHANGER CC RETURN VALVE, by pressing its open pushbutton until the desired valve position is reached and then simultaneously pressing both its open and close pushbuttons, and then releasing the buttons.
- C. Throttle shut MOV-100B, RHR HEAT EXCHANGER CC RETURN VALVE, by pressing its shut pushbutton until the desired valve position is reached, and then releasing the button.
- D. Throttle shut MOV-100B, RHR HEAT EXCHANGER CC RETURN VALVE, by pressing its shut pushbutton until the desired valve position is reached and then simultaneously pressing both its open and close pushbuttons, and then releasing the buttons.

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DISTRACTOR ANALYSIS:

- A CORRECT MOV-100A/B are unique in the fact that both the open and close pushbuttons do not have to be pressed simultaneously to throttle the valves. Releasing the pushbutton will stop valve travel.
- B INCORRECT MOV-100A/B are unique in the fact that both the open and close pushbuttons do not have to be pressed simultaneously to throttle the valves. This distractor is plausible in that a number of valves operated from the control room require both the open and close pushbuttons be pressed simultaneously to throttle the valves, a nuance that is specifically addressed in the system description describing the operation of these valves.
- C INCORRECT Although this action might act to clear the alarm, it could also adversely impact the operation of the "B" heat exchanger and would not be appropriate or procedurally correct.
- D INCORRECT See the rationale given for distractors B and C.

REFERENCES:

1. OP-14.1, "Residual Heat Removal," Section 5.1.
2. NCRODU-40-NA, "Residual Heat Removal System," pages 19, 24, 25, fig 40-1-NA.
3. NCRODP-51-NA, "Component Cooling System," pages 25, 26, fig 51-7-NA.
4. Self Study Guide for Residual Heat Removal System, pages 12, 13, 14, 17, 18, 24.
5. 1-AR-E-A5, RHR HX CC OUTLET HI TEMP / HI FLOW.

K/A CATALOGUE QUESTION DESCRIPTION:

- Emergency Core Cooling System (ECCS); Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: CCW flow (establish flow to RHR heat exchanger prior to placing in service).

K/A MATCH:

- The question matches the K/A in that it relates to plant conditions shortly after Component Cooling Water (CCW) flow would have been established. By selecting the correct answer the applicant, through inference, must have predicted how the plant would respond. It would also demonstrate understanding of the associated controls which operate differently from other valve open/close switches.

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7.

A large-break LOCA occurred several hours ago. The Emergency Core Cooling System (ECCS) is to be placed in the cold-leg recirculation mode.

Which ONE of the following describes operator responsibilities with respect to the operation of the ECCS in this mode?

- A. Monitoring indications to verify reflux boiling is occurring in the steam generators.
- B. Monitoring heat transfer between the Reactor Coolant System and the steam generators during natural circulation flow.
- C. Monitoring water injection from the recirculation sump and removal of steam/water from the break.
- D. Monitoring heat transfer between the Reactor Coolant System and the steam generators during forced circulation flow.

DISTRACTOR ANALYSIS:

- A INCORRECT This is not in accordance with 1-ES-1.3 but is a plausible distractor as it represents one of the alternative modes of ECCS operation.
- B INCORRECT This is not in accordance with 1-ES-1.3 but is a plausible distractor as it represents one of the alternative modes of ECCS operation.
- C CORRECT This is the method of core decay-heat removal when the plant is aligned for cold-leg recirculation..
- D INCORRECT This is not in accordance with 1-ES-1.3 but is a plausible distractor as it represents one of the alternative modes of ECCS operation.

REFERENCES:

1. 1-ES-1.3, "Transfer To Cold Leg Recirculation," step 8.
2. North Anna Emergency Procedures Exam Bank, question 209, page 223, ID 2781.

K/A CATALOGUE QUESTION DESCRIPTION:

- Emergency Core Cooling System (ECCS); Knowledge of operator responsibilities during all modes of plant operation.

K/A MATCH:

- This question matches the K/A in that the operator must have an understanding of all the modes of ECCS operation in order to answer the question correctly.

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8.

Unit 1 is at 8% preparing to connect the generator to the grid when a "Pressurizer High Level Reactor Trip" red first-out annunciator alarms and locks in. Operators observe the following:

- Turbine Load is 7% and increasing
- S/G levels are stable
- Pressurizer Level indicates 95% and increasing
- Charging flow is 70 gpm
- Letdown flow is 85 gpm
- Seal Leakoff flow is 1.0 gpm each
- Seal Injection flow is 8 gpm each

Based on the above, which ONE of the following describes how the plant should respond and the actions the crew should take?

The reactor _____. The crew should _____.

- A. should have tripped;
trip the reactor and take actions for "Reactor Trip or Safety Injection" IAW 1-E-0.
- B. should have tripped;
trip the reactor and take actions for "Response to ATWS" IAW 1-FR.S.1.
- C. should not have tripped;
take actions for a "Loss of Vital Instrumentation" IAW 1-AP-3.
- D. should not have tripped;
take actions in accordance with 1-AR-B-F6, PRZ HI LEVEL CH I-II-III.

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DISTRACTOR ANALYSIS:

- A INCORRECT Based on the indications given, the reactor should not have tripped. This distractor is plausible in that if power had been above the P-7 setpoint (10%) then this response would have occurred.
- B INCORRECT The reactor should not have tripped. This distractor is plausible in that the applicant might fail to account for power being below the P-7 setpoint thereby thinking the reactor should have tripped.
- C INCORRECT The first part is correct. This distractor is plausible in that the applicant might ASSUME that the high level is due to an instrument error since no indications are given that the reactor tripped. He/she would thereby mistake the associated action as being correct, which it would be for such an assumption. However, based on NRC guidelines, no assumptions should be made beyond the information given.
- D CORRECT Based on the information given, a high pressurizer level exists. This would be the correct response for the crew to take in this situation.

REFERENCES:

1. 1-AR-B-F6, Annunciator response for PRZ HI LEVEL.
2. NCRODP-77-NA, "Reactor Protection Systems," pages T-12, T-15 thru T-17.
3. 1-ES-0.1, "Reactor Trip Response."
4. 1-F-0, Attachment 6.
5. 1-FR-I.1, "Response To High Pressurizer Level."

K/A CATALOGUE QUESTION DESCRIPTION:

- Reactor Trip; Knowledge of the interrelations between a reactor trip and the following: Reactor trip status panel.

K/A MATCH:

- Although a reactor trip did not occur based on information given in the question stem, the applicant must understand the interrelations between the trip status panel (of which "first-out" alarms indicate) and an actual reactor trip.

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9.

The PRT level column vent valve was inadvertently left uncapped during recovery from the last refueling outage. Current plant conditions are as follows:

- Unit at 100% power
- The column vent valve has since developed leak-by of approximately 0.1 scfm.
- Containment vacuum pumps became inoperable minutes ago.
- PRT pressure is currently within limits.

Based on the conditions given, which ONE of the following is correct.

- A. ✓ Containment partial pressure will increase more rapidly.
- B. Containment dewpoint indication will increase.
- C. PRT pressure indication will be lower than actual pressure.
- D. PRT water level indication will be higher than actual water level.

DISTRACTOR ANALYSIS:

- A CORRECT With current PRT nitrogen leakage of 0.1 scfm, a net increase in containment partial pressure will result given that no vacuum pumps are in service.
- B INCORRECT Not adding any moisture to air. Leakage is non-compressible gas only. Additionally the containment dewpoint instruments are not operational. These instruments are only used for the Type A testing.
- C INCORRECT Loss of pressure from vent valve will be the same as that experienced by the tank.
- D INCORRECT There is no effect on level indication since the tank pressure will effect the high and low sides of the level transmitter equally.

REFERENCES:

1. North Anna Reactor Coolant System Exam Bank question 197, page 209

K/A CATALOGUE QUESTION DESCRIPTION:

- Pressurizer Relief Tank/Quench Tank System (PRTS); Knowledge of the effect that a loss or malfunction of the PRTS will have on the following: Containment.

K/A MATCH:

- Although the malfunction does not directly impact containment (i.e. the containment structure), this question matches the K/A in that it affects the containment environment (i.e. parameters that describe its environment) and by inference, have a direct affect on containment.

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10.

Unit 2 was operating at 100% power with the following conditions:

- Component Cooling (CC) systems are in a normal lineup.
- CC backpressure regulating valve, 2-CC-PCV-210, is regulating CC system pressure.

An operator in the plant inadvertently isolates instrument air to CC backpressure regulating valve, 2-CC-PCV-210.

Based on the above, which ONE of the following describes the effects with no further operator involvement?

- A. Thermal Barrier Trip Valves, TV-116A/B/C, will shut within 10 seconds.
- B. The Unit 2 standby CC pump will automatically start.
- C. ✓ CC system pressure will increase.
- D. The Unit 1 standby CC pump will automatically start.

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DISTRACTOR ANALYSIS:

- A **INCORRECT** Although it might be possible, with the increase in system pressure that will occur as a result of this event, for flow through RCP thermal barrier heat exchangers to increase to the trip setpoint of 59 gpm, it must remain so for **GREATER THAN 10 seconds**. This distractor is plausible if the applicant confuses the limit of ">" with "<".
- B **INCORRECT** Although the standby CC pump has auto-start features, system low pressure is not one of them. This distractor is plausible in that many systems the standby pump often starts on system low pressure.
- C **CORRECT** Since CC is in a normal lineup, Units 1 & 2 CC systems will be cross-connected. In this configuration, the two backpressure regulating valves 1-CC-PCV-110 and 2-CC-PCV-210 are set such that one will regulate 5-10 psig higher than the other. The result is that the regulator with the the lower setting (in this case 2-CC-PCV-210) will be the on-service regulator. The valves fail closed on a loss of air signal which results in CC system pressure increasing to the point where the regulator with the higher set pressure begins to maintain pressure.
- D **INCORRECT** Although the standby CC pump has auto-start features, system low pressure is not one of them. This distractor is plausible in that many systems the standby pump often starts on system low pressure.

REFERENCES:

1. 1-OP-51.1, "Component Cooling System," pages 4, 22, and 24.
2. NCRODP-51-NA, "Component Cooling System," pages 2, 3, 10, 20, 24, 27, 28, 30, 31, figures 2, 3, and 8.
3. North Anna Component Cooling Water & Neutron Shield Cooling Systems Exam Bank question 15, ID 3872.

K/A CATALOGUE QUESTION DESCRIPTION:

- Component Cooling Water System (CCWS); Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCWS controls including: CCW pressure.

K/A MATCH:

- This question matches the K/A in that it requires the applicant to predict how the CC system will respond to the operation of the CC system controls (although inadvertently) to one of the CC system components causing a change to CC system pressure. It also addresses exceeding design limits in that the applicant must be able to recall the design flow limit associated with CC flow through RCP thermal barrier heat exchangers.

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11.

Assume the following plant conditions:

- The operating crew is performing 1-E-3, "Steam Generator Tube Rupture," in response to a tube rupture in the "B" Steam Generator.
- After terminating safety injection, a small-break LOCA occurs.
- Pressurizer level drops to 8% with charging flow at maximum.

The operating crew should _____.

- A. Manually initiate Safety Injection and go to 1-ES-0.0, "Re-diagnosis."
- B. ✓ Start Charging Pumps and align the boron injection tank as required and then go to 1-ECA-3.1, "SGTR with Loss of Reactor Coolant - Subcooled Recovery Desired."
- C. Start Charging Pumps and align the boron injection tank as required and then continue in 1-E-3, "Steam Generator Tube Rupture."
- D. Manually initiate Safety Injection and return to 1-E-0, "Reactor Trip or Safety Injection."

DISTRACTOR ANALYSIS:

- A INCORRECT The crew should not exit the procedure they are in based on the conditions given. However, this distractor is plausible considering that the crew is responding to one casualty when another casualty occurs.
- B CORRECT Given the stated conditions, specifically, PZR level unable to be maintained > 21%, the foldout page of 1-E-3 directs operators to take this action.
- C INCORRECT Although the actions stated to be taken are correct, the foldout page then directs an immediate transition to 1-ECA-3.1.
- D INCORRECT The procedure does not direct the performance of this action based on the conditions given. However, this distractor is plausible considering that the crew is responding to one casualty when another casualty occurs.

REFERENCES:

1. North Anna Emergency Procedures Exam Bank, question 302, page 324, ID 2901.
2. 1-E-3, "Steam Generator Tube Rupture," page 22, step 23, and foldout page.

K/A CATALOGUE QUESTION DESCRIPTION:

- Small Break LOCA; Knowledge of operator responsibilities during all modes of plant operation.

K/A MATCH:

- While it may be possible to develop a scenario wherein a small-break LOCA spans all mode of plant operation, it is unlikely that operators would realistically ever encounter such a scenario. In lieu of substituting another K/A, a scenario was utilized encompassing at least one mode that required operators to derive answers subsequent to possessing an understanding of their responsibilities.

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12.

Which ONE of the following describes either the design or method used to limit thermal stresses on the pressurizer spray valve?

- A. ✓ The installation of spray bypass valves.
- B. The installation of thermal sleeves.
- C. The size of the spray line.
- D. The installation of an auxiliary spray line.

DISTRACTOR ANALYSIS:

- A CORRECT These valves allow a minimum 1 gpm total spray flow into the pressurizer during all operations with the RCPs operations to prevent the spray and surge lines from cooling off due to ambient heat losses.
- B INCORRECT The thermal sleeves, while intended to absorb the thermal stresses associated with the temperature gradients, were designed to provide stress protection to the piping welds which serve as the pressure boundary.
- C INCORRECT The size of the spray line was designed to allow sufficient spray flow to prevent the PORVs from opening during a 10% step-decrease in power.
- D INCORRECT The auxiliary spray line was designed to provide the capability of initiating spray from the CVCS charging pumps when RCPs are not operating.

REFERENCES:

1. NCRODP-38-NA, "Reactor Coolant System," pages 25, 33, 52, figure 38-19.
2. 1-AR-B-G3, PRZ SPRAY LINE LO TEMP.
3. North Anna Reactor Coolant System Exam Bank, question 99, page 109, ID 5698.

K/A CATALOGUE QUESTION DESCRIPTION:

- Pressurizer Pressure Control System (PZR PCS); Knowledge of PZR PCS design feature(s) and/or interlock(s) which provide for the following: Spray valve warm-up.

K/A MATCH:

- None of the plant procedures/documentation speak directly to a warm-up of the spray valve but do speak to design features utilized to reduce/minimize thermal stresses to which the spray line (and hence the spray valve) might be subjected. In this regard, the question addressed the K/A.

QUESTIONS REPORT

for NORTH ANNA 2006-301 RO TEST FINAL NRC 6-14-2006

13. 012K6.04 001/2/1/REACTOR PROTECTION/C/A/BANK/NA06/RO/MC

Unit 2 is performing a reactor shutdown. Plant conditions are as follows:

- During the shutdown the turbine first stage pressure channel, MS-PT-2446, sticks at 35% power.
- Steam Flows, Feed Flows, and First Stage Pressure are selected to Channel III.
- Reactor power is currently 14%.

Based on the plant conditions given above, which ONE of the following will occur?

- A. If 2 reactor coolant pumps are lost a reactor trip will occur.
- B. If the generator output breaker is opened a reactor trip will occur.
- C. Source range nuclear instruments will have to be manually unblocked.
- D. Power range channel low setpoint high neutron flux level will not unblock.

DISTRACTOR ANALYSIS:

- A CORRECT P-8 (power < 30% generated from NIs) is satisfied and will block the 1.3 loss of flow sing loop reactor trip. However P-7 is not satisfied from any input (3.4 PR <10% AND 2.2 first-stage pressures <10%), so the 2.3 loss of flow trip is not blocked.
- B INCORRECT Although the turbine will trip if the generator output breaker is opened since C-5 is not satisfied because of the failed first-stage pressure channel, the reactor will not trip on the turbine trip because P-8 is satisfied.
- C INCORRECT Source range block/unblock input comes from PR, not first-stage pressure. This distractor is plausible in that the applicant may confuse the source from which the blocking signal is generated.
- D INCORRECT See C.

REFERENCES:

1. NCRODP-77NA, "Reactor Protection Systems," pages 31, 32, 42, 68, T-4, T-10, and figure 77-9.
2. NCRODP-24-NA, "Main Turbine System," pages 13, 14, 21, and 31.
3. INPO Exam Bank

K/A CATALOGUE QUESTION DESCRIPTION:

- Reactor Protection System; Knowledge of the effect of a loss or malfunction of the following will have on the RPS: Bypass-block circuits.

K/A MATCH:

- This question matches the K/A in that it speaks directly to a bypass-block circuit, specifically C-5. The failure occurs at its source of generation, in this case the actual pressure detector that provides an input signal to the bypass-block circuit (C-5). The applicant must have knowledge of that circuit and how its failure will affect the response of the reactor protection system once additional stimulus (signals) are inserted into the reactor protection system such that a response is elicited.

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14.

Unit-1 is stable in Mode 5 with the following conditions:

- 1-RH-P-1A is running, returning flow to the "C" loop
- RCS cold leg temperature is 140°F
- RCS pressure is 150 psig
- All RCS loops are isolated
- RCS is solid
- "A" charging pump is running
- Instrument Department is conducting solid state protection testing
- A failure during testing causes a single train safety injection to occur. All "B" train equipment actuates.

Assuming no operator action, RCS pressure will rapidly increase to the _____ and stabilize there for the next several hours.

- A. ✓ PRZR PORV setpoint for approximately 10 minutes, then increase to the RHR suction relief valve setpoint
- B. RHR suction relief valve setpoint for approximately 10 minutes, then increase to the PRZR PORV setpoint
- C. RHR suction relief valve setpoint
- D. PRZR PORV setpoint

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DISTRACTOR ANALYSIS:

- A. CORRECT PORVs are on the LTOPs setpoints (365 psig and 370 psig). The PORVs would be using nitrogen as the motive force in this mode. These bottles would only be good for approximately 10 minutes. Pressure would then increase to the RHR RV setpoint (467 psig).
- B. INCORRECT Backwards as the RHR RV setpoint is > PORV setpoints at this temperature.
- C. INCORRECT This would be correct if the PORVs were not on LTOPs setpoints.
- D. INCORRECT On LTOPs the PORVs use nitrogen, no air to back it up, so the tanks would deplete in approximately 10 minutes.

REFERENCES:

1. North Anna Integrated Plant Operations Exam Bank, question 93, page 93, ID 4093.
- 2.
- 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Engineered Safety Features Actuation System (ESFAS); Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ESFAS controls including: RCS pressure and temperature.

K/A MATCH:

- Question matches the K/A since the operator must be able to predict the effect that the event will have on RCS pressure and temperature in order to answer correctly.

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15.

Given the following plant conditions:

- Two minutes ago, an MSTV inadvertently closed causing secondary safeties to lift and a reactor trip and safety injection due to high steam flow coincident with low steamline pressure.
- The reactor trip breakers failed to open.
- Operators tripped the reactor locally from 307 switchgear by tripping both M-G Set Motor Supply Breakers per FR-S.1, Attachment 4, "Response to Nuclear Power Generation/ATWS, Remote Reactor Trip."
- It is now desired to reset SI and secure SI equipment.
- RCS pressure is 1950 psig.

Which ONE of the following represents why an automatic SI will not be blocked following a reset from the Main Control Board under the above conditions?

- A. RCS pressure is less than the SI setpoint.
- B. Permissive P-4 has not actuated.
- C. Permissive P-11 has actuated.
- D. The SI timing relays.

DISTRACTOR ANALYSIS:

- A INCORRECT P-11 (2000 psig) is the set point above which a blocked SI signal will auto unblock.
- B CORRECT The block remains in effect until the reactor trip breakers are reset. Resetting the reactor trip breakers automatically defeats the blocking circuit and arms the SI automatic initiating circuits.
- C INCORRECT Pressurizer pressure below the SI setpoint will initiate an SI signal but will not prevent resetting SI.
- D INCORRECT SI will not reset if the 60 second timer is active. However, the timer timed out 60 seconds ago.

REFERENCES:

1. NCRODP-77-NA, "Reactor Protection Systems," pages 24, 25, 46, A-3, 50, 51, T-12, T-13, figures 77-4 & 77-12.
2. FR-S.1, Attachment 4, "Response to Nuclear Power Generation/ATWS, Remote Reactor Trip," Steps 1 & 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Engineered Safety Features Actuation System (ESFAS); Ability to manually operate and/or monitor in the control room: Reset of ESFAS channels.

K/A MATCH:

- This question matches the K/A in that the operator must be able to determine from plant indications (monitor) whether or not ESFAS channels will be able to be reset (ability).

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16. Which ONE of the following indications would be indicative of only a RCP Number 2 seal failure?
- A. ✓ RCP High Standpipe level.
 - B. RCP Seal Leakoff High Flow.
 - C. RCP Thermal Barrier Low Differential Pressure.
 - D. RCP Thermal Barrier Cooling Water High temperature.

DISTRACTOR ANALYSIS:

- A CORRECT A High RCP Standpipe Level is indicative of a #2 RCP Seal failure.
- B INCORRECT This would be due to a #1 RCP seal failure.
- C INCORRECT This would be due to a #1 RCP seal failure.
- D INCORRECT This would be due to a #1 RCP seal failure.

REFERENCES:

1. North Anna Reactor Coolant System Exam Bank, question 68, page 75, ID 5426
2. NCRODP-38-NA, "Reactor Coolant System," pages 17, 42, figures 38-4, 5, 7, 8, 9.
3. 1-AR-C-H3, RCP 1C STANDPIPE LO LEVEL.
4. 1-AR-C-G3, RCP 1C STANDPIPE HI LEVEL.
5. 1-AR-C-H4, RPC 1A-B-C BEARING HI TEMP.

K/A CATALOGUE QUESTION DESCRIPTION:

- Reactor Coolant Pump (RCP) Malfunctions; Ability to operate and/or monitor the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): RCP seal failure/malfunction.

K/A MATCH:

- This question matches the K/A in that it addressed the "or monitor" portion of the RCP seal failure.

QUESTIONS REPORT

for NORTH ANNA 2006-301 RO TEST FINAL NRC 6-14-2006

17. 015K5.14 001/2/2/NIS/C/A/MODIFIED/NA06/RO/MC

A reduction in feed to the SGs will cause _____ neutron attenuation and _____ indicated reactor power.

(Attenuation - slowed to thermal energy)

(Assume actual reactor power (turbine load) remains constant.)

- | | |
|--------------|-----------|
| A. increased | decreased |
| B. decreased | decreased |
| C. increased | increased |
| D✓ decreased | increased |

DISTRACTOR ANALYSIS:

- A INCORRECT See distractor D analysis.
- B INCORRECT See distractor D analysis.
- C INCORRECT See distractor D analysis.
- D CORRECT Assuming turbine load is not changed, as feedwater to the SGs is reduced, less heat is being removed from the coolant passing through the SG u-tubes. As a result, T_{cold} increases. This warmer water enters the reactor and fuel area. Since this water is warmer, its density is lower and results in a reduction of the number of neutrons being slowed to thermal energy values. Now more neutrons escape the area of the core to be seen by nuclear instrument detectors. The result is an increase in the number of neutrons being detected by the NIs..

REFERENCES:

1. North Anna Ex-cre Nuclear Instrumentation System Exam Bank, question 75, page 75, ID 2186.
2. SOER-90-3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Nuclear Instrumentation System (NIS); Knowledge of the operational implications of the following concepts as they apply to the NIS: Neutron flux density, definition and relation to reactor power.

K/A MATCH:

- This question matches the K/A in that as the result of an operational change, the operator must determine the implication with respect to reactor power as indicated by the NIS. Although not specifically addressed in the question, the operator must know and understand the definition of flux density in order to answer correctly.

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18.

In accordance with 0-AP-48, "Charging Pump Cross-Connect," which ONE of the following statements is correct?

Operators should _____

- A. **only** trip the affected unit, enter E-0, and send an operator to the auxiliary building with the appropriate attachment to supply charging to the affected unit.
- B. ✓ trip both units; if a low head SI pump is supplying the suction of the running charging pump then consider flowing the BIT on the unit to be borated.
- C. **only** trip the affected unit, enter E-0, secure letdown, then isolate RCP seal leakoff.
- D. trip both units; if a low head SI pump is supplying the suction of the running charging pump then Emergency Borate.

DISTRACTOR ANALYSIS:

- A INCORRECT Both units should be tripped.
- B CORRECT This is IAW 0-AP-48 step one and the first note on Attachment 4..
- C INCORRECT Both units should be tripped.
- D INCORRECT IAW the note on Attachment 4, emergency boration in this configuration will not be effective.

REFERENCES:

1. 0-AP-48, "Charging Pump Cross-Connect," pages 1 and 2; Attachment 4, page 1.
2. Tech Spec 3.5.2, ECCS-Operating.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Reactor Coolant Makeup; Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Makeup: Charging Pump problems.

K/A MATCH:

- This question matches the K/A in that the applicant must determine how to respond to the loss of charging (makeup) due to losing all charging pumps specific to one unit. A failure of all charging pumps was chosen due to the impact that loss has on the opposite Unit.

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19.

The following conditions exist:

- Both units are operating at 100% power
- All systems are lined up normally
- The backboards operator has inadvertently placed switch 1-SW-TV-101A/B, Service Water Supply and Return to Recirc Air Fans, in the **SW** position.

Assuming all systems have operated as expected, which ONE of the following describes the immediate effects on the Containment Cooling System?

- A. ✓ Containment temperature and partial pressure will remain the same.
- B. Containment temperature will decrease and containment partial pressure will increase.
- C. Containment temperature will decrease and containment partial pressure will remain the same.
- D. Containment temperature and partial pressure will decrease.

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DISTRACTOR ANALYSIS:

- A. Correct. Although 1-SW-TV-101A/B will open, the flowpath is isolated by the 110 and 114 MOVs being de-energized.
- B. Incorrect. If the examinee does not realize that the MOVs in the flowpath are de-energized this answer could be chosen based on an expected containment temperature response. More cooling flow would cause the partial pressure indication to increase due to the postulated decrease in temperature ($P_{TOT} - P_{SAT} = \text{Partial pressure}$).
- C. Incorrect. See above for temperature. Pressure response is correct.
- D. Incorrect. See above for temperature. If examinee confuses lower temperature with lower pressure, then the second part is plausible.

References:

Objective 7678 for SW.

REFERENCES:

1. NCRODP-47-S, "Primary Ventilation System," pages 20, 21, 33,.
2. 1-F-0, Attachment 5.
3. 1-FR-Z.4, "Response to Containment Positive Pressure," step 3.c, page 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Containment Cooling System (CCS); Knowledge of the physical connections and/or cause-effect relationships between the CCS and the following systems: SEC/remote monitoring systems.

K/A MATCH:

- This question matches the K/A in that it addresses the "or cause-effect relationships . . ." portion of the K/A. Without an understanding of the physical connections between the the pertinent Containment Cooling Systems, the operator could not correctly answer the question. The affected fans draw air through coolers in contrast to fans located within the Containment that exist solely for the purpose of preventing temperature stratification, for example.

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20.

Unit 2 is operating at 100% power when the following occur:

- CD TO AIR RECIRC CLRS HI-LO TEMP alarms.
- Containment temperature is noted to have a slow, gradually increasing trend.

Which ONE of the following would account for these conditions?

- A. The hot gas bypass valve for the mechanical chiller compressor has failed shut.
- B. 1-BC-PCV-135 located in the Bearing Cooling System discharge header to the tower failed shut.
- C. 1-SW-TV-101A, Containment Recirc Air Cooler Service Water Supply Valve failed shut.
- D✓ The guide vanes for the mechanical chiller compressor are failed shut.

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DISTRACTOR ANALYSIS:

- A INCORRECT Should the hot gas bypass valve fail shut, it would have the opposite effect. This distractor is plausible in that if the applicant does not fully understand the operation of the unit, he/she might think that the hot gas ought to be allowed to bypass the unit under this condition.
- B INCORRECT This valve controls backpressure at 20 psig in the discharge header of the Bearing Cooling System which supplies cooling to the air conditioner chillers. If this valve were to experience a fault in the shut direction then backpressure would increase and actually increase cooling flow to the chillers which would in turn result in lower, not higher, containment temperatures. This distractor is plausible in that the valve is located in the discharge header but in parallel path such that it would not restrict cooling flow.
- C INCORRECT Although this would result in the conditions given, Chilled Water, not Service Water, is the normal supply to this cooler, a condition also given in the stem of the question. This distractor is plausible in that there are circumstances where the cooler would be supplied by Service Water.
- D CORRECT If the guide vanes were being controlled such that they were less open (i.e. control or positioner malfunction) the temperature of the chill water leaving the unit would be higher, thereby resulting in less cooling to the containment recirc air coolers. Hence, higher containment ambient temperatures.

REFERENCES:

1. 1-AR-G-B2, CD TO AIR RECIRC CLRS HI-LO TEMP.
2. North Anna Chilled Water System Exam Bank, questions 17 on page 17, 19 on page 19.
3. NCRODP-15-NA, "Chilled Water System," pages 29, 34, figure 15-3.
4. NCRODP-47-NA, "Primary Ventilation System," pages 44, 45, figure 47-7.
5. NCRODP-33-NA, "Bearing Cooling System," pages 2, 3, 5, 16, 28, A-2, A-4, figures 33-1 and 33-4.

K/A CATALOGUE QUESTION DESCRIPTION:

- Containment Cooling System (CCS); Knowledge of the physical connections and/or cause-effect relationships between the CCS and the following systems: Chilled water.

K/A MATCH:

- This question matches the K/A in that the applicant must know which systems work to provide cooling (i.e. use of heat-exchangers) to the CCS as well as how the operation of various components in each of the systems affects the final cooling available to the CCS.

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21.

Unit 1 has experienced a loss of offsite power coincident with a Containment Depressurization Actuation (CDA).

Which ONE of the following describes the status of the "B" train of the Quench Spray (QS) System?

1-QS-MOV-100B SUCT VLV: _____ (1) _____

1-QS-MOV-101B DISCH VLV: _____ (2) _____

1B QS Pump is running: _____ (3) _____

- A. 1 initially shut then opens
2 initially shut then opens
3 immediately upon restoration of power to the bus
- B. 1 initially open and remains open
2 initially shut then opens
3 immediately upon restoration of power to the bus
- C. 1 initially shut then opens
2 initially shut then opens
3 13.3 seconds after restoration of power to the 1J bus
- D✓ 1 initially open and remains open
2 initially shut then opens
3 18 seconds after restoration of power to the 1J bus

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DISTRACTOR ANALYSIS:

- A INCORRECT The suction valve is initially open as this is its normal position. The pump starts after at least 15.75 seconds. This distractor is plausible as this is the shutdown configuration of most systems.
- B INCORRECT The pump starts after at least 15.75 seconds. This distractor is plausible since most pumps start upon receiving power.
- C INCORRECT The suction valve is initially open as this is its normal position. The pump starts after at least 15.75 seconds. This distractor is plausible in that the operator might confuse the 13.3 second delay with the 15 second delay.
- D CORRECT On a receipt of a CDA signal, the QS pumps automatically start and the discharge valves open. If a loss of offsite power is experienced coincident to a containment overpressurization, the QS System is actuated with a 29-Second time delay. The undervoltage condition on the QS Pump supply buses causes the breakers to open. After the diesel starts and energizes the supply bus within 13.3 seconds, a timer in the QS pump circuit breaker closes the breaker after an additional 15 ± 0.75 seconds..

REFERENCES:

1. NCRODP-53-NA, "Quench Spray System," pages 2, 16, 26, 27, 28, figure 53-1.
2. 1-FR-Z.1, "Response to High Containment Pressure," step 3.
3. North Anna Recirculation Spray System Exam Bank, questions 22 & 26.

K/A CATALOGUE QUESTION DESCRIPTION:

- Containment Spray System (CSS); Ability to monitor automatic operation of the CSS, including: Pump starts and correct MOV positioning.

K/A MATCH:

- This question matches the K/A in that it specifically asks the operator the conditions of both the spray system valves and pump after an automatic operation.

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22.

Assume the following plant conditions:

- Both units are at 100% power
- The Component Cooling Water System is in a normal configuration, except that 1-CC-P-1A is tagged out for bearing replacement
- 1-CC-P-1B and 2-CC-P-1A are running
- 2-CC-P-1B is in Auto
- 1-CC-P-1B has just tripped on overcurrent

Which ONE of the following statements describes the expected plant and crew response to this event in accordance 0-AP-15, Loss of Component Cooling Water?

- A. ✓ CC flow to RCPs on both Units will decrease; the crew should manually start 2-CC-P-1B and verify flow to the RCPs returns to normal.
- B. CC flow to RCPs on both Units will decrease; 2-CC-P-1B will Auto start, the crew should verify flow to the RCPs returns to normal.
- C. All CC flow is lost to Unit 1 and Unit 2 RCPs; the crew should trip both Units and enter 1-E-0 and 2-E-0.
- D. All CC flow is lost to only the Unit 1 RCPs; the crew should trip the Unit 1 reactor and enter 1-E-0.

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DISTRACTOR ANALYSIS:

- A. Correct. Since CC is normally cross-tied and there is now only one pump running, the CC flow to both unit's RCPs will decrease. Since the unit 1 "A" CC pump is tagged out no pump will start automatically, but the unit 2 pump can be manually started.
- B. Incorrect. There is no auto-start for the opposite unit CC pump when a pump trips.
- C. Incorrect. First part is incorrect since flow to the RCPs will only be degraded, not lost. Since a unit 2 CC pump is available it can be manually started to restore adequate flow. Plausible since there are failures that cause a loss of CC to RCPs and eventually require the unit to be tripped.
- D. Incorrect. See above.

Bank question 5562D

REFERENCES:

1. NCRODP-13-NA, "Service Water System," pages 5, 6, 10, 11, 12, 34, 35, 46, 47, figures 31-1 & 13-3.
2. NCRODP-77-NA, "Reactor Protection Systems," pages 49, 59, 60, 61, figures 77-12 & 77-14.
3. NCRODP-51-NA, "Component Cooling System," page 31.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Component Cooling Water (CCW); Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: Effect on the CCW flow header of a loss of CCW.

K/A MATCH:

- This question matches the K/A in that a lose of CCW will occur by design, automatically, on a CDA signal. The reference to the 2 minutes in the stem was inserted to allow for automatic system response and is not associated with any particular time relay.

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23.

Assume that all pressurizer pressure controls are in AUTOMATIC with the plant operating at 100% power when pressurizer pressure transmitter, 1-RC-PT-1444, fails high.

Which ONE of the following describes how the pressurizer PORVs, spray valves, and backup heaters will initially respond?

- A. ✓ One PORV will open, both spray valves will open, and all backup heaters will de-energize.
- B. Both PORVs will open, one spray valve will open, and all backup heaters will remain energized.
- C. One PORV will open, one spray valve will open, and all backup heaters will remain energized.
- D. Both PORVs will remain closed, both spray valves will open, and all backup heaters will de-energize.

DISTRACTOR ANALYSIS:

- A. Correct. PT-1444 feeds the master pressure controller. It will cause PORV 1455C and both spray valves to open, and all heaters to de-energize.
- B. Incorrect. Only one PORV and both spray valves are controlled by the master pressure controller. At 100% power there would be one set of backup heaters locked on.
- C. Incorrect. See above.
- D. Incorrect. See A and B.

Bank question 50379 with slight modifications.

REFERENCES:

1. NCRODP-74-NA, "Pressure Control and Protection System," pages 5, 6, 31, 32, T-8, figure 74-1.
2. 1-AR-B-F2, "PRZ PWR RELIEF VLVS AUTO BLOCK."
3. North Anna Pressure Control and Protection System Exam Bank, question 4, page 4, ID 711.

K/A CATALOGUE QUESTION DESCRIPTION:

- Pressurizer Pressure Control System (PZR PCS) Malfunction; Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: Operable control channel.

K/A MATCH:

- This question matches the K/A in that the operator must determine the impact of the failure on both affected and unaffected channels by determining the integrated response of the system as a whole.

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24.

Containment Purge Supply Fan, 1-HV-F-4A, fails to start when its handswitch is placed in "ON."

Which ONE of the following will prevent the fan from starting?

- A. Only Unit 1 Outside Containment Purge Exhaust Isolation, 1-HV-MOV-100D, NOT FULL OPEN.
- B. Only Unit 2 Outside Containment Purge Exhaust Isolation, 1-HV-MOV-200D, NOT FULL OPEN.
- C✓ Only Containment Purge Supply Unit air temperature is 30 degrees and reset locally.
- D. Only Unit 2 Hi Hi RMS on RM-259 or RM-262.

DISTRACTOR ANALYSIS:

- A INCORRECT Both MOV-HV-100D **AND** MOV-HV-101 (Unit 1 Outside Containment Purge Exhaust Isolation and Bypass) must be fully closed.
- B INCORRECT Both MOV-HV-200D **AND** MOV-HV-201 (Unit 2 Outside Containment Purge Exhaust Isolation and Bypass) must be fully closed.
- C CORRECT Containment Purge Supply Unit air temperature downstream of the heating coils > 35 degrees and temperature switch reset locally.
- D INCORRECT Unit 2 Hi Hi RMS on RM-259 or RM-262 **AND** either MOV-HV-200D (Unit 2 Outside Containment Purge Exhaust Isolation) or MOV-HV-201 (Unit 2 Outside Containment Purge Exhaust Isolation Bypass) not full closed.

REFERENCES:

1. NCRODP-47-NA, "Primary Ventilation System," pages 48 & 49.
2. North Anna Primary Ventilation System Exam Bank, question 38, page 38, ID 2100.

K/A CATALOGUE QUESTION DESCRIPTION:

- Containment Purge System (CPS); Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Containment Purge System controls including: Containment pressure, temperature, and humidity.

K/A MATCH:

- This question matches the K/A in that it addresses the temperature portion of this K/A and the operator's ability to predict changes in parameters (in this case a pump either running or not) in order to prevent exceeding a design limit (to prevent the heating coils from freezing).

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25.

A Large Break LOCA coincident with an ATWS has occurred on Unit 2.

According to the basis documents related to FR-S.1 "Response to Nuclear Power Generation/ATWS," aside from adding negative reactivity to the core "Emergency Boration" is initiated for which ONE of the following reasons?

- A. Manual initiation of SI would delay the addition of borated water and complicate recovery.
- B. It keeps the core covered without substantially affecting the moderator coefficient.
- C. It limits the affect of any overcompensation of intermediate range flux instruments.
- D✓ It is quicker than initiating local actions to trip the reactor.

DISTRACTOR ANALYSIS:

- A INCORRECT Although initiation of SI would delay recovery actions as well as affect maintaining a secondary heat sink, it would not delay the addition of borated water.
- B INCORRECT The basis document indicates that when CETs approach 1200 degrees, the addition of cooler water may adversely affect criticality due to its affect on the moderator coefficient.
- C INCORRECT If intermediate range flux is not decreaing, and undercompensation is ruled out, then emergency boration is initiated to reduce the flux to a point where the source range channels can be manually energized. This distractor is plausible in that an applicant might confuse this information with the compensation that occurs when in the intermediate range using compensating voltage in an intermediate range compensated ion chamber.
- D CORRECT After control rod trip and rod insertion functions, boration is the next most direct manner of adding negative reactivity to the core. Methods of rapid boration include emergency boration.

REFERENCES:

1. Basis document HFRS1 for FR-S.1, pages 70, 79, 98, 100.
2. North Anna Self-Study Guide for Subcriticality Series, page 14.

K/A CATALOGUE QUESTION DESCRIPTION:

- Anticipated Transient Without Scram (ATWS); Knowledge of the reasons for the following responses as they apply to the ATWS: Initiating emergency boration.

K/A MATCH:

- The knowledge of the [primary] reason for initiating emergency boration is considered almost too simplistic to ask. This question matches the K/A in that it addresses secondary reasons for initiating emergency boration that are not so blatantly obvious.

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26.

Unit 1 was operating at 100% power when the crew entered 1-AP-3, "Loss of Vital Instrumentation," due to the failure of "B" steam generator level channel III. In accordance with 1-AP-3, which ONE of the following describes an immediate action that must be taken?

- A. ✓ Place the associated MFRV and Bypass Valve in MANUAL.
- B. Verify MFRV controlling SG level in AUTO.
- C. Place the Control Rod Mode Selector switch in MANUAL.
- D. There are no required "immediate" actions.

DISTRACTOR ANALYSIS:

- A CORRECT This is the action called out by step 2 of 1-AP-3. Operation at 100% power was added to the stem to ensure only one correct answer.
- B INCORRECT Since level channel III feeds SGWLCS the MFRV must be controlled manually. Plausible because the other 2 level channels do not feed into SGWLC. If either of these channels fail the MFRV can remain in auto.
- C INCORRECT Although placing rod control in manual is called out as an immediate action step (if affected), this is not a required action. This distractor is plausible in that it is called out as an immediate action but only if rod control is affected. This distractor also acts to differentiate as to whether the operator is just taking the actions of a related procedure or whether they actually understand which actions are required to mitigate the failure.
- D INCORRECT Placing both the main feed reg valve and the bypass valves in manual are immediate action steps. This distractor is plausible in that the operator might be aware of the action to be taken but not recall that it is also an immediate action step.

REFERENCES:

1. 1-AP-3, "Loss of Vital Instrumentation," page 1 and page 2, step 2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Steam Generator System (S/GS); Knowledge of the effect of a loss or malfunction on the following will have on the S/GS: S/G level detector.

K/A MATCH:

- This question matches the K/A in that the operator must understand the effect of a loss or malfunction of the S/G level detector will have on the S/G in order to take the appropriate actions.

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27.

Unit 1 was operating at 100% power when the crew manually tripped the reactor due to a steam generator tube rupture which occurred in the "A" steam generator. Currently, plant conditions are as follows:

- RCS subcooling based on CETC is 50 degrees.
- Intact narrow range SG levels indicate 45%.
- SI has actuated.
- The crew is taking actions IAW 1-E-3, "Steam Generator Tube Rupture."
- Condenser Steam Dumps are being used for cooldown.

Which ONE of the following completes the statement in describing operator responsibilities given the above conditions?

Steam flow from _____.

- A. ✓ each intact SG should be kept less than 1.0×10^6 LBM/HR
- B. both intact SGs together shall not exceed a total of 1.0×10^6 LBM/HR
- C. both intact SGs may be steamed at a maximum rate of 4.0×10^6 LBM/HR
- D. the ruptured SG may be allowed to reach 1.0×10^6 LBM/HR

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DISTRACTOR ANALYSIS:

- A CORRECT If Steam Dumps are used for RCS cooldown, then, to prevent an undesired Main Steamline Isolation, each Main Steamline flow should be kept less than 1.0×10^6 LBM/HR.
- B INCORRECT The caution is for each separately. Limiting the total to less than 1.0×10^6 LBM/HR would unnecessarily limit the crew's ability to remove decay heat and is not in accordance with procedure.
- C INCORRECT This distractor is plausible in that the operator might confuse this figure with the design flow rate for one atmospheric dump valve which is sized to pass approximately 10% (425,244 lbm/hr at 1025 psig).
- D INCORRECT The numerical value chosen for this distractor is plausible for the same reason. However, this answer is incorrect in that this steam generator should have no steam flow indicated.

REFERENCES:

1. 1-E-3, "Steam Generator Tube Rupture," Caution and Note before step 12, page 10.
2. NCRODP-23-NA, "Main Steam System," pages 9 & 17.

K/A CATALOGUE QUESTION DESCRIPTION:

- Steam Generator Tube Rupture (SGTR); Ability to operate and monitor the following as they apply to a SGTR: Steam flow indicators.

K/A MATCH:

- This question matches the K/A in that the operator's selection of the correct answer demonstrates the ability to operate (limit steam flow to the appropriate value) by monitoring steam flow (which would be observed on steam flow indicators).

To make the question more operationally oriented, operators are given indications that should enable them to determine (without being told) that RCPs are still operating (i.e. subcooling is not less than 25 degrees), that intact SG levels are greater than 11%, and that SI has not actuated. If the question is considered too difficult, the stem could be modified as follows: "Which ONE of the following completes the statement in describing operator responsibilities with regard to dumping steam" portion of the stem to make the question more challenging.

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28.

Plant conditions are as follows:

- The plant is at 68% power.
- A MFP trips.
- Control rods are stepping in.
- All steam dumps fail to open as required.
- A steam dump arming signal is present.
- Tavg is 592 degrees F.

Given the above information, which ONE of the following describes the effect on the main steam system and the action the crew should take IAW 1-AP-2.2, "Fast Load Reduction?"

NOTE: The following refer to S/G conditions one minute after rods begin stepping in but prior to any operator action.

- A. Main steam pressure will increase, perform AP-2.1, "Turbine Trip Without Reactor Trip Required."
- B. Main steam pressure will decrease, perform E-0, "Reactor Trip or Safety Injection."
- C✓ Main steam pressure will increase, perform E-0, "Reactor Trip or Safety Injection."
- D. Main steam pressure will decrease, perform AP-2.1, "Turbine Trip Without Reactor Trip Required."

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DISTRACTOR ANALYSIS:

- A INCORRECT IAW AP-2.2, Attachment 3, if Tavg is > 591 degrees F, then trip the reactor and go to E-0.
- B INCORRECT Steam pressure will increase. This distractor is plausible in that the applicant might incorrectly reason that since rods are moving in that steam pressure will decrease.
- C CORRECT Even though rods are moving in, they account for 10% of 50% of a design load reduction (the steam dumps are designed to account for the remaining 40%). Therefore, Tavg, and hence steam pressure, will increase. While AP-2.2 gives the operator the option of transitioning to either E-0 or AP2.1, if certain conditions are met (i.e. > 591 degrees F) the operator is specifically directed to trip the reactor and go to E-0.
- D INCORRECT Steam pressure will increase. This distractor is plausible in that the applicant might incorrectly reason that since rods are moving in that steam pressure will decrease. Also, IAW AP-2.2, Attachment 3, if Tavg is > 591 degrees F, then trip the reactor and go to E-0.

REFERENCES:

1. AP-2.2, "Fast Load Reduction," pages 3 - 5, and Attachment 3 page 1.
2. NCRODP-23-NA, "Main Steam System," pages 5, and 30 - 34.
3. NCRODP-77-NA, "Reactor Protection Systems," page T-10 & figure 77-9.

K/A CATALOGUE QUESTION DESCRIPTION:

- Main and Reheat Steam System (MRSS); Ability to (a) predict the impacts of the following malfunctions or operations on the MRSS; and (b) based on predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
Malfunctioning steam dump.

K/A MATCH:

- This question matches the K/A in that the applicant is required to predict the impact the malfunctioning steam dumps will have on the main steam system (specifically, main steam pressure). The applicant is then asked to determine the action necessary to mitigate the consequences of the malfunction via selection of procedures.

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29.

Unit 1 is operating at power when the following indications are reported:

- Reactor power is 99% and slowly increasing.
- Auctioneered High Tavg is 576 degrees F and slowly decreasing.
- RCS pressure is 2210 psig and slowly decreasing.
- Turbine load is 970 MWe and decreasing.
- Steam Pressure is 815 psig and slowly decreasing.
- Containment Pressure is 9.5 psia and slowly increasing.

Based on these parameters, which ONE of the following is in progress?

- A. ✓ Steamline break inside containment.
- B. Steamline break outside containment.
- C. RCS cold leg leak inside containment.
- D. RCS hot leg leak inside containment.

DISTRACTOR ANALYSIS:

- A CORRECT Rational.
- B INCORRECT Rational.
- C INCORRECT Rational.
- D INCORRECT Rational.

REFERENCES:

1. Transient Accident Analysis
- 2.
- 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Steam Line Rupture; Ability to determine and interpret the following as they apply to the Steam Line Rupture: Difference between steam line rupture and LOCA.

K/A MATCH:

- This question matches the K/A in that the applicant must determine and interpret, from a set of given parameters, if a steam line rupture or a LOCA is occurring. The parameters are given for only one of the two casualties minus a key parameter that would result in analyzing for the other. With both casualty types listed among the available answers, the applicant is forced to check the information given in the stem to distinguish between the two types and, hence, determine the correct answer.

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30.

Unit 2 is at 100% rated thermal power with 2A-D1, ROD CONTROL URGENT FAILURE, in alarm. Control Rods are in automatic mode. The turbine governor valves close unexpectedly resulting in a 11% load rejection over a 90 second period.

Which ONE of the following correctly describes how RCS temperature is controlled given the above conditions?

- A. ✓ RCS temperature will be controlled entirely by steam dumps because the control rods will not move.
- B. RCS temperature will be controlled entirely by control rods because the power change is not enough to require steam dump operation.
- C. RCS temperature will go down due to higher xenon concentration with no rod motion and no steam dump operation.
- D. RCS temperature will be controlled with a combination of control rods and steam dumps because of the rate of load rejection.

DISTRACTOR ANALYSIS:

- A CORRECT Rods will not move due to the urgent failure. Steam dumps will arm with a 10% rejection in 2 minutes as sensed by turbine impulse pressure. Therefore, with an arming signal and a Tave-Tref deviation of 4 F (i.e. a demand signal), the dumps will open.
- B INCORRECT Rods will not move due to the urgent failure. This distractor is plausible if the applicant does not know that the alarm is indication that rods will not move even though the rods and rod control are designed to respond to a load rejection such as this without assistance from the steam dumps.
- C INCORRECT Steam dumps will respond as stated in the analysis for answer "A." This distractor is plausible because in that the applicant might consider that since the rods will not operate that the steam dumps will; except that the steam dumps are armed with a demand signal.
- D INCORRECT Rods will not move due to the urgent failure. This distractor is plausible if the applicant does not know that the alarm is an indication that the rods will not move.

REFERENCES:

1. 1-AR-A-D1, ROD CONTROL URGENT FAILURE
2. NCRODP-23-NA, "Main Steam System," pages 18, 31 - 34.

K/A CATALOGUE QUESTION DESCRIPTION:

- Steam Dump System (SDS) and Turbine Bypass Control; Knowledge of the effect of a loss or malfunction on the following will have on the SDS: Controller and positioners, including ICS, S/G, CRDS.

K/A MATCH:

- This question matches the K/A in that it addresses almost every facet of the K/A.

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31.

Unit 2 is in Mode 1 at 30% power. Attachment 1, "Turbine Mechanical Trip Test," of OP-15.1, "Operation of the Main Turbine," is in progress.

An operator is currently holding the Overspeed Trip Test Lever in the TO TEST position.

Which ONE of the following would still result in a Main Turbine and Reactor trip?

- A. Actual turbine speed increases to 2000 rpm.
- B. Loss of power to the Master Trip solenoid valve, SOV-20/AST-2
- C✓ Energizing the Master Trip solenoid valve, SOV-20/AST-2
- D. Actual Thrust Bearing wear exceeds its trip setpoint.

DISTRACTOR ANALYSIS:

- A INCORRECT With the overspeed trip test lever in the TO TEST position, the auto-stop supply to one side of the overspeed trip cylinder is blocked. The turbine will not trip on a mechanical overspeed condition.
- B INCORRECT The Low Vacuum Trip is blocked with the overspeed trip test lever in the TO TEST position. SOV-20AST-2 is normally deenergized.
- C CORRECT SOV-20-AST-2 is normally deenergized. It allows testing of the mechanical trips while affording turbine protection by actual signals whenever one of the "customer trips" is activated. Customer trips are the monitored events in the plant that trip the turbine. When energized, it pulls down on the protection control tripping bar. Since the solenoid is attached behind the fulcrum point, it causes the dump valve to be lifted to its trip position, initiating a turbine trip.
- D INCORRECT With the overspeed trip test lever in the TO TEST position, the auto-stop supply to one side of the overspeed trip cylinder is blocked. The turbine will not trip on a thrust bearing trip condition.

REFERENCES:

1. OP-15.1, "Operation of the Main Turbine," Attachment 1, page 68.
2. NCRODP-75-NA, "Main Turbine Control and Protection System," pages 13 - 16, 22, and A-2.
3. NCRODP-24-NA, "Main Turbine System," page 30.

K/A CATALOGUE QUESTION DESCRIPTION:

- Main Turbine Generator (MT/G) System; Knowledge of MT/G system design feature(s) and/or interlock(s) which provide for the following: Defeat of reactor trip by overspeed trip test lever.

K/A MATCH:

- This question matches the K/A in that the applicant must understand the design of the turbine trip test lever and how it provides interlock protection to prevent a reactor trip when in use.

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32.

Given the following conditions:

- The plant is stable at 90% power
- The main turbine is on the valve position limiter
- T_{avg} is 0.8 degrees greater than T_{ref}
- Bank D rods are at 200 steps with the Rod Control Bank Selector switch in AUTO
- No plant evolutions are in progress.

Which ONE (1) of the following describes the effect on rod control if a loss of condenser vacuum started to occur and why? (Assume **NO** operator action, the turbine trip setpoint is not reached, and feedwater temperature is unaffected.)

- A. ✓ Bank D rods would remain at 200 steps because a T_{avg}/T_{ref} mismatch would not occur.
- B. Bank D rods would remain at 200 steps because the main turbine is on the limiter.
- C. Bank D rods would step IN since T_{ref} would be decreasing.
- D. Bank D rods would step OUT since T_{ref} would be increasing.

DISTRACTOR ANALYSIS:

- A CORRECT Rational.
- B INCORRECT Rational.
- C INCORRECT Rational.
- D INCORRECT Rational.

REFERENCES:

1. 1-AP-14, "Low Condenser Vacuum,"
- 2.
- 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Condenser Vacuum; Ability to operate and/or monitor the following as they apply to the Loss of Condenser Vacuum: Rod position.

K/A MATCH:

- For this K/A, if condenser vacuum were lost, the only (and obvious) result would be either a unit trip or taking actions that would preclude the observance of any affect on rod position other than rods being on the bottom as the result of a trip. This question matches the K/A in that certain conditions are set wherein the operator must demonstrate the ability to monitor the affect of a loss of condenser vacuum.

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33.

Unit 1 experienced an event 2 minutes ago and the following conditions now exist:

- Reactor Power is 26% and STABLE.
- RCS Tavg is at normal operating temperature and STABLE.
- 1B and 1C SGs are operating normally.
- Containment pressure is 16.9 psia and rising slowly.

The following conditions now exist on 1A SG:

- Steam flow STABLE
- Feed flow RISING
- Pressure DECREASING
- Level At low level alarm setpoint and DECREASING RAPIDLY the
STM GEN 1A LO LEVEL annunciator alarms.

Which ONE of the following represents the correct actions to take for this event?

- A. Increase feed flow to 1A SG then go to 1-AP-31, "Loss of Main Feedwater."
- B. Manually initiate SI and go to E-0, "Reactor Trip or Safety Injection."
- C. Start a Standby Main Feedwater Pump in accordance with 1-AP-31, "Loss of Main Feedwater."
- D✓ Go to 1-E-0, "Reactor Trip or Safety Injection."

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DISTRACTOR ANALYSIS:

- A INCORRECT The annunciator response page for this alarm, 1-AR-F-C1, specifically states this as the action to take. This is incorrect for a faulted steam generator.
- B INCORRECT This action is plausible because containment pressure is almost at the SI set point. It is incorrect, because E-0 is always entered before initiating a manual SI.
- C INCORRECT This action is per AP-31, but only when power is greater than 70%.
- D CORRECT This is the correct action for a obviously faulted steam generator .

REFERENCES:

1. 1-AP-31, "Loss of Main Feedwater," pages 1 through 4.
2. Annunciator Page 1-AR-F-C1, STM GEN 1A LO LEVEL.
3. Annunciator Page 1-AR-F-A4, MAIN FD PPS DISCH HDR LO PRESS.
4. NCRODP-26-NA, "Feedwater System," pages 29 and 58.
5. Tech Spec 3.6.4, Containment Pressure.
6. 1-AP-18, "Increasing Containment Pressure," pages 2 through 4.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Main Feedwater (MFW); Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): MFW line break depressurizes the S/G (similar to a steam line break).

K/A MATCH:

- By asking the applicant to determine the correct operator actions when given the indications for this event (i.e. a feed line rupture), the operator must know the operational implications in order to take the appropriate actions. Although it would be more straightforward to ask the operator what event is in progress based on the given indications, without asking what actions are required, the question would not discriminate the operator's understanding with regard to operational implications resulting from a simple loss of MFW vice a MFW line break.

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34.

1-ECA-0.0, "Loss of All AC Power," directs the operator to:

- "Depressurize ALL INTACT SGs to 145 PSIG:"

The caution that precedes this step states that:

- "SG pressure should be maintained greater than 120 psig."

Which ONE of the following correctly describes the BASIS for the step AND the caution?

- A. To minimize RCS inventory loss.
- B. To prevent voiding in the reactor vessel upper head.
- C. To prevent losing Pressurizer level.
- D✓ To prevent injection of SI Accumulator nitrogen in the RCS.

DISTRACTOR ANALYSIS:

- A INCORRECT This is given as the basis for the RATE at which the SGs should be depressurized. This distractor is plausible in that it is closely related to the FINAL PRESSURE to which the SGs are to be depressurized.
- B INCORRECT Although this is almost always an undesirable condition, it is for this very reason that it is plausible as a distractor. For this event, depressurization of SGs should be continued even if this does occur so this answer is incorrect.
- C INCORRECT Although this is almost always an undesirable condition, it is for this very reason that it is plausible as a distractor. For this event, depressurization of SGs should be continued even if this does occur so this answer is incorrect.
- D CORRECT This is given as the basis.

REFERENCES:

1. 1-ECA-0.0, "Loss of All AC Power," Step 21 and NOTES and CAUTION on page 12.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Offsite and Onsite Power (Station Blackout); Knowledge of the reason for the following responses as they apply to the Station Blackout: Actions contained in EOP for loss of offsite and onsite power.

K/A MATCH:

- This question matches the K/A in that by asking the applicant to describe the "BASIS" for a particular action contained in the EOP for this event, it asks for the reason.

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35.

Which ONE of the following describes the effect of having air ejectors in service during normal operations at power?

- A. Increase in the condensate pump required NPSH.
- B. Increase in the hotwell temperature.
- C. ✓ Increase in the steam cycle efficiency.
- D. Increase in the mass of non-condensable gas in the main condenser.

DISTRACTOR ANALYSIS:

- A. Incorrect. No effect on the required condensate pump NPSH.
- B. Incorrect. The air ejectors have no effect on hotwell temperature.
- C. Correct. This is the purpose of main condenser air ejectors.
- D. Incorrect. This is backwards. Actually decreases the mass of non-condensable gases.

Reference:

Based on GFES question P3078.

REFERENCES:

1. NCRODP-25-NA, "Main Condensage System," pages 24, 25, and 27.

K/A CATALOGUE QUESTION DESCRIPTION:

- Condenser Air Removal System (CARS); Knowledge of system purpose and or function.

K/A MATCH:

- This question matches the K/A in that the applicant must understand how the system functions.

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36.

Both Units are operating at 100% power. Conditions are as follows:

- Component Cooling Water Pumps 1-CC-P-1A and 2-CC-P-1A are running.
- CC systems are in a normal lineup.

A loss of offsite power occurs. Emergency diesels are supplying power to their respective busses with the exception of the Unit 1, 1H 4160 VAC bus.

Given the above information, which ONE of the following describes plant conditions 25 seconds after emergency diesels are supplying power with no operator action?

- A. Only the 2-CC-P-1A is running supplying cooling water flow to Unit 2 only.
- B. 2-CC-P-1A and 1-CC-P-1A are running supplying cooling water flow to both units.
- C✓ 2-CC-P-1A, 2-CC-P-1B and 1-CC-P-1B are running supplying cooling water flow to both units.
- D. Only the 2-CC-P-1B and 1-CC-P-1B are running supplying cooling water flow to both units.

DISTRACTOR ANALYSIS:

- A INCORRECT The pump would be supplying both units since Units 1 & 2 CCW systems are normally cross-connected.
- B INCORRECT 2-CC-P-1A would be running but 1-CC-P-1A is powered from the 1H 4160 VAC bus and since power to that bus has not been restored, this pump will not be running.
- C CORRECT Both unit 2 CC pumps would be running due to the loss and restoration of power to their respective busses. Unit 1 "B" CC pump would have started when power was restored to the 1J bus.
- D INCORRECT These are not the ONLY pumps running. 2-CC-P-1A would also be running.

REFERENCES:

1. North Anna Self-Study Guide for Component Cooling Water System, pages 8 - 10.
2. NCRODP-51-NA, "Component Cooling System," pages 2, 10, & 31.
3. North Anna Component Cooling Water Exam Bank, questions 47, 61, & 64.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Offsite Power; Ability to operate and/or monitor the following as they apply to the Loss of Offsite Power: CCW pump.

K/A MATCH:

- This question matches the K/A in the operator must have the ability to monitor CCW pump response to the plant conditions in order to provide a correct answer.

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37.

At full power operation, a loss of power to 1B SG level channel III occurs. Which ONE of the following describes the effect on 1B SG level indication on channels I & II?

Assume no operator action and that all control and/or protection systems operate as designed.

- A. They will decrease to approximately 33% and then be maintained at that level with no more than a $\pm 5\%$ deviation.
- B. They will decrease until a 5% deviation exists between actual level and programmed level and then slowly increase to program level.
- C. They will increase to approximately 69.5% and then decrease.
- D✓ They will increase to approximately 75% and then decrease.

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DISTRACTOR ANALYSIS:

- A INCORRECT Level will increase. This distractor is plausible because the operator might confuse this fault with the program level for 0% turbine load.
- B INCORRECT Level would increase. This distractor is plausible because the operator might confuse this with the 5% deviation between actual and programmed level that actuates the annunciator.
- C INCORRECT Level would continue to increase to 75%. This distractor is plausible in that the operator might confuse the Steam Generator and Pressurizer hi level set points.
- D CORRECT Loss of power to this channel would have the same affect as the level failing low. The bypass FRV would modulate open to increase actual level to programmed level but would stay open due to constant level error caused by the low level input due to the loss of power. SG level would continue to increase to 75% until the Hi-Hi SG level signal closed the bypass FRV. This signal would also trip the main turbine, trip the mainfeedwater pumps, close the main feedwater pump discharge MOVs, close the main feedwater isolation MOVs, and close the MFRVs.

REFERENCES:

1. North Anna Self-Study Guide for Steam Generator Level Control and Protection System, section 2.1.2b.4 on page 12.
2. NCRODP-26-NA, "Feedwater System," pages 32, 33, 34, and 50.
3. NCRODP-77-NA, "Reactor Protection Systems," pages T-4 & T-16.
4. 1-AR-B-G8, PRZ HI LEVEL.
5. 1-AR-R-B1, STM GEN 1A LO-LO LEVEL CH I-II-III.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Vital AC Electrical Instrument Bus; Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: S/G pressure and level meters.

K/A MATCH:

- This question matches the K/A in that it addresses the S/G level portion of the K/A and the operator's ability to both determine and interpret the effect of a loss of the vital AC instrument bus supplying a particular channel.

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38.

Unit 1 was tripped from 100% power following a loss of several electrical busses. The following conditions exist:

- Operating crew has completed 1-ES-0.1, "Reactor Trip Response."
- All electrical busses have been restored with the exception of the 1J emergency bus.
- Repairs to the 1J emergency bus are expected to take 6 hours
- The 1J bus has been dead for one hour.
- All vital busses are being supplied from their respective inverters.

Continued operation in this condition could cause a loss of _____.

- A. Vital bus 1-I
- B. Air-side seal oil pump, 1-GM-P-1
- C✓ Breaker control power for "A" station service loads
- D. DC turbine oil pump, 1-TM-P-5

DISTRACTOR ANALYSIS:

- A. Incorrect. DC busses 1-III and 1-IV supply power to the 1-III and 1-IV vital buses, respectively.
- B. Incorrect. The air-side seal oil backup pump is powered from 1-IV. The air-side seal oil pump (1-GM-P-1) is powered from MCC 1A2-4.
- C. Correct. DC bus 1-III supplies breaker control power to "A" station service 4160V and 480V breakers. (1-IV supplies power to only breaker 15D3.)
- D. Incorrect. DC bus 1-II supplies power to the DC turbine oil pump via the H bus.

REFERENCES:

1. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," pages 3, 10, 36, 37, 45, 49, & A-3.
2. Technical Specification Bases 3.8.4 on page B 3.8.4-2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of DC Power; Knowledge of the operational implications of the following concepts as they apply to Loss of DC Power: Battery charger equipment and instrumentation.

K/A MATCH:

- This question matches the K/A in that it specifically addresses the operational implications of a loss of DC power (which would be caused by a station blackout) on battery charger equipment and instrumentation.

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39.

The following conditions exist on Unit 2:

- Reactor power is 45% and stable.
- 2-FW-P-1B is supplying feedwater.
- Steam Generator Water Level Controls are in AUTOMATIC.

Which ONE of the following failures will cause RCS Tavg to INITIALLY decrease?

- A. Feed Pump differential pressure transmitter, PDT-102, fails high.
- B. ✓ Feed Pump differential pressure transmitter, PDT-102, fails low.
- C. Steam Generator level channel III fails high.
- D. Steam Generator level channel II fails low.

DISTRACTOR ANALYSIS:

- A INCORRECT See rational for answer B.
- B CORRECT This failure will cause an auto-start for the standby main feedwater pump which will initially result in an increase in feedwater flow to the steam generators resulting in a decrease in Tavg due to the initial drop in Tcold.
- C INCORRECT This failure will cause the SGWL control system to reduce feedwater to the steam generators causing Tcold to initially increase due to less cooling. Tavg will initially increase as a result.
- D INCORRECT This failure will have no impact since only level channel III has input into SGWL control.

REFERENCES:

1. NCRODP-26-NA, "Feedwater System," pages 28, 29, & 53.

K/A CATALOGUE QUESTION DESCRIPTION:

- Main Feedwater (MFW) System; Knowledge of the effect that a loss or malfunction of the MFW will have on the following: RCS.

K/A MATCH:

- This question matches the K/A in that each of the choices presented to the applicant will have an effect on the RCS and in order to select the correct answer, the applicant must know what the effect will be.

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40.

The following Unit conditions exist:

- Both Units are at 100% power, steady state conditions.
- Waste gas decay tank outlet flow control valve 1-GW-FCV-101 is in HAND control.
- Annunciator 2-AR-B-A5, PROCESS VENT VNT STACK A&B LOW RAD MON ALERT/RAD actuates.
- Annunciator 2-AR-B-B5, PROCESS VENT VNT STACK A&B HI HI RADIATION actuates.
- The process radiation alarms associated with these two annunciators have been verified to be valid.
- No other process radiation monitors have exceeded their alarm setpoints.

Which ONE of the following describes the system and/or operator response?

- A. Operators should verify that the following valves automatically shut:
- Unit 1 containment vacuum pump discharge trip valve, 1-GW-TV-102A
 - Unit 2 containment vacuum pump discharge trip valve, 1-GW-TV-102B
 - Waste gas decay tank outlet flow control valve 1-GW-FCV-101.
- Operators must manually trip containment vacuum pumps.
- B. ✓ Operators should verify that the following valves automatically shut:
- Unit 1 containment vacuum pump discharge trip valve, 1-GW-TV-102A
 - Unit 2 containment vacuum pump discharge trip valve, 1-GW-TV-102B
 - Waste gas decay tank outlet flow control valve 1-GW-FCV-101.
- Operators should verify that containment vacuum pumps automatically trip.
- C. Operators should manually shut the following valves:
- Unit 1 containment vacuum pump discharge trip valve, 1-GW-TV-102A
 - Unit 2 containment vacuum pump discharge trip valve, 1-GW-TV-102B
 - Waste gas decay tank outlet flow control valve 1-GW-FCV-101.
- Operators must manually trip containment vacuum pumps.
- D. Operators should verify that the following valves automatically shut:
- Unit 1 containment vacuum pump discharge trip valve, 1-GW-TV-102A
 - Unit 2 containment vacuum pump discharge trip valve, 1-GW-TV-102B
- Operators should close waste gas decay tank outlet flow control valve 1-GW-FCV-101.
Operators should verify that containment vacuum pumps automatically trip.

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DISTRACTOR ANALYSIS:

- A INCORRECT Although the containment vacuum pumps do not receive a trip signal as a result of the alarms, they trip on interlock when their associated discharge valves shut. This distractor is plausible in that the operators may recall that these pumps do not trip directly from the high radiation signal but may not recall the interlock with the discharge valves.
- B CORRECT All three of the valves listed will automatically shut whenever the Westinghouse process radiation monitors (GW-RM-102 and GW-RM-101) or the Kaman Science radiation monitors (1-GW-RM-178-1 and 178-2) detect high-high radiation levels. The two annunciators given in the stem can be actuated by 178-1 and 178-2 respectively. Although the containment vacuum pumps do not receive a trip signal as a result of the alarms, they trip on interlock when their associated discharge valves shut.
- C INCORRECT Operators do not need to take any of the actions listed. This distractor is plausible because operators might think that valves might not automatically shut unless the Westinghouse process radiation monitors are also alarming which is why the statement was added to the stem regarding no other radiation monitors were alarming.
- D INCORRECT -GW-FCV-101 will automatically shut irregardless if it is in HAND or AUTOMATIC upon receipt of the radiation signals given in the stem.

REFERENCES:

1. 2-AR-B-A5, PROCESS VENT VNT STACK A&B LOW RAD MON ALERT/RAD.
2. 2-AR-B-B5, PROCESS VENT VNT STACK A&B HI HI RADIATION.
3. North Anna Self-Study Guide for Gaseous Waste Disposal System, Section 3.1b.4 on page 22 & Section 4.1b.2 on page 26.
4. NCRODP-45-NA, "Gaseous Waste System," pages 21, 22, A-2, & T-7.
5. 0-AP-5.2, "MGP Radiation Monitoring System," step 5 on Attachment 5, page 2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Accidental Gaseous Radwaste Release; Ability to operate and/or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system.

K/A MATCH:

- This question matches the K/A in that it addresses the operator's ability to both monitor and operate the ventilation system as it relates to an accidental gaseous radwaste release.

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41.

Unit 1 is in Mode 5 and Unit 2 is operating at 100% power. The following plant conditions exist:

- The Fuel Building Radiation Automatic Interlock (key) switch is in ENABLE.
- Annunciator 1K-D4, RAD MONITOR SYST HI-HI RAD LEVEL, actuated 3 minutes ago due to a valid alarm signal.
- MCR Emergency Ventilation Fans are running.
- The MCR Bottled Air System is dumped.

Assuming all plant systems responded as expected, which ONE of the following caused the conditions given above?

- A. Actions taken by the crew in response to Unit 1 Containment, manipulator crane radiation monitor, RMS-RM-162, Hi-Hi alarm.
- B. Automatic plant response to Unit 1 Containment, manipulator crane radiation monitor, RMS-RM-162, Hi-Hi alarm.
- C✓ Automatic plant response to Fuel Building, fuel pit bridge radiation monitor, RMS-RM-153, Hi-Hi alarm.
- D. Actions taken by the crew in response to Fuel Building, fuel pit bridge radiation monitor, RMS-RM-153, Hi-Hi alarm.

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DISTRACTOR ANALYSIS:

- A INCORRECT With Unit 1 in Mode 5, RMS-RM-162 is expected to be deenergized. This distractor is plausible since this radiation monitor is the only other monitor that will initiate an automatic plant response and the operator might confuse this with the automatic plant responses generated by RMS-RM-153.
- B INCORRECT With Unit 1 in Mode 5, RMS-RM-162 is expected to be deenergized. This distractor is plausible since this radiation monitor is the only other monitor that will initiate an automatic plant response and the operator might confuse this with the automatic plant responses generated by RMS-RM-153.
- C CORRECT A Hi-Hi alarm on either RMS-RM-152 or 153 will, following a two-minute time delay, automatically dump the MCR Bottled Air System and start the MCR Emergency Ventilation Fans if the "Fuel Building Radiation Automatic Interlock" (key) switch in the MCR is in the "Enable" position.
- D INCORRECT The conditions are a result of automatic plant response two minutes after receipt of the alarm.

REFERENCES:

1. MCRODP-45-NA, "Radiation Monitoring System," pages 27, 28, T-1 & T-11.
2. 1-AR-K-D4, RAD MONITOR SYST HI-HI RAD LEVEL.
3. 1-AP-5, "Unit 1 Radiation Monitoring System," third bullet of NOTE on page 2.
4. 0-AP-5.1, "Common Unit Radiation Monitoring System," steps 1 & 2 on page 2, Attachment 3, step 4 on pages 2 & 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Area Radiation Monitoring (ARM) System Alarms; Knowledge of the interrelations between the Area Radiation Monitoring (ARM) System Alarms and the following: Detectors at each ARM system location.

K/A MATCH:

- This question matches the K/A in that in order to correctly answer the question, the operator must know the alarms generated by different detectors at different locations.

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42.

The following unit conditions exist:

- Unit 1 has been operating at 100% power for several months
- A main feedwater piping rupture in the turbine building resulted in a unit trip
- The Auxiliary Feedwater System failed to function.

Which ONE of the following is correct concerning the response of the Reactor Coolant System (RCS), assuming that no operator actions are taken?

- A. Steam generator inventory is sufficient to remove decay heat for 30 minutes; RCS temperature stabilizes at T_{sat} corresponding to the setpoint for the steam generator PORVs.
- B. RCS temperature and pressure decrease rapidly; safety injection (SI) actuates; SI flow refills the pressurizer; RCS pressure increases rapidly; pressurizer PORVs cycle to control pressure.
- C. RCS temperature and pressure increase; pressurizer PORVs cycle to control RCS pressure; primary relief tank rupture disks blow; safety injection actuates due to increase in containment pressure.
- D✓ Steam generators boil dry; RCS temperature and pressure increase; pressurizer PORVs and/or safety valves cycle to control RCS pressure; core will eventually uncover.

Distractor Analysis:

- A. Incorrect. Plausible since the candidate may believe that the remaining steam generator inventory may last for an extended period of time. However, due to the loss of main feedwater at the onset of the event with no subsequent aux feedwater actuation, post-trip steam generator inventory will be significantly lower than normal. Coupled with significant decay heat and RCP heat loads this will lead to depletion of steam generator inventory early in the event.
- B. Incorrect. Plausible since the RCS temperature and pressure response is the normal initial response to post-trip conditions. However, pressure does not normally decrease to the SI setpoint. The rest of the distractor would be true for a SI when the RCS repressurizes.
- C. Incorrect. Plausible since the described RCS and PRT response is correct. However, no SI actuation setpoint will be reached since the magnitude of release from the ruptured PRT will not be sufficient to raise containment pressure above atmospheric pressure.
- D. Correct. With a loss of all main and aux feedwater, steam generator inventory will be depleted over time resulting in a total loss of RCS heat removal. Consequently, RCS pressure and temperature will increase resulting in a depletion of RCS inventory from pressurizer PORV and/or safety valve relief leading to core uncover.

Bank question 2415.

K/A CATALOGUE QUESTION DESCRIPTION:

- Auxiliary/Emergency Feedwater (AFW) System; Knowledge of the effect that a loss or malfunction of the AFW will have on the following: RCS.

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43.

The following conditions exist:

- Reactor Power is 50%
- A total loss of all Service Water has occurred.
- 0-AP-12, "Loss of Service Water," has been entered.
- RCP temperatures are beginning to rise.

Which ONE of the following correctly describes the actions operators must take in response to the given conditions?

- A. When RCP Stator Winding temperature reaches 300°F; stop the affected RCP(s), then trip the affected unit.
- B. When RCP Stator Winding temperature reaches 225°F; trip the affected unit, then stop the affected RCP(s).
- C✓ When RCP Pump Bearing temperature reaches 225°F; trip the affected unit, then stop the affected RCP(s).
- D. When RCP Pump Bearing temperature reaches 195°F; stop the affected RCP(s), then trip the affected unit.

DISTRACTOR ANALYSIS:

- A INCORRECT This is the correct temperature at which to take action. However, the reactor should be tripped before stopping the affected RCP(s).
- B INCORRECT The stator winding temperature at which to take action is 300°F.
- C CORRECT Correct.
- D INCORRECT The pump bearing temperature at which to take action is 225°F. RCP(s) should not be tripped until after the affected unit is tripped.

REFERENCES:

1. 0-AP-12, "Loss of Service Water," step 9, page 8.
2. NCRODP-13-NA, "Service Water System," page 35.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Nuclear Service Water; Ability to perform specific system and integrated plant procedures during all modes of plant operation.

K/A MATCH:

- This question matches the K/A in that it requires the operator to perform specific system actions on other (integrated) affected systems that take the plant through at least two different modes of plant operation.

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44.

A loss of off-site power has left the "H" bus without power.

Assuming no operator action, which ONE of the following DC buses would lose power first?

- A. 1-III
- B. 1-I
- C. 1-II
- D. 1-IV

DISTRACTOR ANALYSIS:

- A INCORRECT This DC bus is powered from the "J" bus which was not affected based on the indications given.
- B INCORRECT The amount of load on this DC bus is less than the load on 1-II.
- C CORRECT Battery 1-II has no spare capacity as determined by the battery sizing sheets in Calculation EE-0009 relative to the other three and therefore would lose power first.
- D INCORRECT This DC bus is powered from the "J" bus which was not affected based on the indications given.

REFERENCES:

1. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," page 22 and figures 35-1 & 35-2.
2. North Anna Vital and Emergency Electrical Distribution System Exam Bank, question 108, ID 50277 on page 110
- 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- AC Electrical Distribution; Knowledge of the effect that a loss or malfunction of the AC distribution system will have on the following: DC system.

K/A MATCH:

- This question matches the K/A in that the applicant must know the effect of the loss of a particular portion of the AC distribution system has on a related portion of the DC system.

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45.

Which ONE of the following would prevent the H stub bus breaker (15H12) from reclosing automatically following restoration of power to the emergency bus but would not prevent operators from manually reclosing the breaker?

- A. H bus voltage restored for at least 15 seconds
- B. ✓ 1-RH-P-1A pump breaker closed
- C. Ground condition present
- D. CDA signal present

DISTRACTOR ANALYSIS:

- A INCORRECT If H bus voltage has been restored for at least 15 seconds then neither action would be prevented.
- B CORRECT To automatically close the H stub bus breaker the 1-RH-P-1A pump breaker must be open.
- C INCORRECT This would prevent a manual or automatic closing of the stub bus breaker.
- D INCORRECT This would prevent a manual or automatic closing of the stub bus breaker.

REFERENCES:

1. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," pages 34 & 35.

K/A CATALOGUE QUESTION DESCRIPTION:

- AC Electrical Distribution; Knowledge of AC distribution system design feature(s) and/or interlock(s) which provide for the following: Bus lockouts.

K/A MATCH:

- This question matches the K/A in that the applicant must know the lockout that would prevent an automatic reclosing of the stub bus breaker resulting in a BUS lockout.

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46.

A failed breaker has caused the loss of a 125-volt battery charger. Fifteen minutes later, as the OATC monitoring the voltage on the bus you will expect bus voltage will drop _____.

- A. ✓ slowly at first; then later drop faster
- B. quickly at first; then later drop more slowly
- C. at a constant, but slow rate
- D. at a constant, but quick rate

DISTRACTOR ANALYSIS:

A. Correct. After the initial drop the voltage will drop slowly until cell reversal starts having an effect at which time the voltage drop will occur at a faster rate.

B. Incorrect. See A. Could be chosen based on misconception of cell reversal effects.

C. Incorrect. See A. Could be chosen if cell reversal effects are not considered.

D. Incorrect. See A. Could be chosen based on misconception of cell reversal effects.

Based on bank question 4086.

References:

Objective 3280 in Vital and Emergency Electrical.

REFERENCES:

1. 1-AR-K-C2, STA BATTERY VOLTAGE TROUBLE.
2. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," pages 14 & 30.
3. Technical Specification 3.8.6.2 and Table 3.8.6-1 on pages 3.8.6-3 & 4.
4. 1-ECA-0.0, "Loss of All AC Power," steps 12 & 19.

K/A CATALOGUE QUESTION DESCRIPTION:

- DC Electrical Distribution; Ability to manually operate and/or monitor in the control room:
Battery voltage indicator.

K/A MATCH:

- This question matches the K/A in that the operator is specifically asked about battery voltage which is monitored on the control room (MCR).

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47.

Both units were operating at 100% power when a loss of off-site power occurs.
The following conditions exist on unit 1:

- 1-FW-P-2, Steam-Driven Auxiliary Feedwater Pump, did not start and cannot be started
- 1H EDG is tagged out for major maintenance
- 1J EDG started and loaded
- The crew is currently in 1-ES-0.1, "Reactor Trip Response" and 1-AP-10, "Loss of Electrical Power"
- 15J2, 1J EDG output breaker, has just opened due to a fault.

Which ONE of the following correctly describes the crew's response to the above conditions?

- A. Go to 1-E-0, "Reactor Trip and Safety Injection," and then transition to 1-ECA-0.0, "Loss of All AC Power."
- B✓ Go directly to 1-ECA-0.0, "Loss of All AC Power."
- C. Remain in 1-ES-0.1, "Reactor Trip Response," and 0-AP-10, "Loss of Electrical Power."
- D. Go directly to 1-FR-H.1, "Loss of Secondary Heat Sink."

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DISTRACTOR ANALYSIS:

- A. Incorrect. There is a transition to ECA-0.0 out of E-0, but there is no reason to go back to E-0 at this time.
- B. Correct. ECA-0.0 can be entered directly.
- C. Incorrect. A loss of all emergency power has occurred. Although AP-10 will still be applicable, it is not the controlling procedure.
- D. Incorrect. Although a loss of all aux feed flow has occurred. ECA-0.0 directs that CSFs only be monitored and FRs should not be entered.

REFERENCES:

- 1. 2H-F7, 4KV EMER BUS 2H UV
- 2. 2H-F8, 4KV EMER BUS 2J UV
- 3. E-0, "Reactor Trip or Safety Injection," step 3 on page 3 and step 16 on page 5 of Attachment 5.
- 4. ECA-0.0, "Loss of All AC Power," pages 1 & 2.
- 5. 0-AP-10, "Loss of Electrical Power," pages 1 & 2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Emergency Diesel Generator (ED/G) System; Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures.

K/A MATCH:

- This question matches the K/A in that it requires the applicant to recognize an abnormal indication that meets entry-level conditions for entering emergency and abnormal operating procedures.

QUESTIONS REPORT

for NORTH ANNA 2006-301 RO TEST FINAL NRC 6-14-2006

48. 064K4.04 001/2/1/ED/G/MEMORY/MODIFIED/NA06/RO/MC

The following conditions exist:

- Both units are at 100% power
- 1-PT-82H, "1H Emergency Diesel Generator Slow Start Test," is being conducted and 1H EDG is currently paralleled to the grid
- A safety injection signal has occurred due to a LOCA

Which ONE of the following signals will trip the 1H EDG?

- A. Low crankcase pressure.
- B. ✓ Generator differential (87X).
- C. High jacket cooling temperature.
- D. Overexcitation.

DISTRACTOR ANALYSIS:

- A INCORRECT High crankcase pressure, not low, will result in a diesel shutdown.
- B CORRECT This is one of the 3 conditions which will result in EDG trip when an emergency start condition has occurred.
- C INCORRECT High jacket cooling temperature of > 205 degrees F is a trip, but not when an emergency start is present. Could be chosen if the examinee does not realize that even though the EDG was already running it still has an emergency start.
- D INCORRECT Overexcitation is not a diesel trip at any time.

Based on bank question 5567. Changed initial conditions and some distractors.

REFERENCES:

1. CNRODP-55-NA, "Station Diesel Generator Systems," pages 86, 87, 93, 94, 102, T-12, T-14 thru T-17.
2. 0-OP-6.1, "Operation of the SBO Diesel," step 5.2.27 on page 23.
3. 0-OP-6.4, "Operation of the SBO diesel," step 4.20 on page 13.
4. Technical Specification Bases 3.8.1.3, page B 3.8.1-23.

K/A CATALOGUE QUESTION DESCRIPTION:

- Emergency Diesel Generators (ED/G); Knowledge of ED/G system design feature(s) and/or interlock(s) which provide for the following: Overload ratings.

K/A MATCH:

- This question matches the K/A in that the operator must know the interlock that protects the SBO (Emergency Diesel Generator) Diesel from overcurrent.

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49.

The following conditions exist:

- Unit 1 is at 30% power.
- 2-IA-C-1 is tagged for PMs.
- A total loss of the switchyard occurs.
- Both Unit 1 EDGs fail to reenergize the emergency busses and the crew implements 1-ECA-0.0, "Loss of All AC Power."
- The crew is directed to "**MANUALLY** dump steam at the maximum rate using S/G PORVs."

In accordance with ECA-0.0, "Loss of All AC Power," which ONE of the following is correct concerning the **INITIAL** crew response?

- A. Fail open the S/G PORVs using the keyswitches in the cable vault.
- B. ✓ Open the S/G PORVs using the controllers on the benchboard.
- C. Direct a watchstander to open the S/G PORVs using the handwheels.
- D. Direct a watchstander to fail the IA to the S/G PORVs.

DISTRACTOR ANALYSIS:

- A INCORRECT The keyswitches only have the ability to isolate, not open. This distractor is plausible if the operator fails to remember that the switches only isolate.
- B CORRECT Rational.
- C INCORRECT This answer would be correct for long-term operation but not for an initial response.
- D INCORRECT Performing this action would have no affect since the valves fail closed. This answer is plausible if the operator thinks that the valve fails open.

REFERENCES:

1. ECA-0.0, "Loss of All AC Power," Step 21.b on page 13.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Instrument Air; Ability to locate and operate components, including local controls.

K/A MATCH:

- This question matches the K/A in that the loss of the switchyard in conjunction with the one air compressor being tagged results in a loss of instrument air which, under the given conditions, requires operation of local benchboard controls.

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50.

A liquid radwaste release is in progress.

Which ONE of the following should operators expect to observe upon receipt of a hi-hi radiation signal from LW-RM-111? (Assume no operator action.)

- A. Clarifier Holdup Tank Inlet Valve, LW-FCV-100, shuts **and**
All running SG Blowdown Pumps stop.
- B. ✓ Liquid Waste Discharge Valve, LW-PCV-115, shuts **and**
Clarifier Holdup Tank Inlet Valve, LW-FCV-100 shuts **and**
All running SG Blowdown Pumps stop.
- C. Actuation of a radiation alarm **and**
Liquid Waste Disch Valve, LW-PCV-115, shuts.
- D. **Only** actuation of a radiation alarm.

DISTRACTOR ANALYSIS:

- A INCORRECT A high radiation signal from LW-RM-111 also causes LW-PCV-115 to shut.
- B CORRECT A high radiation signal from LW-RM-111 shuts LW-PCV-115 and
FCV-LW-100. The blowdown pumps trip due to FCV-LW-100 closure.
- C INCORRECT A high radiation signal from LW-RM-111 also causes FCV-LW-100 to shut
which, in turn, causes the blowdown pumps to trip.
- D INCORRECT This would be the expected response upon a receipt of a hi radiation signal
from LW-RM-100, Liquid Waste Evaporator radiation monitor.

REFERENCES:

1. NCRODP-43-NA, "Liquid Waste System," pages 4, 16, 17, 39, and figure 43-6.
2. NCRODP-46-NA, "Radiation Monitoring System," pages 6, 15, 30, and T-7.

K/A CATALOGUE QUESTION DESCRIPTION:

- Liquid Radwaste System (LRS); Ability to manually operate and/or monitor in the control room: Automatic isolation.

K/A MATCH:

- This question matches the K/A in that the applicant is asked to determine the automatic liquid radwaste system responses that could be monitored in the control room as a result of an isolation signal.

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51.

The N-16 main steam radiation monitor's indication is invalid below 20% reactor power for which ONE of the following reasons?

- A. Steam flow is so low that all of the N-16 decays prior to reaching the detector.
- B. ✓ The neutron flux is insufficient to produce representative amounts of N-16.
- C. Microprocessor neutron flux peaks cannot be identified at this power.
- D. At this power level, the 0.5-inch slot in the detector shield limits the collimation of the radiation field.

DISTRACTOR ANALYSIS:

- A INCORRECT Not ALL of the N-16 decays. this distractor is plausible considering the short half-life of N-16.
- B CORRECT At low powers, neutron flux is insufficient to produce representative amounts of N-16.
- C INCORRECT This detector measures gamma, not neutron, flux. This distractor is plausible in that the applicant might confuse this detector with those designed to detect neutron flux, in which case this rationale could apply.
- D INCORRECT Although this detector does incorporate such a design, its ability to detect would not be diminished as a result of low power.

REFERENCES:

1. North Anna Radiation Monitoring System Exam Bank, question 59, ID 1339, page 61.
2. NCRODP-46-NA, "Radiation Monitoring System," pages 3, 4, 19, & 20.

K/A CATALOGUE QUESTION DESCRIPTION:

- Process Radiation Monitoring (PRM) System; Knowledge of the operational implications as they apply to concepts as they apply to the PRM system: Radiation theory, including sources, types, units, and effects.

K/A MATCH:

- This question matches the K/A in the following respects: the low power aspect addresses operational implications applicable to the PRM system; distractors "C" and "D" require the applicant to have knowledge of radiation theory, sources, and types.

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52.

The crew has entered 1-FR-C.1, "Response to Inadequate Core Cooling."

You have been directed to open 1-SI-MOV-1869A, SI Hot Leg Injection Alternate Header Isolation IAW 1-FR-C.1.

Which ONE of the following describes your actions?

- A. Turn on control power to the valve by shutting its breaker locally then operate the valve from the MCR; a key is required.
- B. Turn on control power to the valve by shutting its breaker locally then operate the valve from the MCR; a key is NOT required.
- C✓ Turn on control power to the valve from the MCR and then operate the valve from the MCR; a key is required.
- D. Turn on control power to the valve from the MCR and then operate the valve from the MCR; a key is NOT required.

DISTRACTOR ANALYSIS:

- A INCORRECT Control power to the valve is turned on from the MCR. However, this distractor is credible in that the operator might confuse this action with a similar action required for SI Accumulator isolation valves.
- B INCORRECT Control power to the valve is turned on from the MCR. However, this distractor is credible in that the operator might confuse this action with a similar action required for SI Accumulator isolation valves. A key is required to operate the valves.
- C CORRECT MOV-1869A is controlled by a pushbutton handswitch and a keyswitch on MCR vertical board Safeguards Panels. The handswitch has two positions, ON and OFF, that energize or deenergize the valve control circuits. Its keyswitch has two positions, OPEN and CLOSE, to allow operation of the valve.
- D INCORRECT A key is required to open the valve.

REFERENCES:

1. 1-FR-C.1, "Response to Inadquate Core Cooling," step 2 RNO a)2).
2. NCRODP-52-NA, "Safety Injection System," pages 10, 25, T-1 & T-4.
3. NCRODP-35-NA, "Vital and Emergency Electrical Distribution System," page T-1.

K/A CATALOGUE QUESTION DESCRIPTION:

- Inadequate Core Cooling; Ability to locate and operate components, including local controls.

K/A MATCH:

- This question matches the K/A in that in order to answer the question correctly the operator must know the location of and how to operate controls associated with inadequate core cooling.

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RO Exam

53.

Plant conditions are as follows:

- Unit 2 is stable at 5% reactor power waiting to clear a Chemistry hold.
- A failure of "B" reserve station service transformer is caused by internal arcing.
- 15G1 automatically opens.
- All equipment is available and operated as expected.

Which ONE of the following describes the affect on the plant?

15G10 will automatically _____.

- A. open and unit 2 circulating water pumps will continue to run
- B. open and unit 2 circulating water pumps trip due to undervoltage
- C✓ close and unit 1 circulating water pumps will continue to run
- D. close and unit 1 circulating water pumps trip due to undervoltage

DISTRACTOR ANALYSIS:

- A INCORRECT 15G10 will automatically shut.
- B INCORRECT 15G10 will automatically shut.
- C CORRECT
- D INCORRECT Unit 1 circualting water pumps will not trip.

REFERENCES:

1. North Anna Basic Electrical Distribution System Exam Bank, question 55, ID 2952, page 56.
2. NCRODP-18-NA, "Basic Electrical Distribution," pages 36, 50, T-8, and fig 18-8.

K/A CATALOGUE QUESTION DESCRIPTION:

- Circulating Water System; Knowledge of bus power supplies to the following: Emergency/essential SWS pumps.

K/A MATCH:

- This question matches the K/A in that the applicant must know which circulating water pumps are powered from which buses in order to answer the question correctly.

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54.

Unit 1 is at 100% reactor power. Letdown flow is currently 88 gpm.

- 1-CH-RI-128, Reactor Coolant Letdown Radiation Monitor, alarms.
- The crew has verified that the alarm is not due to an instrument malfunction.

Which ONE of the following describes the required actions for a high radiation alarm on 1-CH-RI-128?

- A. ✓ Notify Health Physics and Chemistry Department to obtain and analyze a sample from the RCS letdown.
- B. Reduce power as required to maintain less than 80% of the allowable Technical Specifications 3.4.16 limit.
- C. Reduce letdown flow to 45 gpm and monitor 1-CH-RI-128 response.
- D. Increase RCS cleanup flow by opening another letdown orifice and increasing charging pump flow.

DISTRACTOR ANALYSIS:

- A CORRECT The applicant must know that the alarm does not in itself confirm the existence of high RCS activity due to the detector location and features as the alarming condition could be attributable to an increase in background radiation levels. A sample must be taken to confirm high RCS activity.
- B INCORRECT This action is performed if the high RCS activity is confirmed from the specific activity measurement from an RCS sample.
- C INCORRECT The NOTE following step 3 of Attachment 8 of 1-AP-5 states, "Maintaining letdown in service through the IXs is preferred to minimize RCS activity," indicating that flow should not be reduced.
- D INCORRECT This action would be performed after consulting with Health Physics and Chemistry IAW step 4 of Attachment 8 of 1-AP-5.

REFERENCES:

1. 1-AP-5, "Unit 1 Radiation Monitoring System," pages 2 & 3, Attachment 8 page 1.
2. Technical Specification 3.4.16, page 3.4.16-1 & Figure 3.4.16-1 on page 3.4.16-3.
3. NCRODP-41-NA, "Chemical and Volume Control System," page 16.

K/A CATALOGUE QUESTION DESCRIPTION:

- High Reactor Coolant Activity; Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: Location or process point that is causing an alarm.

K/A MATCH:

- This question matches the K/A in that the operator must determine that coolant activity is actually high (which is confirmed by Health Physics/Chemistry analysis). The operator must also interpret the alarm in that it could be caused by an increase in area radiation.

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55.

Unit 1 and Unit 2 are both operating at 100% power with all systems configured normally.

Which ONE of the following is correct regarding the statement:

Service water pump 1-SW-P-1A will receive an automatic start signal upon receipt of a _____.

- A. train B safety injection signal on Unit 2 only
- B. train B safety injection signal on either Unit 1 or Unit 2
- C✓ train A safety injection signal on either Unit 1 or Unit 2
- D. train A safety injection signal on Unit 1 only

DISTRACTOR ANALYSIS:

- A INCORRECT Service Water Pump 1B starts automatically on receipt of a Train B SI signal from either unit.
- B INCORRECT Service Water Pump 1B starts automatically on receipt of a Train B SI signal.
- C CORRECT Service Water Pump 1A starts automatically on receipt of a Train A SI signal from either unit or a loss of reserve station service power, on the associated unit, provided certain conditions are met.
- D INCORRECT Service Water Pump 1A starts automatically on receipt of a Train A SI signal from either unit.

REFERENCES:

1. North Anna Service Water System Exam Bank, question 17, ID 1595 on page 17.
2. NCRODP-13-NA, "Service Water System," pages 10, 34, 35, 36, T-6 & fig 13-7.
3. NCRODP-18-NA, "Basic Electrical Distribution System," figure 18-2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Service Water System (SWS); Knowledge of bus power supplies to the following: Service water.

K/A MATCH:

- This question matches the K/A in that the applicant must know which bus the service water pump receives power from in order to provide a correct answer.

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56.

Unit 1 was operating at 100% power, with both Unit 2 Service Water Pumps in operation when a total loss of off-site power occurred in conjunction with a Containment Depressurization Actuation (CDA). The following conditions exist:

- Moments prior to the above events, the 1H bus lost power.
- Operators have been unable to restore power to the 1H bus .

Give the above conditions, which ONE of the following describes the flow of service water to the Recirculation Spray (RS) Heat Exchangers? (Assume no local valve operations were performed.)

Service water supplied to the Unit 1 "C" RS Heat Exchanger will be via _____.

- A. RSHX Supply Valve, SW-MOV-101C ONLY.
- B. RSHX Supply Valve, SW-MOV-101D ONLY.
- C. RSHX Supply Valve, SW-MOV-101A **AND**
RSHX supply header cross-connect valves, SW-MOV-102A and -102B
- D✓ RSHX Supply Valve, SW-MOV-101B **AND**
RSHX supply header cross-connect valves, SW-MOV-102A and -102B

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DISTRACTOR ANALYSIS:

- A INCORRECT This valve did not open automatically due to the loss bus 1H, its power supply.
- B INCORRECT There will be a flow path from SW supply header #2 through MOV-SW-101D, which opened automatically as a result of the CDA, and then through MOV-SW-103C which also opened automatically upon receiving the CDA signal. Both of these valves receive power from bus 1J. However this is not the ONLY flowpath as 101B through 102A and 102B is also an option.
- C INCORRECT MOV-SW-101A would not open due to the loss of its power supply, bus 1H.
- D CORRECT MOV-SW-101B would have opened automatically upon receipt of the CDA and SW-MOV-102A and 102B are always open.

REFERENCES:

1. NCRODP-13-NA, "Service Water System," page 37, figures 13-2, 13-313-6, & 13-7

K/A CATALOGUE QUESTION DESCRIPTION:

- Service Water System (SWS); Knowledge of bus power supplies to the following: ESF-actuated MOVs.

K/A MATCH:

- This question matches the K/A because the flow of water to the "C" RS Heat Exchanger is determined by the position of valve in each of the supply lines. In order to correctly determine the supply flow path, the applicant must know which valves experienced a loss of power due to the loss of the 1H bus.

REFERENCES:

1. NCRODP-13-NA, "Service Water System," page 37, figures 13-2, 13-313-6, & 13-7

K/A CATALOGUE QUESTION DESCRIPTION:

- Service Water System (SWS); Knowledge of bus power supplies to the following: ESF-actuated MOVs.

K/A MATCH:

- This question matches the K/A because the flow of water to the "C" RS Heat Exchanger is determined by the position of valve in each of the supply lines. In order to correctly determine the supply flow path, the applicant must know which valves experienced a loss of power due to the loss of the 1H bus.

QUESTIONS REPORT

for NORTH ANNA 2006-301 RO TEST FINAL NRC 6-14-2006

57. 078A3.01 001/2/1/IAS/MEMORY/MODIFIED/NA06/RO/MC

The following conditions exist:

- 1-IA-C-1 Instrument Air Compressor was running in HAND.
- Instrument Air header pressure is 110 psig.
- The "AUTO" pushbutton for the 2-IA-C-1 Instrument Compressor was depressed.
- 2-IA-C-1 was in the "Hand" mode

Which ONE of the following describes the Instrument Air system 12 minutes later?

Instrument air pressure will _____ .

- A. be higher and both compressors will be running
- B. be higher and only one compressor will be running
- C. ✓ remain unchanged and both compressors will be running
- D. remain unchanged and only one compressor will be running

DISTRACTOR ANALYSIS:

- A INCORRECT When the "Auto" pushbutton is depressed, the compressor will start. Since instrument air header pressure is 110 psig and the compressor loads at 108 psig decreasing and unloads at 113 psig increasing, header pressure will remain unchanged.
- B INCORRECT Both instrument air compressors will be running.
- C CORRECT When the "Auto" pushbutton is depressed, the compressor will start. Since instrument air header pressure is 110 psig and the compressor loads at 108 psig decreasing and unloads at 113 psig increasing, header pressure will remain unchanged. If the compressor is in AUTO and runs for 15 minutes unloaded, it will automatically shut down.
- D INCORRECT Both instrument air compressors will be running.

REFERENCES:

1. North Anna Compressed Air System Exam Bank, question 27, ID 5062, on page 27.
2. NCRODP-17-NA, "Compressed Air System," page 30.
3. 1-OP-46.1, "Operation of 1-IA-C-1, Instrument Air Compressor," pages 4 thru 6.

K/A CATALOGUE QUESTION DESCRIPTION:

- Instrument Air System (IAS); Ability to monitor automatic operation of the IAS, including: Air pressure.

K/A MATCH:

- This question matches the K/A in that in order to answer correctly, the applicant must understand how system air pressure will be affected by automatic operation of the instrument air system, specifically with regard to the automatic (loading/unloading/starting/stopping) of one of the compressors.

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RO Exam

58.

The crew is responding to a loss of secondary heat sink IAW FR-H.1, "Response to Loss of Secondary Heat Sink," and must align a low pressure water source to feed SGs.

Which ONE of the following describes the **preferred** source and lineup IAW FR-H.1?

- A. Service Water System using the RSHX supply header.
- B. Service Water System using the Diesel-Driven Fire Pump, 1-FP-P-2.
- C ✓ Fire Protection System using the Motor-Driven Fire Pump, 1-FP-P-1.
- D. Fire Protection System using the Diesel-Driven Fire Pump, 1-FP-P-2.

DISTRACTOR ANALYSIS:

- A INCORRECT While this lineup is correct, it is considered the source of last resort because of the chemical contamination that would result in the S/Gs.
- B INCORRECT The Service Water System would be used only if the Fire Protection System was not available. Also, IAW FR-H.1, the Diesel-Driven Fire Pump would only be used if the Motor-Driven Fire Pump was not available.
- C CORRECT This is the preferred source and lineup.
- D INCORRECT IAW FR-H.1, the Diesel-Driven Fire Pump would only be used if the Motor-Driven Fire Pump was not available.

REFERENCES:

1. 1-F-0, Attachment 3, Heat Sink.
2. FR-H.1, "Response To Loss Of Secondary Heat Sink;" Step 24, page 24; Attachment 3, page 2; Attachment 4, pages 1 & 2.
3. AP-22.5, "Loss Of Emergency Condensate Storage Tank 1-CN-TK-1," page 3, page 3 of Attachment 2, and page 2 of Attachment 3.
4. NCRODP-13-NA, "Service Water System," pages 4, 9, 10, and 16.
5. North Anna Auxiliary Feedwater System Exam Bank, question 66, ID 6098, page 66.

K/A CATALOGUE QUESTION DESCRIPTION:

- Fire Protection System (FPS); Knowledge of the physical connections and/or cause-effect relationships between the Fire Protection System and the following Systems: AFW System.

K/A MATCH:

- This question matches the K/A in that the applicant must know how and in what way the two systems are physically connected in order to render a correct answer.

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RO Exam

59.

Unit 1 was operating at 100% power when a large break loss of coolant accident occurs. The operating crew is performing 1-E-0, REACTOR TRIP OR SAFETY INJECTION. Only one train of safeguards equipment actuated. The following plant conditions exist:

- All train "A" containment isolation phase A and phase B valves are CLOSED.
- All train "B" containment isolation phase A and phase B valves are OPEN
- Containment pressure is 21 psia.

Based on the present plant status, which ONE of the following is correct?

Single train containment isolation is _____ for satisfying post-accident containment isolation criteria. The train B containment isolation valves should be verified closed by using _____.

- A. insufficient; 1-PT-91 Containment Penetrations.
- B. ✓ sufficient; 1-E-0.
- C. sufficient; 1-PT-91 Containment Penetrations.
- D. insufficient; 1-E-0.

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DISTRACTOR ANALYSIS:

- A INCORRECT Isolation is sufficient.
- B CORRECT Containment isolation is sufficient with one train closed. However, isolation valves should be verified closed using the attachments.
- C INCORRECT Isolation valves should be verified closed using the attachments.
- D INCORRECT Isolation is sufficient.

REFERENCES:

1. North Anna Containment Isolation System Exam Bank, question 2, ID 5710, on page 2.
2. 1-E-0, "Reactor Trip or Safety Injection," step 12 on page 8 & Continuous Action Page.
3. 1-FR-Z.1, "Response to High Containment Pressure," step 2 on page 2.
4. FSAR Chapter 3, "Design Criteria," Sections 3.1.47.2 and 3.1.48.1 on pages 3.1-40 & 41.

K/A CATALOGUE QUESTION DESCRIPTION:

- Containment System; Ability to (a) predict the impacts of the following malfunction or operations on the containment system and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Phase A and B isolation.

K/A MATCH:

- This question matches the K/A in that the applicant must determine the impact of a malfunction of one train of Phase A/B on a containment isolation signal. The applicant is then required to determine the actions and procedures to mitigate the consequences of the malfunction.

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60.

Unit 1 is operating at 100% power when Engineering discovers a common mode failure that renders all three AFW pumps inoperable on Unit 1.

Which ONE of the following correctly describes the actions required by Technical Specifications?

- A. Within one hour initiate action to place Unit 1 in Mode 4 on RHR.
- B. ✓ Immediately initiate action to restore one AFW train to operable. LCO 3.0.3 requirements are suspended.
- C. Immediately initiate action to place Unit 1 in Mode 4 on RHR.
- D. Immediately initiate action to restore one AFW train to operable. LCO 3.0.3 requirements are not suspended.

DISTRACTOR ANALYSIS:

- A INCORRECT Although the TS would not apply in Mode 4, this is an incorrect action as the unit should not be moved without an operable AFW train. There is no one hour to take action.
- B CORRECT The crew needs to immediately take action to restore one AFW train to operable.
- C INCORRECT Although action must be taken immediately, the unit should not be moved with no operable AFW trains.
- D INCORRECT Although two AFW trains are required in this mode there is a separate action for having two inoperable trains of AFW.

References
Tech Spec 3.7.5

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61.

During the Unit 1 refueling outage, you are tasked with performing the initial valve lineup for 1-OP-31.2A, "Valve Checkoff - Auxiliary Feedwater." You are required to check 1-FW-149, Turb Drvn AFW Pump to S/G MOV Hdr Disch Isol Valve, in the "Locked Closed" position.

Which ONE of the following statements describes the correct method for checking the position of 1-FW-149 in accordance with OPAP-0012, Valve Operations?

- A. Visually verify that the stem is in the down position, then check the lock and chain are installed properly.
- B. ✓ Unlock the valve, using reasonable force, turn the valve in the clockwise direction. Re-install the lock and chain.
- C. Check the lock and chain are installed properly, using reasonable force, turn the valve in the clockwise direction.
- D. Unlock the valve, using reasonable force, turn the valve slightly in the counter clockwise direction and then reclose the valve. Reinstall the lock and chain.

Distractor Analysis:

- A. Incorrect. This would be correct for the independent verifier.
- B. Correct. This is how a locked closed valve would be initially checked.
- C. Incorrect. Correct actions, but incorrect order.
- D. Incorrect. Some of the steps are correct, but not all of them. Valve would NOT be turned in the open direction.

Modified from bank question 5712. Now initial performer, not Independent Verifier. Changes correct answer from A to B.

Reference:

OPAP 0012, pages 11-14.

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of how to conduct and verify valve lineups.

K/A MATCH:

- Question was written to both parts of this K/A in accordance with the guidance provided in NUREG 1021 Rev.9 Section 401.

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RO Exam

62.

The following Unit 2 conditions exist:

- The reactor is at 100% Rated Thermal Power.
- Loop "A" Tavg instrument failed hi.
- Control rods have been placed in manual.
- PRZR Level has been placed in manual.
- Steam Dumps have been placed in Steam Pressure Mode.
- The DELTA T DEFEAT SWITCH has been selected to defeat the failed channel.
- The Tavg DEFEAT SWITCH has been selected to defeat the failed channel.

If no other actions were taken, which ONE of the following correctly states the plant status and/or required operator actions?

- A. The reactor should have already tripped on OTDT. The RO is required to immediately trip the reactor.
- B. ✓ If another loop OTDT trip setpoint is subsequently exceeded, then the operators are to ensure the reactor automatically trips.
- C. The turbine should have already undergone a runback. The BOP is required to manually runback the turbine.
- D. The reactor should have already tripped on OPDT. The RO is required to immediately trip the reactor.

DISTRACTOR ANALYSIS:

- A INCORRECT Not in a 2/3 logic (I.E. loop is not bypassed). Plausible because loop can be removed from control, but not protective, circuits.
- B CORRECT OTDT is essentially in 1/3 logic because the protective circuit is not bypassed by the actions stated in the stem.
- C INCORRECT Runback occurs on 2/4 within 3% of trip setpoint. Plausible because applicant may not understand or correctly remember runback logic.
- D INCORRECT See A.

REFERENCES:

1. 2-AR-B-A8, LOOP 2A-B-C TAVG DEVIATION.
2. NCRODP-77-NA, "Reactor Protection Systems," pages 12, 13, 14, 18, 19, T-10, and figures 77- & 77-2.

K/A CATALOGUE QUESTION DESCRIPTION:

- Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.

K/A MATCH:

- This question matches the K/A in that the applicant must make operational judgements based on plant configuration and instrument interpretation to determine the required operator/plant response.

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63.

Which ONE of the following describes part of the procedure change process that is unique to temporary procedures?

- A. ✓ The requester must enter an expiration date and it should not exceed 120 days.
- B. A 10CFR50.59 review must be performed for non-intent changes.
- C. If the procedure will be used to satisfy Technical Specification requirements then the validation review must include actual performance of the procedure.
- D. They require a Writers Guide Review.

DISTRACTOR ANALYSIS:

- A CORRECT As per VPAP-0502, Procedure Process Control, para 4.25 on page 16 and Attachment 3, page 1, block 6.
- B INCORRECT For temporary procedures, this is only required when involving compensatory measures implemented to support operability.
- C INCORRECT Section 4.26 of VPAP-0502 specifically states that actual performance of the procedure should not be used on procedures which satisfy Technical Specification requirements.
- D INCORRECT They require an editorial review not a writers guide review.

REFERENCES:

1. VPAP-0502, "Procedure Process Control," pages 16, 27, and 100.
2. DNAP-1408, "Operability Determination Program," page 14, para 3.3.3.
3. VPAP-1101, "Test Control," page 15, para d.
4. DNAP-0502, "Dominion Nuclear Procedure Process Control," page 28.
5. VPAP-1403, "Temporary Modifications," pages 20 - 23.

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of the process for controlling temporary changes.

K/A MATCH:

- This question matches the K/A in that the operator must know the process for controlling temporary changes in order to provide a correct answer.

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RO Exam

64.

Your crew had been on shift for about an hour when you were asked about a Technical Specification limiting condition for operation for planned maintenance that was entered during the last shift.

Which ONE of the following was designed to provide you the information requested with little or no delay?

- A. Plan Of The Day
- B. Abnormal Status Log.
- C✓ Action Statement Status log.
- D. Record of Plant Issues submitted during the last shift.

DISTRACTOR ANALYSIS:

- A INCORRECT An LCO would not appear on the POD after so short a period of time.
- B INCORRECT The Abnormal Status log does not have Action Statements in it.
- C CORRECT The Action Statement Status log has a copy of all the current action statements.
- D INCORRECT A Plant Issue (PI) is not required to be submitted if the entry into an LCO was for planned maintenance.

REFERENCES:

1. OPAP-0005, "Shift Relief & Turnover," Section 6.1.4 on page 6.
2. VPAP-1501, "," Attachments 1 & 2.
3. North Anna Administrative Procedures Exam Bank, question 56, ID 3231, page 57.
4. DNAP-2000, "Dominion Work Management Process," Attachment 9, page 1.

K/A CATALOGUE QUESTION DESCRIPTION:

- Ability to track limiting conditions for operations.

K/A MATCH:

- This question matches the K/A in that it specifically asks the applicant about one tool that is used to track LCOs.

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65.

Unit 2 is refueling with a core on-load in progress when the following events occur:

- Annunciator E-C6, SPENT FUEL PIT LO LEVEL actuates.
- A report is received that the refueling cavity level is rapidly decreasing.
- There is one fuel assembly in the cavity.
- Power is lost to the Manipulator Crane.
- There is one fuel assembly in the fuel building transfer canal.

IAW 2-AP-52, "Loss of Refueling Cavity Level During Refueling," which ONE of the following represents the correct sequence of actions in response to the above conditions?

- A. Verify lower internals removed from the reactor vessel and adequately shielded, then return the fuel assembly in the cavity to the reactor vessel.
- B. Verify lower internals installed in the reactor vessel, then return the fuel assembly in the cavity to the reactor vessel.
- C✓ Return the fuel assembly in the cavity to the reactor vessel manually then evacuate all unnecessary personnel from containment.
- D. Evacuate all unnecessary personnel from containment. When power is restored to the manipulator crane then return the fuel assembly in the cavity to the reactor vessel.

DISTRACTOR ANALYSIS:

- A INCORRECT If lower internals are removed from the reactor vessel, cannot place a fuel assembly in the vessel.
- B INCORRECT The order is reversed.
- C CORRECT This is the correct order. The first part is an immediate action step which has a note preceding it stating that if electrical power is unavailable to the manipulator crane the manual operation may be required.
- D INCORRECT The steps are reversed.

REFERENCES:

1. 2-AP-52, "Loss of Refueling Cavity Level During Refueling," pages 1 & 2.
2. E-C6, SPENT FUEL PIT LO LEVEL.
3. 0-AP-27, "Malfunction of Spent Fuel Pit System," pages 1, & 4.

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of new and spent fuel movement procedures.

K/A MATCH:

- This question matches the K/A in that it applies to a procedure used to respond to an abnormal condition when moving new and spent fuel. The applicant must have knowledge of the procedure in order to answer correctly.

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66.

The Auxiliary Building operator must enter radiation areas to gather routine data and perform daily equipment checks. Consequently, this operator has logged onto a RWP designated only for Operations personnel entering the RCA. This RWP includes the following information:

- General Areas 1- 20 mR/hr
- Entry to contaminated areas require coveralls, shoe covers, gloves, hood, etc.
- Digital Alarming Dosimeter setpoints: 150 mR/hr and 50 mR

DETERMINE what type of RWP this is and the HIGHEST dose rate posting that the Auxiliary Building Operator is allowed to enter WITHOUT Rad Protection personnel coverage?

- A. Special RWP
CAUTION RADIATION AREA
- B. Special RWP
CAUTION HIGH RADIATION AREA
- C. Standing RWP
CAUTION RADIATION AREA
- D✓ Standing RWP
CAUTION HIGH RADIATION AREA

DISTRACTOR ANALYSIS:

- A INCORRECT This is a Standing RWP and the DAD alarm setpoint is indicative of areas greater than 5 mr/hr. Plausible if candidate interprets the information as a "special" RWP for only designated personnel.
- B INCORRECT This is a Standing RWP. Plausible if candidate interprets the information as a "special" RWP for only designated personnel.
- C INCORRECT The DAD alarm setpoint is indicative of areas greater than 5 mr/hr. Plausible if the candidate does not understand that the 50 mr setpoint is cumulative, i.e., assumes that it is a dose rate.

D CORRECT

REFERENCES:

1. VPAP-2101N, Radiation Protection Program (North Anna) Section 6.8.5
- 2.
- 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure.

K/A MATCH:

- Question was written to the second part of this K/A in accordance with the guidance provided in NUREG 1021 Rev.9 Section 401.

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RO Exam

67.

A plant worker is unconscious and presumed badly injured in a Very High Radiation Area.

A 50-year-old volunteer member of the rescue team is attempting to reach the man. The rescuer has already received a whole body exposure of 4 REM.

Which ONE of the following identifies the additional allowable exposure the rescue worker may receive in this rescue attempt?

- A. 1 REM
- B. 6 REM
- C. 21 REM
- D✓ No Limit

DISTRACTOR ANALYSIS:

- A INCORRECT There is no dose limit to save a life. Plausible because 5 REM is listed in Enclosure limit associated with Emergency Worker Exposure Limits.
- B INCORRECT There is no dose limit to save a life. Plausible because 10 REM is listed in Enclosure limit associated with Emergency Worker Exposure Limits.
- C INCORRECT There is no dose limit to save a life. Plausible because 25 REM is listed in Enclosure limit associated with Emergency Worker Exposure Limits.
- D CORRECT There is no limit to save a life. Note that the injured person is in a Very High Radiation Area which is defined as an area with dose rate in excess of 500 RADS/hr making this a life saving rescue.

REFERENCES:

1. 0-EPIP-20111, Enclosure 1

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.

K/A MATCH:

- This question matches the K/A in that the applicant must know both exposure limits as well as permissible levels in excess of those authorized which includes voluntary live-saving limits of which the key is to know that there is no limit.

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RO Exam

68. Within the EOPs at North Anna, action steps that are considered "Immediate Actions" are identified by which ONE of the following?

- A. Letters
- B. Bullets
- C. Bold Circles
- D. Brackets

DISTRACTOR ANALYSIS:

- A INCORRECT Letters are used to designate sequential steps.
- B INCORRECT Bullets are used to designate subtasks that do not have to be performed in a sequence.
- C INCORRECT As per OPAP-0013, a decision making step is an EOP step designated by a bold circle around the step number.
- D CORRECT As per DNAP-0509 and OPAP-0002.

REFERENCES:

1. DNAP-0509, "Dominion Nuclear Procedure Adherence and Usage;" page 15, para 3.6.2.b; page 18, para 3.8.1.a; page 35, para 4.e.1; page 36, para l.
2. OPAP-0013, "Emergency Operating Procedure Decision Steps Pilot Program," page 7, para 6.0.
3. OPAP-0002, "Operations Department Procedures," page 23, para 6.4.4.e.1.

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of EOP layout, symbols, and icons.

K/A MATCH:

- This question matches the K/A in that the applicant must have knowledge of the symbols used within the EOPS and their specific meaning.

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69.

Unit 2 operating crew entered FR-H.1, "Response to Loss of Secondary Heat Sink," in response to a Red Heat Sink condition. The crew is still progressing through FR-H.1 when critical safety function status tree conditions are reported as follows:

- Subcriticality: Orange path to FR-S.1, "Response to Nuclear Power Generation/ATWS."
- Core Cooling: Green
- Heat Sink: Green
- Integrity: Green
- Containment: Red path to FR-Z.1, "Response to High Containment Pressure."
- Inventory: Green

Which ONE of the following describes the actions the crew should take in response to the conditions given above?

- A. Immediately exit FR-H.1 and transition to FR-Z.1.
- B. Immediately exit FR-H.1 and transition to FR-S.1.
- C✓ Complete FR-H.1, then transition to FR-Z.1.
- D. Complete FR-H.1, then transition to FR-S.1.

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DISTRACTOR ANALYSIS:

- A INCORRECT Since FR-H.1 was entered on a Red path it must be completed unless a higher priority Red path condition is diagnosed.
- B INCORRECT Although the procedure should be immediately exited, the transition to FR-S.1 would be incorrect. As per F-0 Bases, first para on page 15, a red path takes priority over an orange path even if the orange path exists on a higher priority Critical Safety Function.
- C CORRECT Once H.1 has been entered on a Red path it must be completed unless a higher red path condition is diagnosed. See rational for answer "A."
- D INCORRECT The crew should immediately exit FR-H.1. The transition is also incorrect. See rational for answer "B."

REFERENCES:

1. F-0BG, "Background Information for F-0 Critical Safety Function Status Trees," pages 11, 12, 15, & 16.
2. HE-0BG, "Background Information for E-0 Reactor Trip or Safety Injection," pages 1, 43, & 64.
3. HFR-H1BG, "Background Information for FR-H.1 Response to Loss of Secondary Heat Sink," page 2.
4. North Anna Self-Study Guide for Heat Sink Series, page 6.
5. North Anna Self-Study Guide for Critical Safety Function Trees, page 11.

K/A CATALOGUE QUESTION DESCRIPTION:

- Knowledge of the bases for prioritizing emergency procedure implementation during emergency operations.

K/A MATCH:

- This question matches the K/A in that the applicant must have knowledge of the bases for prioritizing implementation of emergency procedures in order to prioritize his/her responses which is what the question asks.

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70.

The unit supervisor announces to the crew that 1-ES-0.0, "Rediagnosis," must be entered.

Which ONE of the following conditions would require the RO to agree with this course of action (i.e. allow entry into 1-ES-0.0)?

- A. 1-E-0, "Reactor Trip or Safety Injection," has not been exited and Safety Injection has not actuated but is required.
- B. 1-E-0, "Reactor Trip or Safety Injection," has not been exited and Safety Injection has actuated but is not required.
- C. 1-E-0, "Reactor Trip or Safety Injection," has been exited and Safety Injection has not actuated and is not required.
- D. ✓ 1-E-0, "Reactor Trip or Safety Injection," has been exited and Safety Injection has actuated and is required.

DISTRACTOR ANALYSIS:

- A INCORRECT E-0 must have been exited.
- B INCORRECT E-0 must have been exited.
- C INCORRECT SI must be either required on in service.
- D CORRECT This is per the note at the beginning of 1-ES-0.0.

REFERENCES:

1. 1-ES-0, "Re-Diagnosis." Note at beginning.

K/A CATALOGUE QUESTION DESCRIPTION:

- Rediagnosis; Knowledge of the interrelations between the (Reactor Trip or Safety Injection/Rediagnosis) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

K/A MATCH:

- This question matches the K/A in that in order to make the correct decision regarding the procedure to transition to, the operator must have knowledge of the interrelations between the rediagnosis and the various components, functions, and control of safety systems, instrumentation, and interlocks. It also tests the direct correlation between the reactor trip or safety injection and rediagnosis. ROs are required to know procedure entry conditions.

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71.

Which ONE of the following describes the sequence of actions required to establish bleed and feed heat removal, in accordance with, 1-FR-H.1, "Response to Loss of Secondary Heat Sink?"

- A. "Feed" is established first by initiating Main Feed to a S/G, then "Bleed" is established by depressurizing a S/G with an atmospheric steam dump.
- B. "Bleed" is established first by opening Both Pressurizer PORVs, then "Feed" is established by initiating Safety Injection.
- C✓ "Feed" is established first by initiating Safety Injection, then "Bleed" is established by opening All Pressurizer PORVs.
- D. "Bleed" is established first by depressurizing a S/G with an atmospheric steam dump, then "Feed" is established by initiating Main Feed to a S/G.

DISTRACTOR ANALYSIS:

- A INCORRECT Feed is established first, however it is with SI flow, and Bleed is with pressurizer PORVs.
- B INCORRECT Beed is established after Feed is established.
- C CORRECT Feed by initiating an SI is established first, and then the Pressurizer PORVs are opened to establish a bleed path.
- D INCORRECT Bleed is established after Feed is established, and not from these sources.

REFERENCES:

1. 1-FR-H.1, "Response To Loss Of Secondary Heat Sink," pages 18 - 24 beginning with step 14 and caution that follows.

K/A CATALOGUE QUESTION DESCRIPTION:

- Loss of Secondary Heat Sink; Knowledge of the operational implications of the following concepts as they apply to the (Loss of Secondary Heat Sink): Normal, abnormal and emergency operating procedures associated with (Loss of Secondary heat Sink).

K/A MATCH:

- Even though this question does not specifically ask "what are the implications of actions taken" (i.e. emergency operating procedures used), it matches the K/A in that in order for the operator to determine the correct sequence of actions to be taken associated with a loss of secondary heat sink, he/she must understand that the implication to the plant as a result of those actions will be the re-establishment of a means of heat removal in spite of the loss of the secondary heat sink.

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72.

Plant conditions are as follows:

- The crew has entered 1-FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition."
- Letdown is in service.
- Normal spray is not available.
- The crew has commenced an RCS temperature soak.
- Shortly after commencing the soak you notice RCS pressure increasing.

Given the above conditions, and IAW 1-FR-P.1, which ONE of the following describes the appropriate response?

- A. Open Reactor vessel head vent valves.
- B. Use ONE PRZR PORV to reduce pressure.
- C. Increase feed to SGs to reduce pressure.
- D✓ Use Auxiliary Spray to reduce pressure.

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DISTRACTOR ANALYSIS:

- A INCORRECT Although opening of head vents is correct in some cases (C.1, H.1, it is not correct in this situation.
- B INCORRECT This would be correct only if letdown was not in service.
- C INCORRECT IAW Step 27b)3), perform actions of other guidelines in effect that do not cool down or raise RCS pressure until the RCS temperature soak has been completed.
- D CORRECT IAW Step 25 RNO, if normal spray in not available and letdown is in service, then auxiliary spray would be used.

REFERENCES:

1. 1-FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition," Steps 25 & 27 on pages 18 & 20, Attachment 1.
2. North Anna Self-Study Guide for Pressurized Thermal Shock Series, pages 5 - 7.
3. OPAP-0006, "Shift Operating Practices," para 6.13.3 on page 19.

K/A CATALOGUE QUESTION DESCRIPTION:

- Pressurized Thermal Shock; Ability to perform without reference to procedures those actions that require immediate operation of system components and controls.

K/A MATCH:

- While this procedure contains no actions that could be defined "Immediate Actions" as understood by industry standards (such as North Anna procedures, E-0 & FR-S.1) the K/A was retained since it does resemble the immediate action requirements as called out in OPAP-0006. The applicant would reasonably be expected to respond to the condition presented in the question without reference to procedures and do so immediately, to reduce risk and protect the plant from this RAD risk level.

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73.

The crew is performing a natural circulation cooldown in accordance with ES-0.4, "Natural Circulation Cooldown with Steam Void in Vessel (Without RVLIS)," when the SRO states that his intention is to transition to FR-I.3, "Response to Voids in Reactor Vessel," in order to perform a head venting operation.

As RO, which ONE of the following describes why you would, or would not, support the SRO's intention and why or why not (IAW the bases)?

You recommend to the SRO that the crew _____.

- A. should not take this action as it will result in a loss of pressure control.
- B. should not take this action as pressure decreases (from venting) will result in a loss of RCS inventory.
- C. should take this actions as pressure decreases (from venting) will result in increased core cooling and partial elimination of the steam void.
- D. should take this action as it will restore RVLIS indication.

DISTRACTOR ANALYSIS:

- A INCORRECT Although this is the correct recommendation, the rational is not IAW the bases.
- B CORRECT According to the bases, at no time is it appropriate to make a transition to FR-I.3 and perform a head venting operation as the steam void would not be eliminated but would result in more water flashing to steam in the head region, replacing the steam that was vented.
- C INCORRECT This action should not be taken for any reason.
- D INCORRECT This action should not be taken for any reason.

REFERENCES:

1. HESO4BG, "Natural Circulation Cooldown with Steam Void in Vessel (Without RVLIS) Background Information," pages 2 & 3.

K/A CATALOGUE QUESTION DESCRIPTION:

- Natural Circulation Operations; Knowledge of the reasons for the following responses as they apply to the (Natural Circulation Operations): RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.

K/A MATCH:

- This question matches the K/A in that asks about RO actions and recommendations related to the ES-0.3 procedure and related to his function as a member of the control room team such that the procedure is not violated and limitations are not exceeded.

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74.

Unit 1 was operating at 100% power when a loss of offsite power occurred. The following plant conditions exist:

The crew is currently in 1-ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel"
The cooldown rate is 50° F/hr and initiation of Reactor Coolant System (RCS) depressurization has begun

To keep pressurizer (PRZR) level within the desired band, an operator establishes charging significantly greater than letdown

The operator now observes PRZR pressure increasing and PRZR level decreasing

The reason this is occurring is because vessel voids are _____.

- A. decreasing due to RCS pressure increasing
- B. decreasing due to the compression of any non-condensables
- C. increasing due to the RCS cooldown
- D. increasing due to condensation of steam in the PRZR

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Distactor Analysis:

- A. Correct. With a void present, the pressurizer will not respond in the normal manner. If letdown < charging, pressurizer pressure will increase, the vessel void will shrink and pressurizer level will decrease.
- B. Incorrect. There will be no significant amount of non-condensables. Plausible because there will be some, but the percentage will be insignificant.
- C. Incorrect. Plausible if the applicant confuses the effects of cooldown on vessel voids.
- D. Incorrect. Plausible if the applicant believes the pressurizer bubble is controlling the void volume in the vessel.

Bank question 60349.

REFERENCES:

1. ES-0.3, "Natural Circulation Cooldown with Steam Void in Vessel (With RVLIS)," steps 3 - 10 on pages 5 - 8.
2. HES03BG, "Natural Circulation Cooldown with Steam Void in Vessel (With RVLIS) Background Information," pages 2, 27, & 30.

K/A CATALOGUE QUESTION DESCRIPTION:

- Natural Circulation with Steam Void in Vessel with/without RVLIS; Knowledge of the reasons for the following responses as they apply to the (Natural Circulation with Steam Void in Vessel with/without RVLIS): Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.

K/A MATCH:

- This question matches the K/A in that the proposed actions will result in changes to temperature/pressure conditions the affect of which the applicant must know and undersatnd in order to prevent exceeding operating limitations.