Final Submittal

CATAWBA OCTOBER 2004

EXAM 50-413, 414/2004-301
OCTOBER 4 - 8, 2004 &
OCTOBER 13, 2004 (WRITTEN)

1. Reactor Operator Written Examination

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

Applicant Information

Name: MASTER EXAM KEY

Date: **October 13, 2004**	Facility/Unit: **Catawba Nuclear Station**
Region: **II**	Reactor Type: **W** / CE / BW / GE
Start Time: 0800	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 six hours after the examination starts.

Applicant Certification

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

Applicant's Signature
AUTHOR

Results

Examination Value	75	Points
Applicant's Score	_____	Points
Applicant's Grade	_____	Percent

CHANGES OR CLARIFICATIONS MADE:
NONE

Catawba RO Exam Reference Package - FINAL

Sorted by Question:

Ques_311.1 - Steam Tables
Ques_526.1 - COLR CNEI-0400-24 page 25
Ques_912.1 -ECA-1.1 Encl 5 page 72
Ques_1142 - Steam Tables
Ques_1160 - Tech Spec 3.6.4
Ques_1160 - Tech Spec 3.6.5

Sorted by Reference:

COLR CNEI-0400-24 page 25
ECA-1.1 Encl 5 page 72
Steam Tables
Tech Spec 3.6.4
Tech Spec 3.6.5

Bank Question: 033 ***Answer: B***

1 Pt(s) Unit 1 is in a refueling outage. Given the following events and conditions:

- A full core off-load is in progress
- One spent fuel assembly is in the fuel transfer tube being transported to the spent fuel pool
- The following annunciators alarm:
  - SPENT FUEL POOL LEVEL HI/LO
  - 1EMF-17 REACTOR BLDG REFUEL BRIDGE

Which one of the following correctly describes the type of event and the required operator actions that should be performed first in accordance with AP-26 (*Loss of Refueling Canal or Spent Fuel Pool Level*)?

A. Loss of refueling cavity or spent fuel pool level.
Install the weir gate and inflate the seals.

B. Loss of refueling cavity or spent fuel pool level
Move the fuel transfer cart to the spent fuel side

C. Loss of spent fuel pool level only
Move the fuel transfer cart to the reactor side.

D. Loss of refueling cavity level only
Close 1KF-122 (*KF Fuel Transfer Canal Isolation*).

Distracter Analysis:

A. **Incorrect**: using the weir gate is optional.
Plausible: this is one of the operator follow-up actions.

B. **Correct**:

C. **Incorrect**: the cart must be moved to the SFP side.
Plausible: if the problem is on the SFP side it might be reasonable to not to add more fuel to that side.

D. **Incorrect**: level is dropping on both sides, and you can't close valve with cart in the tube.
Plausible: the candidate may choose this answer due to the EMF alarm and closing the valve is the next action.

Level: RO Exam

KA: SYS 034 A1.02 (2.9/3.7)

Lesson Plan Objective: KF LPRO 15

Source: NRC Catawba Exam 2000 Ques_033

Level of knowledge: memory

References:
1. OP-CN-FH-FHS pages 7-8, 17
2. OP-CN-FH-KF page 16
2. AP/1/A/5500/26 pages 1-2

KA SYS 034 Fuel Handling Equipment A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: A1.02 Water level in the refueling canal 2.9 3.7 (CFR: 41.5 / 45.5)

Objective FH-KF 15 Describe system/operator action during abnormal conditions per AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Pool Level)

Bank Question: 059.1 ***Answer: A***

1 Pt(s) Unit 1 is at 100% power with RC pumps 1A, 1C and 1D running. Given the following events and conditions:

- RC pump 1C breaker trips due to a motor phase to phase fault
- Unit 1 begins to lose vacuum.
- The operators do not take any action.

Which one of the following statements correctly describes:
1. the expected plant power response and
2. the correct operator action(s)?

A. 1. Turbine power will decrease
2. Start the 1B RC pump

B. 1. Turbine power will remain constant
2. Start the 1B RC pump and manually open the 1B RC pump discharge valve

C. 1. Turbine power will decrease
2. Start the 1B RC pump and manually open the 1B RC pump discharge valve

D. 1. Turbine power will remain constant
2. Start the 1B RC pump

Distracter Analysis:

A. **Correct**: At 100% power, the turbine is running with the "MW out" selected. When vacuum decreases, the turbine slows down and turbine output decreases.

B. **Incorrect**: Turbine power will decrease not remain constant. The discharge valve opens automatically on pump start. Opening the discharge valve prior to starting the pump will cause reverse flow through the idle pump and the pump should not be started if rotating in reverse.
Plausible: If the turbine was operating with MW 'IN", reactor power would maintain turbine load. Formerly, the turbine was operated with MW IN selected. Many systems require manual discharge valve alignment prior to starting the pump.

C. **Incorrect**: The discharge valve will open automatically when the pump starts – no need to open it manually. Opening the discharge

valve prior to starting the pump will cause reverse flow through the idle pump and the pump should not be started if rotating in reverse.
Plausible: Partially correct – power will decrease and the pump must be started.

D. **Incorrect**: Turbine power will decrease with MW OUT.
Plausible: Partially correct – the pump should be started without first opening the discharge valve.

Level: RO Exam

KA: SYS 075 A2.02 (2.5/2.7)

Lesson Plan Objective: MT-RC SEQ 13

Source: MOD Ques_59e

Level of knowledge: comprehension

References:
1.OP-CN-GEN-EHC pages 10-11
2. OP-CN-MT-RC page 8
3. AP/23 pages 2-3
4. OP/1/B/6400/001A Encl 4.7 pages 1-2

K/A 075A2.02: Ability to (a) predict the impacts of the following malfunctions or operations on the circulating water system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of circulating water pumps 2.5/2.7 (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective MT-RC-13: Generalize the basic procedures used to accomplish the following:
• Operate RC pumps

Bank Question: 124.2 ***Answer: B***

1 Pt(s) A team of workers must repack the seals on a pump in an 1800 mrem/hr high radiation area.

Assuming all workers have no exposure for the current year, which one of the following work teams and estimated repair times would maintain overall team exposure ALARA and not exceed the Duke Power alert flag limit?

A. 10 people working for 40 minutes

B. 6 people working for 50 minutes

C. 4 people working for 60 minutes

D. 3 people working for 90 minutes

Distracter Analysis: Workers are allowed to receive up to 1600 mrem (alert flag level = 80% of 2000 mrem) before obtaining a dose extension.

N (persons) x T (time) x R/hr (dose rate) = total person-dose – to be minimized to maintain exposure ALARA

A. **Incorrect**: Individual worker exposure = 1200 mrem – OK. Total job exposure = 12000 mrem. This work plan would not minimize the total job dose – and maintain exposure ALARA.
Plausible: Each worker would have the least individual exposure – only 1200 mrem.

B. **Correct**: Individual worker exposure = 1500 mrem – OK. Total job exposure = 9000 mrem.

C. **Incorrect**: Individual worker exposure = 1800 mrem – exceeds the 1600 mrem alert flag and requires a dose extension.
Plausible: Total job exposure = 7200 mrem which is the lowest total job exposure. This plan minimizes job exposure but exceeds to 1600 mrem dose limit and would require an extension for each worker.

D. **Incorrect**: Individual worker exposure = 2700 mrem – NOT OK. Total job exposure = 8100 mrem.
Plausible: This plan exposes the fewest individuals.

Level: RO Exam

KA: G2.3.2 (2.5/2.9)

Lesson Plan Objective: RAD-HP SEQ 10

Source: Mod Ques_124.1

Level of knowledge: analysis

References:
1. OP-CN-RAD-HP page 19

K/A G2.3.2: Knowledge of facility ALARA program. (CFR: 41.12 / 43.4 / 45.9 / 45.10)
IMPORTANCE RO 2.5 SRO 2.9

Objective RAD-HP-10: Describe how the ALARA concept is maintained at CNS.

Bank Question: 272.2 ***Answer: B***

1 Pt(s) Unit 1 is responding to a LOCA from a trip at full power. Given the following conditions:

- A safety injection has occurred
- Containment pressure peaked at 3.2 psig and subsequently fell to 1.6 psig
- The FWST lo-lo level alarm was actuated and the operators have taken all appropriate actions in response to this alarm
- 1NS-20A (*NS pump A FWST Suction Block*) would not close

If containment pressure is 1.6 psig, which one of the following statements describes the operation of the NS pumps upon completion of the swapover?

A. The 1B NS pump will not restart automatically unless containment pressure increases above 3.0 psig, but can be restarted manually. The 1A NS pump cannot be restarted.

B. The 1B NS pump will restart automatically as soon as the pump suction alignment is completed. The 1A NS pump cannot be restarted.

C. Neither NS pump will restart automatically unless containment pressure exceeds 3.0 psig but can be restarted manually.

D. Neither NS pump will restart automatically and cannot be restarted manually.

Distracter Analysis:
After swapover to the cold leg recirc, the NS pumps will restart automatically after the valve interlocks are satisfied if the CPCS permissive signal is present (> 0.4 psig in containment).

3. Upon receiving LO-LO FWST LEVEL (11%), the operator is directed by procedure to manually shutdown the pumps and realign their suction to the containment sump.
   a) The Safety Injection signal and load sequencer was previously reset.
   b) NS pumps are shutdown, isolated from the FWST, and aligned to the containment sump.
   c) The suction valves are interlocked as follows:
      1) To open NS18A (NS pump A sump suction)
         (a) Close NS20A (NS pump A FWST suction block)

(b) Open NI185A (Containment sump isolation)
2) To open NS1B (NS pump B sump suction):
(a) Close NS3B (NS pump B FWST suction block)
(b) Open NI184B (Containment sump isolation)

A. **Incorrect:** The 1B NS pump will restart as soon as 1NS-3B is closed and 1NI-184A is open as long as the containment pressure has not dropped below 0.3 psig and the CPCS signal is still present.
Plausible: Exceeding 3 psig will also restart the 1B NS pump under normal alignment circumstances. Partially correct - the 1A NS pump cannot be started manually until 1NS-20A has closed.

B. **Correct**: pressure > 0.4 psig - CPCS permissive signal is present and the 1B NS pump will restart automatically. The 1AB NS pump cannot be restarted until the valve interlock is satisfied.

C. **Incorrect:** The 1B NS pump will restart as soon as the valve interlocks are met. The 1A NS pump cannot be restarted until 1NS-20A can be closed.
Plausible: Under normal conditions, the NS pumps will auto start at 3.0 psig in containment and can also be manually started. If the candidate does not know that 1NS-20A is interlocked with 1NS-18A – which prevents the 1A NS pump from starting until 1NS-18A is open.

D. **Incorrect**: The 1A NS pump will restart automatically.
Plausible: If containment pressure had dropped below 0.3 psig, the CPCS permissive signal would not be present and this would be the correct answer.

Level: RO Exam

KA: SYS 026 K4.08 (4.1*/4.3*)

Lesson Plan Objective: ECCS-NS 6, 9

Source: MOD Ques_272

Level of knowledge: comprehension

References:
1. OP-CN-ECCS-NS pages 7-11

KA SYS 026 Containment Spray K4 Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: K4.08 Automatic swapover to containment sump suction for recirculation phase after LOCA (RWST low-low level alarm) 4.1* 4.3*

Objective ECCS-NS 6 and 9:

6 List the automatic start signals for the NS System.
9 Explain the procedure to realign the pump suction path and when cooling water is aligned.

Bank Question: 282.3 ***Answer: D***

1 Pt(s) Unit 2 is operating at 69 percent power, with all systems aligned for full power operations. Given the following events and conditions:

- During a routine board walkdown, the BOP operator reports that VI system pressure has dropped to 86 psig.

Which one of the following statements correctly describes the automatic actions that should have occurred?

A. 1VS-78 (*VS Supply to VI*) is open

B. 1VI-670 (*VI Dryer Auto Bypass*) is open

C. 1VI-500 (*VI supply to VS*) is closed

D. The VI compressor in "*standby*" is running

Distracter Analysis:

A. **Incorrect**: 1VS-78 does not open until VI pressure drops to 78 psig.
Plausible: If the candidate confuses the VI system setpoints – VS-78 opens to provide instrument air to VS via the oil removal filters.

B. **Incorrect**: 1VI-670 does not open until VI pressure drops to 80 psig
Plausible: If the candidate confuses the VI system setpoints, bypass valve opens automatically at 80 psig to bypass the dryer in the event of a dryer malfunction.

C. **Incorrect**: 1VI-500 does not close until 80 psig.
Plausible: If the candidate confuses the VI system setpoints, 1VI-500 closes automatically at 80 psig to isolate a VS or VI leak.

D. **Correct**: Standby compressor starts at 96 psig (6-10 psig drop at CR pressure indicator) diesel compressor is started at 85 psig.

Level: RO Exam

KA: SYS 078 A3.01 (3.1/3.2)

Lesson Plan Objective: SS-VI SEQ 9

Source: MOD Ques_282.1

Level of knowledge: memory

References:
1. OP-CN-SS-VI pages 19-20

K/A SYS078 A3.01: Ability to monitor automatic operation of the IAS, including: Air pressure 3.1/3.2 (CFR: 41.7 / 45.5)

Objective SS-VI-9: Describe the Instrument Air compressor automatic actions and their setpoints.

Bank Question: 311.1 ***Answer: C***

1 Pt(s) Unit 1 is operating at 73% power. Given the following events and conditions:

- Pressurizer Relief Tank (PRT) pressure, temperature and level are elevated due to suspected PORV seat leakage.
- The PRT is being cooled by spray from the RMWST.
- PRT pressure is 25 psig.
- PRT temperature is 115 °F.
- PRT level is 81%.
- Pressurizer pressure is 2235 psig.
- Pressurizer temperature is 653 °F.
- Pressurizer level is 47%.

What temperature would be indicated on the PORV tailpipe RTD if a PORV was leaking by?

REFERENCES PROVIDED: Steam Tables

A. 220-239 °F

B. 240-259 °F

C. 260-279 °F

D. 280-350 °F

Distracter Analysis:

A. **Incorrect**: too low
Plausible: if the candidate determines atmospheric pressure by subtracting 14.7 psi from PRT pressure instead of adding.

B. **Incorrect**: too low
Plausible: if the candidate forgets to correct PRT pressure psig to psia

C. **Correct answer**: ~268 °F

D. **Incorrect**: too high
Plausible: if candidate runs up the constant entropy line instead of the constant pressure line on the Mollier diagram

Level: RO Exam

KA: APE 008AA1.08 (3.8/3.8)

Lesson Plan Objective: THF-FLO SEQ 8

Source: Bank #311

Level of knowledge: analysis

References:
1. OP-CN-THF-FLO pages 15-16
2. Steam Tables - PROVIDED

K/A APE 008AA1.08: Pressurizer Vapor Space Accident – AA1.08 Ability to operate and / or monitor the following as they apply to the Pressurizer Vapor Space Accident: PRT level pressure and temperature 3.8/3.8 (CFR 41.7 / 45.5 / 45.6)

Objective THF-FLO -8: Plot the throttling process on a Mollier Diagram and determine fluid properties upstream and downstream, given appropriate information.

Bank Question: 471 ***Answer: D***

1 Pt(s) Unit 1 is responding to a LOCA. Given the following events and conditions:

- Completed E-0 (Reactor Trip or Safety Injection)
- Entered E-1 (Loss of Reactor or Secondary Coolant)
- The STA reported the following valid critical safety functions:
  - Subcriticality - orange path
  - Integrity - red path
  - Heat Sink - red path
  - All other CSFs are green or yellow

Which one of the following statements correctly describes the proper procedure flow path?

A. Remain in E-1 (Loss of Reactor or Secondary Coolant)

B. Transition immediately to FR-S.1 (Response to Nuclear Generation /ATWS)

C. Transition immediately to FR-P.1 (Response to Imminent Pressurized Thermal Shock Condition)

D. Transition immediately to FR-H.1 (Response to Loss of Secondary Heat Sink)

Distracter Analysis:

A. **Incorrect**: - must transition to CSFs
Plausible: - if candidate does not know restrictions and applicability of F-0

B. **Incorrect**: - Orange path does not have priority over red paths
Plausible: - if candidate does not know rules of usage

C. **Incorrect:** - Integrity does not have priority over Heat Sink
Plausible: - if candidate does not know CSF rules of usage

D. **Correct answer**: - Heat sink has priority over integrity

Level: RO Exam

KA: G2.4.5(2.9/3.6)

Lesson Plan Objective: EP-INTRO Obj: none

Source: Bank

Level of knowledge: memory

References:
1. OP-CN-EP-INTRO page 6
2. OMP 1-7 pages 11-15

KA G2.4.5 Knowledge of the organization of the operating procedures network for normal, abnormal, and emergency evolutions. (CFR: 41.10 / 43.5 / 45.13)
IMPORTANCE RO 2.9 SRO 3.6

Objective: none

Bank Question: 495 ***Answer: C***

1 Pt(s) Unit 1 was at full power when a steam break occurred in containment.

Given the following events and conditions:

- Reactor trip and safety injection
- Main steam line isolation actuation
- All equipment has operated as designed

Parameter **Time:**	**0200**	**0205**	**0210**
Containment pressure (psig)	4.5	3.2	2.1
NC pressure (psig)	2000	1980	1945
Steam generator pressure (psig)			
S/G 1A	450	220	0
S/G 1B	750	790	785
S/G 1C	690	770	785
S/G 1D	1000	1050	1130

What is the earliest time, if at all; the operators can block and reset the main steam isolation signal (without the signal immediately reactivating)?

A. 0200

B. 0205

C. 0210

D. The main steam isolation signal cannot be reset

Distracter Analysis:

A. **Incorrect**: to reset the MSI, either the steam generators must all be above the setpoint of 775 psig or NC pressure must be less than P-11 (1955 psig) to allow blocking the low steam pressure signal.
Plausible: A change to the circuit allows MSI to be reset with high containment pressure locked in, however, low main steam line pressure prevents it.

B. **Incorrect**: coincidence not met for MSI reset – still have 2 S/Gs < 775 psig.
Plausible: 2 of 4 generators are above the setpoint, if the candidate not sure of logic.

C. **Correct**: when < P-11 (1955 psig) and operators can reset MSI

D. **Incorrect**: MSI can be reset at 0210
Plausible: If the candidate thinks that MSI cannot be reset with S/Gs < 775 psig.

Level: RO Exam

KA: 013 K4.02 (4.3/4.4)

Lesson Plan Objective: ECCS-ISE 5

Source: Bank Ques_495

Level of knowledge: analysis

References:
1. OP-CN-ECCS-ISE pages 23-24

KA SYS 013 A4.02 Engineered Safety Features Actuation A4 Ability to manually operate and/or monitor in the control room: A4.02 Reset of ESFAS channels 4.3 4.4 (CFR: 41.7 / 45.5 to 45.8)

Objective ECCS-ISE 5 Describe how each ESF Signal is reset.

Bank Question: 526.1 ***Answer: A***

1 Pt(s) Unit 1 is operating at 100% power when the following events occurred:

- Unit 1 OAC failed
- The following AFD readings are taken:
  - N41 – -22 %ΔI at 99% power.
  - N42 – -17 %ΔI at 100% power.
  - N43 – -15 %ΔI at 99% power.
  - N44 – -16 %ΔI at 100% power.

If the crew is directed to continue reactor operations at the highest power level possible, which one of the following statements describes the correct crew response required by Tech Specs?

REFERENCES PROVIDED: COLR CNEI-0400-24 page 25

A. Maintain 100% power and monitor AFD every 7 days.

B. Reduce power to 90% and begin monitoring AFD hourly.

C. Reduce power to < 50% and monitor AFD hourly.

D. Reduce power to < 50% and take PR channel N41 out of service.

Distracter Analysis: N41 is out of the AFD allowable band (-18 to +10)

A. **Correct**: With only 1 AFD channel out of the band, no action is required.

B. **Incorrect:** Only one AFD channel is out of the band. No action is required.
Plausible: If the candidate does not recognize that one NI channel may be outside the AFD bank – this is the correct action for 2 AFD channels outside the band.

C. **Incorrect**: Can maintain power level at 100%.
Plausible: If 2 AFD channels are out of the band, the operators must reduce power < 50% and increase surveillance to hourly until AFD is back in the band.

D. **Incorrect**: Can maintain power level at 100%
Plausible: PR channel N41 is out of the allowable band and monitoring AFD is not required below 50% power.

Level: RO Exam

KA: G2.1.7 (3.7/4.4)

Lesson Plan Objective: CTH-PD SEQ 14

Source: Mod Ques_526

Level of knowledge: comprehension

References:
1. Tech Spec 3.2.3 - PROVIDED
2. Unit 2 COLR Figure 6 - PROVIDED
3. OP-CN-CTH-PD page 27

K/A G2.1.7: Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 43.5 / 45.12 / 45.13) IMPORTANCE RO 3.7 SRO 4.4

Objective CTH-PD-14: Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.

Bank Question: 560 ***Answer: A***

1 Pt(s) Unit 2 was operating at 100% power when one CF pump tripped.

What is the expected response to this event and the reasons for this response?

A. 120 seconds after the trip, when median nuclear power > 65% and NR S/G level is > 55%, DFCS will maintain S/G reference level at 50% for 10 minutes then slowly ramp over 7 minutes to program level setpoint to prevent a hi-hi S/G level turbine trip.

B. Initially, FRVs will open up to restore S/G level until actual level equals programmed level, then will close down rapidly as power decreases. A hi-hi S/G level turbine trip may occur if this transient happens too rapidly.

C. 120 seconds after the trip, when median nuclear power > 65% and NR S/G level is > 55%, DFCS will maintain S/G reference level at 50% for 10 minutes then slowly ramp over 7 minutes to program level setpoint to prevent a lo-lo S/G level reactor trip.

D. Initially, FRVs will open up to restore S/G level until actual level equals programmed level, then will close down rapidly as power decreases. A lo-lo S/G level reactor trip may occur if this transient happens too rapidly.

Distracter Analysis:

A. **Correct:** Unit 2 DFCS has this circuitry installed.

B. **Incorrect**: Unit 2 has different DFCS programming.
Plausible: This is how unit 1 DFCS handles this transient.

C. **Incorrect**: The concern is a hi-hi S/G level trip – not a lo-lo trip.
Plausible: partially correct – DFCS responds as stated.

D. **Incorrect**: DFCS response not correct. The problem is the hi-hi S/G level trip not lo-lo.
Plausible: The DFCS response is appropriate for Unit 1. The candidate may confuse the reason for the DFCS response – if FRVs are commanded to open – they may think a lo-lo S/G level trip is the correct concern.

Level: RO Exam

KA: G2.2.3 (3.1/3.3)

Lesson Plan Objective: ADM-UD SEQ 1

Source: Bank Ques_560

Level of knowledge: memory

References:
1. OP-CN-ADM-UD pages 13-14

K/A G2.2.3: Knowledge of the design, procedural, and operational differences between units. (CFR: 41 / 43 / 45) IMPORTANCE RO 3.1 SRO 3.3

Objective ADM-UD-1: Given a design or operational difference, be able to describe why it exists, how it operates, and its impact on the plant.

Bank Question: 570.1 ***Answer: A***

1 Pt(s) Unit 1 is operating at 100% power. Given the following events and conditions:

- A loss of off-site power de-energizes 1ETA.
- D/G 1A starts but the D/G breaker will not close.
- The OSM desires to re-energize 1ETA from a Unit 2 power source.

Which of the following power sources can be aligned to re-energize 1ETA in accordance with AP-07 (*Loss of Normal Power*)?

A. 2TC can be aligned through SATA

B. 2TD can be aligned through SATB

C. 2TA can be aligned through 2ATC

D. 2TD can be aligned through 2ATD

Distracter Analysis:

A. **Correct**: 2TC can feed 1ETA through SATA.

B. **Incorrect**: 2TD does not supply SATB.
Plausible: 2TD is B train power supply (normal to 2ETB).

C. **Incorrect**: 2ATC has the connection to 1ETB (through 2ETB), but is K-key interlocked. The pull cords do not bypass the prevented need to rack in both 2ETB supply breakers.
Plausible: 2TB supplies 2ATB and is a B train power supply.

D. **Incorrect**: 2TD cannot be aligned to feed 1ETA.
Plausible: If the candidate does not know the electrical bus alignment.

Level: RO Exam

KA: SYS062G2.1.28 (3.2/3.3)

Lesson Plan Objective: EL-EPC SEQ 12

Source: MOD Ques_570

Level of knowledge: memory

References:
1. OP-CN-EL-EPC pages 7-8, 20, 22

K/A SYS062G2.1.28: AC Electrical Distribution - Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)

Objective EL-EPC-12: Explain the purpose of all K-Key interlocks in the 4.16 KV Essential and the 600 V Essential Power Systems.

Bank Question: 587.1 ***Answer: D***

1 Pt(s) Unit 2 was operating at 100% power with all systems in a normal lineup.

Which one of the following conditions would cause the RN system to automatically align to supply the YV containment cooling loads?

A. 0.5 psig containment pressure

B. Phase A containment isolation actuation

C. Phase B containment isolation actuation

D. Loss of Off-site Power.

Distracter Analysis:

A. **Incorrect**: does not swap to RN.
Plausible: 0.5 psig containment pressure is a different setpoint for containment fan cooler speeds.

B. **Incorrect**: does not swap on phase A - not a safety related system
Plausible: phase A is indicative of a high heat load into containment

C. **Incorrect**: cooling to VV isolates on Phase B.
Plausible: phase B is indicative of a high heat load into containment

D. **Correct answer** - Automatically swaps to RN on loss of power to YV chillers.

Level: RO Exam

KA: SYS022K1.01 (3.5/3.7)

Lesson Plan Objective: PSS-RN SEQ 15

Source: Bank Ques_587

Level of knowledge: memory

References:
1. OP-CN-PSS-RN pages 25-26

K/A SYS022 K1.01: Containment Cooling System - Knowledge of the physical connections and/or cause effect relationships between the CCS and the following systems: SWS/cooling system 3.5/3.7 (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective PSS-RN-15: Explain the purpose of the YV system and basic operation of the system.
- Control switch alignments & parameters required for auto swap.

Bank Question: 601.1 ***Answer: B***

1 Pt(s) Unit 2 has experienced a large break LOCA from 70% power. Given the following conditions:

- The operator have entered ECA-1.1 (*Loss of Emergency Coolant Recirculation*)
- NCS subcooling is 0 degrees.
- FWST level is 3%
- NCPs are not running
- There is no indication of natural circulation.

Which one of the following selections correctly completes the description of the major cooling flow path during this event?

Steam enters the ___(1)____ of S/G U-tubes where the steam condenses and re-enters the core area via the S/G __(2)____.

	(1)	(2)
A.	**hot leg**	**cold leg**
B.	**hot leg**	**hot leg**
C.	**cold leg**	**hot leg**
D.	**cold leg**	**cold leg**

Distracter Analysis:

A. **Incorrect**: steam returns via the hot leg
Plausible: the first part of the answer is correct

B. **Correct answer**

C. **Incorrect**: the steam enters the hot leg
Plausible: the second part of the answer is correct

D. **Incorrect**: cold legs are not affected during reflux boiling
Plausible: psychometric balance

Level: RO Exam

KA: EPE 011 EK1.01 (4.1/4.4)

Lesson Plan Objective: TA-MA SEQ 1, 11

Source: Bank Ques_601.1

Level of knowledge: memory

References:
1. OP-CN-TA-AM page 10

K/A EPE 011EK1.01: Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA : Natural circulation and cooling, including reflux boiling. 4.1 4.4 (CFR 41.8 / 41.10 / 45.3)

Objective TA-AM SEQ 1, 11: Describe available heat sinks and the mechanics of core cooling. Describe alternate success paths when normal components or systems are not available for core cooling

Bank Question: 642.1 ***Answer: B***

1 Pt(s) Unit 1 was in the process of removing spent fuel from the core when a design basis earthquake caused a loss of all AC power (station blackout). Given the following events and conditions:

- Spent fuel pool (SFP) makeup had been aligned from the FWST.
- The operators are implementing ECA-0.0 (*Loss of All AC Power*)
- Spent fuel pool level was noted to have increased by 8 inches since the last known level two hours ago prior to the earthquake.

Which one of the following events correctly explains the increase in spent fuel pool level?

A. The loss of ND cooling to the reactor cavity caused an increase in cavity water level.

B. The loss of containment purge fans caused a change in the differential pressure between the spent fuel pool and the reactor cavity.

C. The FWST gravity makeup line to the spent fuel pool isolation valves failed open and FWST level had dropped from 11% to 10.5%.

D. The standby makeup pump has been in operation for two hours.

Distracter Analysis: Spent fuel pool level curve is 17,000 per foot. The FWST contains 395,000 gals.

A. **Incorrect**: the loss of ND flow would not cause an appreciable increase in cavity level
Plausible: if the candidate thinks that loss of cooling flow from the ND system would cause an increase in cavity level -- which could cause an increase in spent fuel pool level.

B. **Correct**: The loss of VP would cause fuel pool level to increase due to the manometer effect. The spent fuel pool level will change if there is a change in differential pressure between containment and the refueling building -- has occurred in the past.

C. **Incorrect**: A drop of .5% FWST level is insufficient to cause an increase of 8 inches in the SFP. 0.5% x 395000 gals = 1975 gals lost from FWST. 8" x 1ft/12" x 17000 gal/ft = 11333 gals – does not

explain drop. In addition, if FWST level is 11%, there is not enough head to gravity drain to the spent fuel pool.
Plausible: Partially correct – the loss of AC power will cause the FWST isolation valves to fail "as is" – in this case in the open position.

D. **Incorrect**: The standby makeup pump takes suction from the spent fuel pool and would cause level to drop. Loss of AC power would cause the standby makeup pump to stop but the level would not increase.
Plausible: If the candidate thinks that the standby makeup pump provides water into the SFP when refueling - based on misunderstanding plant-operating conditions.

Level: RO Exam

KA: SYS 033A1.01 (2.7/3.3)

Lesson Plan Objective: CP-AD SEQ 4

Source: MOD Ques_642

Level of knowledge: comprehension

References:
1. OP-CN-FH-FW page 10
2. OP-CN-CNT-VP pages 6-9
3. OP-CN-CP-AD page 10

K/A SYS 033A1.01: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Spent Fuel Pool Cooling System operating the controls including: Spent fuel pool water level. 2.7/3.3 (CFR: 41.5 / 45.5)

Objective CNT-VP 2, 3
2 Describe the normal flowpath of the VP System and the refueling flowpath.
3 Explain the importance of a proper flow balance during VP System Operations.

CP-AD-4: State the following associated with the Standby Makeup Pump.
• suction source

Bank Question: 670.1 ***Answer: B***

1 Pt(s) Unit 1 is operating at 99% power. Given the following events and conditions:

- A lightning strike onsite causes a loss of offsite power and fault lockout of bus 1ETB.
- EDG 1A does not start.

Which one of the following statements correctly describes the requirement and maximum allowable time to start the standby makeup pump during this event?

A. **The crew must start the standby makeup pump within 10 minutes to provide makeup water to the NCS to prevent reaching the pressurizer low level alarm.**

B. **The crew must start the standby makeup pump within 10 minutes to provide makeup water to the NCP seals to minimize seal degradation.**

C. **The crew must start the standby makeup pump within 15 minutes to provide makeup water to the NCS to prevent reaching the pressurizer low level alarm.**

D. **The crew must start the standby makeup pump within 15 minutes to provide makeup water to the NCP seals to minimize seal degradation.**

Distracter Analysis:

A. **Incorrect**: reason for action is to protect NCP seals
Plausible: partially correct - time commitment is 10 minutes

B. **Correct answer**

C. **Incorrect**: time commitment is 10 minutes
Plausible: adding water to the reactor does maintain pressurizer level

D. **Incorrect**: time commitment is 10 minutes
Plausible: partially correct - does protect NCP seals

Level: RO Exam

KA: EPE 055 G2.1.32 (3.4/3.8)

Lesson Plan Objective: EP5 SEQ 4; AD SEQ 11

Source: Bank Ques_670

Level of knowledge: memory

References:
1. ECA 0.0 page 3
2. OP-CN-CP-AD page 9-10
3. ECA 0.0 Bkgd Document page 4

K/A EPE 055E G2.1.32: 055 Station Blackout - Ability to explain and apply all system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)

Objective EP-EP5-4: Explain the Bases of the Major Actions of EP/1/A/5000/ECA-0.0 (Loss of All AC Power)
CP-AD-11: Given appropriate plant conditions, apply limits and precautions associated with related station procedures.

Bank Question: 703.2 ***Answer: C***

1 Pt(s) While performing a valve lineup in the boric acid mixing room, an air line failure caused a severe airborne beta contamination problem. A worker received both internal and external contamination that was detected upon attempting to exit the RCA.

Which one of the exposures would exceed the 10CFR20 limit for the worker's annual shallow dose equivalent (SDE) exposure?

A. 55 Rem external dose to the lens of the eye.

B. 17 Rem internal dose equivalent to the lens of the eye.

C. 55 Rem external dose to the leg below the knee.

D. 17 Rem internal dose to the right forearm.

Distracter Analysis:

A. **Incorrect**: skin dose equivalent
Plausible: 50 Rem is correct limit for SDE -- may confuse with LDE eye dose

B. **Incorrect**: SDE is an external skin or extremity dose not an internal dose
Plausible: this is the correct LDE limit (lens of the eye).

C. **Correct**: 50 Rem SDE limit to the extremities (below forearm and below knee) or skin.

D. **Incorrect**: SDE is an external dose not an internal dose
Plausible: the right forearm is the correct part of the anatomy for an SDE - based on confusion of external/internal

Level: RO Exam

KA: G2.3.4 (2.5/3.1)

Lesson Plan Objective: RAD-HP2 - 2

Source: NRC McGuire 2002 Ques_703.2

Level of knowledge: memory

References:
1. GET Training Manual pages 31-32

K/A G2.3.4: Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized. (CFR: 43.4 / 45.10) IMPORTANCE RO 2.5 SRO 3.1

Objective RAD-HP2-2 List the 10CFR20 and Duke Energy Administrative External and Internal Dose Limits for the following: TEDE

Bank Question: 741 ***Answer: D***

1 Pt(s) Unit 2 was operating at 100% when a LOCA occurred. Given the following events and conditions:

- The crew attempted to start train A of the ND system to supply containment spray.
- 2NS-43A (*ND PMP 2A TO CONT SPRAY HDR*) failed to open.

Which one of the following statements correctly describes the cause of 2NS-43A failing to open?

A. Both 2ND-1B and 2 ND-2A (*ND PUMP 2A SUCT FRM LOOP B*) were not closed.

B. Either 2ND-36B or 2ND-37A (*ND PUMP 2B SUCT FROM LOOP C*) was not closed.

C. Train B of the ND system was not operating in the Cold Leg Recirculation mode.

D. CPCS > 0.4 psig signal was not present.

Distracter Analysis:

Interlocks to open 2NS-43A
1. 2ND-1B or 2ND-2A closed
2. 2NI-185A open
3. CPCS > 0.4 psig

A. **Incorrect**: Only one valve of these 2 valves must be closed.
Plausible: if the operator does not recognize that only 1 of these 2 valves is necessary to satisfy the interlock.

B. **Incorrect**: These are the train B interlocks for 2ND-36B/37A.
Plausible: operator reverses the trains

C. **Incorrect**: Does not electrically interlock containment spray. Either train may be aligned for cold leg recirc.
Plausible: It is an administrative requirement to have train B of ND in operation prior to opening 2NS-43A.

D. **Correct**: The CPCS signal prevents 2NS-43A from opening.

Level: RO Exam

KA: SYS 026 K3.02 (4.2*/4.3)

Lesson Plan Objective: ECCS-NS 7, PS-ND-7

Source: NRC Exam 2000 Ques_741

Level of knowledge: comprehension

References:
1. OP-CN-PS-ND page 13
2. OP-CN-ECCS-NS pages 10-12

KA SYS 026 Containment Spray K3 Knowledge of the effect that a loss or malfunction of the CSS will have on the following: K3.02 Recirculation spray system 4.2* 4.3 (CFR: 41.7 / 45.6)

Objectives
ECCS-NS 7 Describe the system response to an automatic start signal.
PS-ND 7 Describe the instrumentation and controls associated with the ND system
- Explain the interlocks associated with the ND system
- Describe the function of ND system controls in the Control Room
- Describe the Control Room instrumentation associated with the ND

Bank Question: 748.2 ***Answer: D***

1 Pt(s) Unit 1 was operating at 100%. Given the following events and conditions:

- An Emergency Diesel Generator has been manually started by the NLO from the local panel to run in parallel with offsite power in accordance with OP/1/A/6350/002 (*Diesel Generator Operation*).
- The operator adjusts the D/G output voltage to be 2 divisions lower than line voltage with the synchroscope running slowly in the fast direction.
- After the operator parallels the 1A D/G with the 1ETA bus, the following indications are observed.
  - Diesel VARS = 1MVAR
  - Diesel load = 0.4 MW

Which one of the following statements correctly describes the:
1. The condition of the Diesel Generator, and
2. The corrective action to return the condition to normal?

A. 1. The diesel has assumed too much real load.
2. Reduce the load by going to "*Lower*" on the speed control.

B. 1. The diesel has assumed too much real load.
2. Reduce the load by going to "*Lower*" on the voltage control.

C. 1. The diesel has assumed too much reactive load.
2. Reduce the load by going to "*Lower*" on the speed control.

D. 1. The diesel has assumed too much reactive load.
2. Reduce the load by going to "*Lower*" on the voltage control.

Distracter Analysis:

A. **Incorrect**: The diesel assumed too much reactive load – not real load. The correct response if to go to lower on the voltage control – not the speed control.
Plausible: If the candidate thinks that the problem will cause the D/G to assume too much real load, the correct response would be to lower the speed control.

B. **Incorrect:** The diesel assumed too much reactive load – not real load.
Plausible: Partially correct – going to lower on voltage control will correct the problem.

C. **Incorrect**: Going to lower on speed control will not effect reactive load, only real load.

Plausible: If the candidate confuses how to control real load and reactive load.

D. Correct:

Level: RO Exam

KA: SYS 064 A2.07 (2.5/2.7)

Lesson Plan Objective: DG-DG3 SEQ 12

Source: MOD Ques_748

Level of knowledge: comprehension

References:
1. OP-CN-DG-DG3 pages 18-19
2. OP/1/A/6350/002 pages 9
3. AP-07 page 2

K/A SYS064 A2.07: Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Consequences of operating under/over-excited 2.5/2.7 (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective DG-DG3-12: Explain the effects of adjusting Speed Control or Voltage Control when the diesel is paralleled or separated from the grid.

Bank Question: 764 ***Answer: D***

1 Pt(s) Unit 2 was operating at 100% power when an ATWS occurred. Given the following events and conditions:

- Reactor power is 96% and the reactor trip breakers are closed.
- The operators implement FR-S.1, (*Response to Nuclear Power Generation/ATWS*).
- Safety injection has not actuated.
- NV pump 2B is running, NV pump 2A is not running
- Both boric acid pumps are running

If all other valves are in their normal full power lineup, which one of the following valve lineups provides adequate boration flow to the NCS?

A. **CLOSED:** **-2NV-312A *(CHRG LINE CONT ISOL)***
-2NV-186A *(B/A TO BLENDER OTLT TO VCT OTLT)*
-2NV-238A *(B/A TO BLENDER CTRL VLV)*
OPENED: **-2NV-314B *(CHRG LINE CONT ISOL)***
- 2NV-188A & 189B *(VCT OTLT ISOL)*
- 2NV-236B *(BORIC ACID TO NV PUMPS SUCT)*

B. **CLOSED:** **-2NV-252A *(NV PUMPS SUCT FROM FWST)***
-2NV-181A *(B/A BLENDER OTLT TO VCT)*
-2NV-186A *(B/A TO BLENDER OTLT TO VCT OTLT)*
OPENED: **-2NV-253B *(NV PUMPS SUCT FROM FWST)***
-2NV-188A & 189B *(VCT OTLT ISOL)*
-2NI-10B *(NV PMP C/L INJ ISOL)*

C. **CLOSED:** **-2NV-314B *(CHRG LINE CONT ISOL)***
-2NV-188A & 189B *(VCT OTLT ISOL)*
-2NV-236B *(BORIC ACID TO NV PUMPS SUCT)*
OPENED: **-2NV-312A *(CHRG LINE CONT ISOL)***
-2NV-186A *(B/A TO BLENDER OTLT TO VCT OTLT)*
-2NV-238A *(B/A TO BLENDER CTRL VLV)*

D. **CLOSED:** **-2NV-252A *(NV PUMPS SUCT FROM FWST)***
-2NV-188A *(VCT OTLT ISOL)*
-2NI-9A *(NV PMP C/L INJ ISOL)*
OPENED: **-2NV-253B *(NV PUMPS SUCT FROM FWST)***
-2NV-189B *(VCT OTLT ISOL)*
-2NI-10B *(NV PMP C/L INJ ISOL)*

Distracter Analysis:

A. **Incorrect**: No emergency boration flow path because 2NV-312A is closed.
Plausible: because all the other valve positions are normal for this condition.

B. **Incorrect**: No emergency boration flow path because 2NV-188A&189B are open, preventing full low from the FWST.
Plausible: there's a flow path from the FWST to the running NV pump.

C. **Incorrect**: No emergency boration flow path because 2NV-314B is closed.
Plausible: there will be boron flow from the blender to the VCT in this lineup.

D. **Correct**: - this describes the B train valve lineup prescribed by the RNO for step 4.d.

Level: RO Exam

KA: APE 024 AK2.01 (2.7/2.7)

Lesson Plan Objective: EP-FRS SEQ 5, PS-NV SEQ 6, 7

Source: NRC Catawba Exam 2000

Level of knowledge: comprehension

References:
1. EP/1/A/5000/FR-S.1 pages 2-3
2. OP-CN-EP-FRS page 6

K/A APE 024AK2.01: Knowledge of the interrelations between the Emergency Boration and the following: Valves 2.7/2.7 (CFR 41.7 / 45.7)

Objective PS-NV-6/7:
6 Describe the operation and flowpath of normal charging.
7 Describe the operation and flowpath of NV seal injection.

Bank Question: 767.1 ***Answer: D***

1 Pt(s) Unit 1 is responding to a small-break loss of coolant accident inside containment. Given the following events and conditions:

- Operators are preparing to transition from E-1 (*Loss of Reactor or Secondary Coolant*) to ES-1.2 (*Post LOCA Cooldown and Depressurization*)
- Containment hydrogen concentration is 7%
- The TSC has recommended purging containment to reduce hydrogen concentration.

Which one of the following statements correctly describes the method for performing this evolution to minimize the off-site dose prior to release from the unit vent stack?

A. Containment air is exhausted to the auxiliary building where it is filtered in the VA system, which will maintain the auxiliary building at a negative pressure referenced to containment.

B. Containment air is exhausted to the containment air release system where it is filtered by the VQ system, which will automatically terminate the release if containment pressure reaches 0 psig.

C. Containment air is exhausted to the containment purge system exhaust and is filtered by VP system, which maintains a flow balance between upper and lower containment in the "normal" mode.

D. Containment air is exhausted to the annulus via the VY system where it is filtered by the VE system, which maintains a 1.5 " water vacuum referenced to the containment.

Distracter Analysis:

A. **Incorrect**: Air is released to the annulus area and filtered by the VY/VE system prior to release up the unit vent stack.
Plausible: This could be a way to filter the release if the air was vented to the auxiliary building. The auxiliary building is maintained at a negative pressure referenced to containment.

B. **Incorrect**: Air is released to the annulus area and filtered by the VY/VE system prior to release up the unit vent stack.

Plausible: If the candidate confuses the VQ and VY systems. The VQ system release will stop if containment pressure drops to 0 psig by closing VQ-13.

C. **Incorrect**: Air is released to the annulus area and filtered by the VY/VE system prior to release up the unit vent stack.
Plausible: VP is used to purge containment for Hydrogen gas. VP flows are balanced between upper and lower containment and the correct mode for operating this system under these conditions is "normal".

D. **Correct**:

Level: RO Exam

KA: EPE 009G2.3.9(2.5/3.9)

Lesson Plan Objective:

Source: NRC Exam Catawba 2000

Level of knowledge: memory

References:
1. OP-CN-CNT-VE pages 5- 7
2. OP-CN-CNT-VQ pages 7-8
3. OP-CN-PSS-VA page 5, 16-17
4. OP-CN-CNT-VP pages 5-7

K/A SYS 028K1.01 028 Hydrogen Recombiner and Purge Control - K1 Knowledge of the physical connections and/or cause effect relationships between the HRPS and the following systems: K1.01 Containment annulus ventilation system (including pressure limits) .2.5* 2.5 (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective CNT-VE 2: Describe why it is necessary to maintain a vacuum in the annulus following a LOCA

CNT-VE 3: Explain how the release of fission products from containment is limited

Bank Question: 805.1 ***Answer: B***

1 Pt(s) Unit 1 is starting up following a refueling outage. Given the following sequence of events:

Event #	Event
1	NCS temperature exceeded 140°F during plant heat up.
2	Commenced withdrawing shutdown banks A and B in mode 4.
3	NCS temperature exceeded 350°F.
4	Commenced withdrawing control banks for the reactor startup.

What is the first event that requires the crew to start the CRDM vent fans?

A. Event #1

B. Event #2

C. Event #3

D. Event #4

Distracter Analysis:

A. **Incorrect**: CRDM vent fans must run if Tave is > 350 F or the CRDM is energized.
Plausible: if the candidate believes the fans are necessary to cool the CRDMs as containment temperature increases. In some plants, CRDM vent fans are used to maintain containment temperature low enough for work. The 140°F is a bases for determining loops-filled/not filled for shutdown risk determinations – but it is a limit that will be familiar to the candidates.

B. **Correct**: CRDM vent fans must run if CRDMs are energized.

C. **Incorrect**: The CRDM vent fans must be running prior to entering mode 3 (350°F).
Plausible: if the candidate knows that CRDM vent fans are required >350°F limit but not when CRDMs are energized.

D. **Incorrect**: A caution states the fans must be running if the CRDMs are energized or NCS temperature is above 350 F
Plausible: if the candidate believes the CRDM vent fans must be running for reactor startup and does not know the temperature requirement.

Level: RO Exam

KA: SYS022K4.04 (2.8/3.1)

Lesson Plan Objective: CNT-VV SEQ 7

Source: MOD Ques_805

Level of knowledge: memory

References:
1. OP-CN-CNT-VV page 9
2. OP/1/A/6450/001 page 2
3. Tech Spec Table 1.1-1

K/A SYS022 K4.04: Containment Cooling System - Knowledge of CCS design feature(s) and/or interlock(s) which provide for the following: Cooling of control rod drive motors 2.8/3.1 (CFR: 41.7)

Objective CNT-VV-7: Describe the conditions for which the CRDM Ventilation System is required to be in service.

Bank Question: 806.2 ***Answer: C***

1 Pt(s) Which one of the following conditions will automatically close 1NF-228A (NF Supply Containment Isolation Valve)?

A. Low glycol flow

B. Low refrigerant compressor oil pressure

C. Low-Low glycol expansion tank level

D. Low refrigerant compressor suction pressure

Distracter Analysis:

The NF supply containment isolation (1NF-228A) is located outside containment and closes on:

1. A loss of air or power
2. A St signal.
3. **A Low-Low expansion tank level.**

1NF-228A is controlled from the control room. A key switch is provided on the local NF control panel to allow the Low-Low Expansion Tank Level interlock to be bypassed.

A. **Incorrect**: Will not automatically close 1NF-228A
Plausible: This condition will trip the refrigerant compressor.

B. **Incorrect**: Will not automatically close 1NF-228A
Plausible: This condition will trip the refrigerant compressor.

C. **Correct**:

D. **Incorrect**: Will not automatically close 1NF-228A
Plausible: This condition will trip the refrigerant compressor.

Level: RO Exam

KA: SYS 025 A1.02 (2.5*/2.2*)

Lesson Plan Objective: CNT-NF SEQ 3

Source: MOD Ques_806.1

Level of knowledge: memory

References:

1. OP-CN-CNT-NF pages 12-13

K/A SYS025 A1.02: Ability to predict and/or monitor changes in parameters associated with operating the ice condenser system controls including: Glycol expansion tank level 2.5*/2.2* (CFR: 41.5 / 45.5) OR A3.01 Ability to monitor automatic operation of the ice condenser system, including: Refrigerant System, 3.0*/3.0* (CFR41.7/45.5)

Objective CNT-NF-3: Describe the operation of the ice condenser components and ice condenser refrigeration system during both normal and accident conditions

Bank Question: 816.1 ***Answer: C***

1 Pt(s) Unit 1 was operating at 25% power. Given the following events and conditions:

- 1A CF pump is out of service for maintenance
- 1B CF pump trips
- The crew manually trips the reactor
- Both motor driven CA pumps operate as designed
- The crew manually started the turbine driven CA pump
- The CA control valves have not been reset
- No other actions have been taken regarding the CA system
- The following annunciators are received in the control room:
  - 1AD-5 E/1 (*CA PUMPS TRAIN A LOSS OF NORMAL SUCT)*
  - 1AD-5 E//2 (*CA PUMPS TRAIN B LOSS OF NORMAL SUCT)*

Which one of the following actions will occur?

A. All the CA pumps will trip in 5 seconds.

B. All the CA pumps continue to run – the suctions will shift to RN in 5 seconds.

C. In 5 seconds, the turbine driven CA pump will trip; the suctions for the motor driven CA pumps will then shift to the RN system.

D. The motor driven CA pumps immediately trip; the suction for the turbine driven CA pumps will shift to the RN system in 5 seconds.

Distracter Analysis:

A. **Incorrect**: motor driven CA pumps do not trip
Plausible: if the CA valves had been reset, this would be the correct answer.

B. **Incorrect**: the turbine driven CA pump will trip in 5 seconds because it was manually started
Plausible: if the candidate does not recognize that the loss of suction protection is disabled for manual start

C. **Correct**: the turbine driven pump trips because it was manually started, the suctions for the motor driven pumps shift to RN

D. **Incorrect**: sequence is backwards
Plausible: If the candidate believes the alarm initiates the shift immediately.

Level: RO Exam

KA: SYS 061K6.01(2.5/2.8*)

Lesson Plan Objective: CF-CA 10

Source: Bank Ques_816.1

Level of knowledge: comprehension

References:
1. OP-CN-CF-CA pages 11-12

K/A SYS 061 Auxiliary/Emergency Feedwater K6 Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: K6.01 Controllers and positioners 2.5 2.8* (CFR: 41.7 / 45.7)

Objective CF-CA #10 Describe the operation of CA System Valve Control reset circuitry.

Bank Question: 830.1 ***Answer: B***

1 Pt(s) A reactor startup is being performed in accordance with PT/0/A/4150/019 (*1/M Approach to Criticality*). During the outage Intermediate Range channel N35 is inadvertently under-compensated during detector replacement.

Which one of the following statements correctly describes the expected Intermediate Range response as power is raised from low in the intermediate range to 100% power?

A. N35 will read higher than N36 for the entire intermediate range due to the addition of the gamma flux signal.

B. N35 will read higher than N36 for the first couple of decades but will read approximately the same as N36 when the neutron flux dominates the gamma flux.

C. N35 will read lower than N36 for the entire intermediate range due to the subtraction of gamma flux signal.

D. N35 will read lower than N36 for the first couple of decades but will read approximately the same as N36 when the neutron flux dominates the gamma flux.

Distracter Analysis: Under compensation will result in not enough gamma flux current to offset the gamma interference in the neutron & gamma section of the detector. This cause the channel to read high, but the effect is only really noticeable the first couple (to about 10^{-9} ICA) decades.

A. **Incorrect**: The effect lasts only a couple of decades.
Plausible: Candidate believes the effect is noticeable for the entire span of the IR.

B. **Correct:**

C. **Incorrect**: N35 will read higher for a couple of decades.
Plausible: candidate confuses over/under-compensating effects, and believes it will be noticeable for the entire span of the IR.

D. **Incorrect**: N35 will read higher.
Plausible: candidate confuses over/under-compensating effects

Level: RO Exam

KA: G2.1.32 (3.4/3.8)

Lesson Plan Objective: IC-ENB SEQ 8

Source: Mod Ques_830

Level of knowledge: comprehension

References:
1. OP-CN-IC-ENB page 11
2. PT/0/A/4150/019 pages 3-4

K/A G2.1.32: Ability to explain and apply all system limits and precautions. (CFR: 41.10 / 43.2 / 45.12) IMPORTANCE RO 3.4 SRO 3.8

Objective IC-ENB-8: Describe the effects of "over" and "under" compensation in the Intermediate Range.

Bank Question: 870.1 ***Answer: B***

1 Pt(s) Unit 1 was operating at 67% power. During a loss of RN flow, KC loop temperature is rising.

- Given the following trends on NC Pump 1C:

Time	1200	1205	1210	1215
Motor bearing temp (°F)	179	186	190	195
Lower pump bearing temp (°F)	221	226	229	235
#1 seal outlet temp (°F)	226	230	236	241
Motor winding temp (°F)	295	304	306	310

What is the earliest time at which the NC Pump 1C must be secured?

A. 1200

B. 1205

C. 1210

D. 1215

Distracter Analysis:

NCP Trip criteria:
Any motor bearing temperature > 195°F
Any bearing water exit temperature > 225°F
Seal Outlet temperature > 235°F
Motor winding temperature > 311°F

A. **Incorrect**: NCP must be stopped at 1205
Plausible: If the candidate does not know the trip limits or applies the lower bearing limit to seal water outlet.

B. **Correct**: NCP must be stopped when lower bearing temperature reaches 226 degrees at 1205

C. **Incorrect**: NCP must be stopped at 1205
Plausible: reach the limit for securing NCP on seal outlet temp at 1210

D. **Incorrect**: NCP must be stopped at 1205
Plausible: reach the temperature for stopping NCP on motor bearing at 1215

Level: RO Exam

KA: SYS 002K6.07(2.5/2.8)

Lesson Plan Objective: PS-NCP SEQ 12

Source: Mod Ques_870

Level of knowledge: comprehension

References:
1. OP-CN-PS-NCP pages 7, 10, 14, 16

KA SYS 002 Reactor Coolant System (RCS) K6 Knowledge of the effect or a loss or malfunction on the following RCS components: K6.07 Pumps 2.5 2.8 (CFR: 41.7 / 45.7)

Objective PS-NCP-12: Evaluate NCP operations including:
- When immediate trip of the NCP is required

Bank Question: 912.1 ***Answer: B***

1 Pt(s) Unit 1 was operating at 100%. Given the following events and conditions:

- 0200 - reactor tripped due to a LOCA outside containment
- 0210 – crew enters ECA-1.2, *(LOCA Outside Containment)*
- 0220 – crew enters ECA-1.1, (*Loss of Emergency Coolant Recirc)*
- 0240 – The crew is at the step in ECA-1.1 to determine NC subcooling
  - Current conditions:
    - NCS pressure is 1400 psig
    - 1 NI pump running, indicating 130 gpm
    - 1 NV pump running, indicating 410 gpm
    - Both ND pumps off
    - No NS pumps running
    - Subcooling is 35°F

Which one of the following statements correctly describes the required actions (if any) to establish minimum SI flow?

REFERENCES PROVIDED: ECA-1.1Encl 5 (page 72)

A. Minimum flow required is 380 gpm, stop the running NI pump.

B. Minimum flow required is 408 gpm, stop the running NI pump.

C. Minimum flow required is 442 gpm, neither pump may be secured at this time.

D. Minimum flow required is 494 gpm, neither pump may be secured at this time.

Distracter Analysis:
Time after trip is 40 minutes, graph starts at 10 minutes, flow required is 408 gpm

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

B. **Correct**: required flow is 408 gpm, the NV pump is providing 410 gpm, and the NI pump may be stopped.

C. **Incorrect**: required flow is 408 gpm
Plausible: candidate uses 30 minutes to determine required flow (time since diagnosis of LOCA outside containment)

D. **Incorrect**: required flow is 408 gpm

Plausible: candidate uses 20 minutes to determine required flow (time since procedure entry)

Level: RO Exam

KA: W/E04 EK2.2 (3.8/4.0)

Lesson Plan Objective: EP-EP2 SEQ 29

Source: NRC McGuire exam 2002; Ques_912

Level of knowledge: analysis

References:
1. ECA-1.1 step 18 and Encl 5 - PROVIDED

K/A W/E04 EK2.2: Knowledge of the interrelations between the (LOCA Outside Containment) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. IMPORTANCE RO 3.8 SRO 4.0 (CFR: 41.7 / 45.7)

Objective EP-EP2-29: Given a set of specific plant conditions and all required procedures, use the rules of usage and outstanding PPRBs to identify the correct procedure flowpath.

Bank Question: 926 ***Answer: B***

1 Pt(s) Unit 2 is conducting a plant startup at 6% power. Given the following events and conditions:

- Intermediate range channel N-35 begins to operate erratically.
- Rod motion was stopped.
- A troubleshooting plan is implemented.
- The N-35 channel "LEVEL TRIP" switch is in "BYPASS".

Which one of the following statements correctly describes the N-35 fuses (if any) that can be removed without resulting in a reactor trip?

A. Control power fuses only

B. Instrument power fuses only

C. None of the fuses can be removed

D. Either the instrument power or control power fuses but not both at the same time

---

Distracter Analysis:

A. **Incorrect**: Only the instrument power fuses can be pulled.
Plausible: candidate confuses which set of fuses can be removed while in BYPASS.

B. **Correct**: in BYPASS, trip signals due to removal of instrument power fuses will not result in a reactor trip.

C. **Incorrect**: Only the instrument power fuses can be pulled.
Plausible: candidate assumes a trip will occur regardless of being in BYPASS.

D. **Incorrect**: Only the instrument power fuses can be pulled.
Plausible: candidate assumes BYPASS blocks trips from either sets of fuses.

Level: RO Exam

KA: APE 033AA1.02 (3.0/3.1)

Lesson Plan Objective: IC-ENB SEQ 6/9

Source: Bank Ques_926

Level of knowledge: memory

References:
1. OP-CN-IC-ENB pages 14-15

K/A APE 033 AA1.02: Ability to operate and / or monitor the following as they apply to the Loss of Intermediate Range Nuclear Instrumentation: Level trip bypass 3.0/3.1 (CFR 41.7 / 45.5 / 45.6)

Objective IC-ENB-6/9:
6 Explain the function of all indications and controls associated with ENB.
9 Describe the plant response to a given detector or instrument failure.

Bank Question: 945.1 ***Answer: A***

1 Pt(s) Which one of the following statements correctly describes the effect (if any) that time in core life has on the pressure transient associated with the design basis ATWS event?

A. **NCS pressure increase will be more rapid at BOL than at EOL because the moderator temperature coefficient is more negative at EOL.**

B. **NCS pressure increase will be more rapid at EOL than at BOL because the moderator temperature coefficient is more negative at EOL.**

C. **NCS pressure increase will be more rapid at BOL than at EOL because the moderator temperature coefficient is less negative at EOL.**

D. **NCS pressure increase will be more rapid at EOL than at BOL because the moderator temperature coefficient is less negative at EOL.**

Distracter Analysis: For a given amount of positive reactivity, the negative reactivity from the temperature increase of the reactor coolant is = MTC * ΔT. This negative reactivity will offset the positive reactivity from the rods and maintain the core in a critical state (but not super-critical). If MTC is small, the rise in ΔT must be proportionately greater. As a result, the NC system temperatures and pressures will be greater for an ATWS at BOL when MTC is at a minimum.

A. **Correct**: small MTC at BOL will lead to a larger temperature increase, which results in a more rapid NCS pressure rise at BOL.

B. **Incorrect**: the pressure transient is larger at BOL.
Plausible: candidate reverses the effect of MTC.

C. **Incorrect**: MTC is more negative not less negative at EOL
Plausible: Partially correct – the pressure rise is more rapid at BOL. The candidate could reverse the changes in MTC between BOL and EOL.

D. **Incorrect**: the pressure transient is larger at BOL, MTC is more negative at EOL.
Plausible: If the candidate reverses the logic.

Level: RO Exam

KA: EPE 029 EK1.01 (2.8/3.1)

Lesson Plan Objective: none

Source: MOD Ques_945

Level of knowledge: comprehension

References:
1. OP-CN-EP-FRS pages 1-7
2. FR-S1 Bases Document page 11

KA EPE 029 Anticipated Transient w/o Scram EK1.01 Reactor nucleonics and thermo-hydraulics behavior 2.8 3.1

Objective: none

Bank Question: 1136 ***Answer: B***

1 Pt(s) Unit 1 is operating at 83% power. Given the following events and conditions:

- A loss of offsite power occurs.
- The reactor trip breakers open
- Control rod H-8 is stuck at 17 steps.
- One turbine stop valve is not closed.
- All other systems have responded normally to the event.

Which of the following is the first reactor operator immediate action required for these conditions?

A. Insert control rod H-8

B. Trip the reactor

C. Runback the main turbine

D. Close the MSIVs and MSIV bypass valves

Distracter Analysis:

A. **Incorrect**: Can't insert the rod with the reactor trip breakers open.
Plausible: The first immediate action in FR-S-1 is to manually insert rods.

B. **Correct**: The first required action is to manually trip the reactor.

C. **Incorrect**: The first required action is to trip the reactor.
Plausible: This would be the first required action after the reactor trip. If the candidate did not think a reactor trip was required for a single stuck rod – stuck low in the core.

D. **Incorrect**: The first required action is to trip the reactor.
Plausible: This action is required only if the stop valve cannot be closed through manual trip or turbine runback.

Level: RO Exam

KA: EPE 007EA2.02 (4.3/4.6)

Lesson Plan Objective: EP-EP1 SEQ 7

Source: New

Level of knowledge: memory

References:
1. EP/1/A/5000/E-0 pages 4-5

K/A EPE 007EA2.02: Reactor Trip – EA2.02 Ability to determine or interpret the following as they apply to a reactor trip: Proper actions to be taken if the automatic safety functions have not taken place 4.3/4.6 (CFR 41.7 / 45.5 / 45.6)

Objective EP-EP1 SEQ 7: State from memory the Immediate Actions of EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).

Bank Question: 1138 ***Answer: C***

1 Pt(s) Unit 1 was operating at 100% when a total loss of instrument air occurred. Given the following events and conditions:

- When the instrument air header depressurized, a total loss of feedwater occurred.
- The operators tripped the reactor and completed E-0 (*Reactor Trip or Safety Injection*).
- The operators transitioned to FR-H.1 (*Respond to a Loss of Secondary Heat Sink*).
- Step 22 of FR-H.1 requires opening the PZR PORVs.

Which one of the following statements correctly describes:
1. The motive force to open the PZR PORVs, and
2. The correct EOP bases for step 22 of FR-H.1?

A. 1. Air pressure comes from dedicated accumulators
2. PORVs are required to respond to NC system pressure changes and provide a bleed and feed path.

B. 1. Air pressure comes from dedicated accumulators
2. PORVs are required for depressurizing the NC system to protect the S/G tubes from creep failure.

C. 1. N_2 pressure comes from the cold leg accumulators
2. PORVs are required to respond to NC system pressure changes and provide a bleed and feed path.

D. 1. N_2 pressure comes from the cold leg accumulators
2. PORVs are required for depressurizing the NC system to protect the S/G tubes from creep failure.

Distracter Analysis:

A. **Incorrect**: N2 pressure comes from the CLAs not dedicated accumulators.
Plausible: Partially correct – the reason for requiring the PORVs to be operable in FR-H.1 is correct. All other safety related AOVs in containment that require a backup supply to VI use a dedicated N2 accumulator (e.g. all CA control valves)

B. **Incorrect**: N2 pressure comes from the CLAs.

Plausible: S/G PORVs use dedicated accumulators with air pressure inside (bottles) as backup opening force. All other safety related AOVs in containment that require a backup supply to VI use a dedicated N2 accumulator (e.g. all CA valves) – but not the PORVs

C. **Correct**:

D. **Incorrect**: PORV(s) must be available for feed and bleed in FR-H.1.
Plausible: Partially correct – the N2 pressure comes from the CLAs.

Level: RO Exam

KA: APE 065AK3.08 (3.7/3.9)

Lesson Plan Objective: SS-VI SEQ 5/28

Source: New

Level of knowledge: memory

References:
1. FR-H.1 page 25-26
2. OP-CN-SS-VI pages 19-20
3. FR-H.1 Bases step 22 page 35

K/A APE 065AK3.08: Loss of Instrument Air - Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: Actions contained in EOP for loss of instrument air. 3.7/3.9 (CFR 41.5,41.10 / 45.6 / 45.13)

Objective SS-VI-5/28: 5. Identify the major components served by the Instrument Air system and describe the effect on plant operations on a loss of Instrument Air
28. Discuss the actions of the Loss of VI AP/0/A/5500/22

Bank Question: 1139 ***Answer: D***

1 Pt(s) Unit 1 is responding to a loss of all feedwater event at 100% power. Given the following events and conditions:

- The crew is implementing FR-H.1 (*Response to Loss of Secondary Heat Sink)*
- NCS pressure is 2335 psig
- Incore thermocouples indicate 545 °F
- Step 18 of FR-H.1 requires operator to "*Perform Steps 19 through 23 quickly ... by NC bleed and feed.*"

Which one of the following statements describes the correct action, time requirement and bases for initiating bleed and feed?

A. The crew must have bleed and feed in service through at least one PORV within 8 minutes to prevent damage to the NV pumps by deadheading.

B. The crew must have bleed and feed in service through at least one PORV within 8 minutes of meeting the initiation criteria to assure enough flow to remove decay heat.

C. The crew must have bleed and feed in service through at least two PORVs within 4 minutes to prevent damage to the NV pumps by deadheading.

D. The crew must have bleed and feed in service through at least two PORVs within 4 minutes of meeting the initiation criteria to assure enough flow to remove decay heat.

Distracter Analysis:

A. **Incorrect**: Two PORVs must be open in 4 minutes.
Plausible: This is the right justification and the action must be completed within 8 minutes the plant trip.

B. **Incorrect**: Two PORVs must be opened in 4 minutes, and the NV pumps are not deadheaded.
Plausible: The action must be completed within 8 minutes the plant trip, and deadheading is a concern for centrifugal pumps.

C. **Incorrect**: The NV pumps are not deadheaded.
Plausible: This is the correct action and deadheading is a concern for centrifugal pumps.

D. Correct:

Level: RO Exam

KA: W/E05 EA2.2 (3.7/4.3)

Lesson Plan Objective: EP-FRH SEQ 4

Source: New

Level of knowledge: memory

References:
1. FR-H.1 page 23
2. ERG Bkgd Document pages FR-H.1 19, 24-25

K/A W/E05 EA2: Ability to determine and interpret the following as they apply to the (Loss of Secondary Heat Sink) Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. IMPORTANCE RO 3.7 SRO 4.3 (CFR: 43.5 / 45.13

Objective EP-FRH-4: Explain the Bases for all steps in each of Function Restoration procedures EP/1/A/5000/FR-H Series - Heat Sink

Bank Question: 1140 ***Answer: C***

1 Pt(s) Unit 1 was operating at 96% power. Given the following events and conditions:

- 1NV-309 (*Seal Water Injection Flow*) failed shut.
- The operators entered AP/1/A/5500/12 Case I (*Loss of Charging*).
- They transitioned to Case II to place excess letdown in service.
- Enclosure 4.12 to OP/1/A/6200/001(*Establishing/Securing Excess Letdown*) contains a requirement to initially limit the opening of 1NV-124B (*Excess Letdn Press Ctrl*) to 6%.

Which one of the following statements correctly characterizes the reason for this procedural limitation?

A. To prevent thermal shock of the VCT thermal sleeve during initiation of excess letdown flow.

B. To minimize any change in VCT boron concentration caused by the initiation of flow through the excess letdown piping.

C. To prevent thermal shock of the excess letdown heat exchanger during initiation of excess letdown flow.

D. To minimize the backpressure fluctuation on the NCP seals, and prevent water hammer in the piping to the VCT.

Distracter Analysis:

A. **Incorrect**: - the concern is thermal shock of the heat exchanger.
Plausible: - thermal sleeve shock is a concern for many NCS components.

B. **Incorrect**: - the concern is thermal shock of the heat exchanger.
Plausible: - there could be a difference in boron concentration between the VCT and excess letdown piping.

C. **Correct answer**

D. **Incorrect:** - the concern is thermal shock of the heat exchanger.
Plausible: - the excess letdown flow does affect the NCP seal backpressure. Water hammer is a concern in many systems.

Level: RO Exam

KA: APE 022AK3.02 (3.5/3.8)

Lesson Plan Objective: PS-NV SEQ 8

Source: New

Level of knowledge: memory

References:
1. AP/1/A/5500/12 page 13
2. OP/1/A/6200/001 Encl 4.12 page 2

K/A APE 022AK3.02: Knowledge of the reasons for the following responses as they apply to the Loss of Reactor Coolant Pump Makeup: Actions contained in SOPs and EOPs for RCPs, loss of makeup, loss of charging, and abnormal charging 3.5/3.8 (CFR 41.5,41.10 / 45.6 / 45.13)

Objective PS-NV SEQ 8: Describe the operation and flowpath of NV excess letdown.

Bank Question: 1141 ***Answer: C***

1 Pt(s) Unit 1 is responding to a LOCA inside containment. Given the following conditions:

- Reactor trip and safety injection actuated
- Containment pressure peaked at 3.2 psig
- FWST level dropped to 41%

Which one of the following statements correctly describes the basis for the automatic alignment of the KC system?

A. Safety injection actuation isolates the non-essential KC headers to maximize cooling to the essential loads.

B. Phase B actuation isolates the non-essential KC headers to maximize cooling to the essential loads.

C. Phase B actuation isolates the non-essential KC headers to prevent KC pump run-out.

D. Safety injection actuation isolates the non-essential KC headers to prevent KC pump run-out.

Distracter Analysis:

A. **Incorrect**: The realignment is by Phase B and for run-out protection.
Plausible: Safety injection with FWST level <37% isolates the non-essential headers and maximizing cooling to essential loads would be advantageous.

B. **Incorrect**: The realignment is for run-out protection.
Plausible: Maximizing cooling to essential loads would be advantageous.

C. **Correct**:

D. **Incorrect**: The realignment is by Phase B actuation.
Plausible: Safety injection with FWST level <37% isolates the non-essential headers.

Level: RO Exam

KA: APE 026AK3.02 (3.6/3.9)

Lesson Plan Objective: PSS-KC SEQ 4

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-PSS-KC pages 9 and 17

K/A APE 026AK3.02: Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: The automatic actions (alignments) within the CCWS resulting from the actuation of the ESFAS 3.6/3.9 (CFR 41.5,41.10 / 45.6 / 45.13)

Objective PSS-KC-4: Explain what happens in the KC System during:
- Safety Injection (Ss)
- Phase A Containment Isolation (St)
- Phase B Containment Isolation (Sp)

Bank Question: 1142 ***Answer: D***

1 Pt(s) Unit 1 is operating at 50% power. Given the following events and conditions:

- Annunciator 1AD-6 B/7 *(PZR LIQUID HI TEMP)* alarms
- Pressurizer liquid temperature reads 668 °F
- WR NC pressure reads 2208 psig
- Pressurizer backup heaters are on
- Pressurizer spray valves are closed
- Pressurizer level reads 40%.

REFERENCES PROVIDED: Steam Tables

Which one of the following statements correctly describes the cause of the alarm, and any required actions?

A. The PZR pressure controller has failed; take manual control of the controller.

B. The PZR pressure controller has failed; secure all PZR heaters and initiate spray.

C. The PZR temperature instrument has failed; secure the PZR backup heaters.

D. The PZR temperature instrument has failed; no action is required.

Distracter Analysis: A 668 °F PZR temperature would have lifted PORV's (Saturation pressure = 2484psig).

A. **Incorrect**: The PZR temperature instrument has failed. Manual control is unnecessary.
Plausible: A pressure controller failure could cause this alarm. Switching to manual control is a normal operator expectation.

B. **Incorrect**: The PZR temperature instrument has failed. These actions exacerbate the below normal pressure condition.
Plausible: A pressure controller failure could cause this alarm. These are immediate actions for this ARP.

C. **Incorrect**: The B/U heaters are needed to recover PZR pressure.
Plausible: This is an immediate action for this ARP.

D. **Correct**:

Level: RO Exam

KA: APE 027AK1.01 (3.1/3.4)

Lesson Plan Objective: PS-ILE SEQ 8/9

Source: New

Level of knowledge: analysis

References:
1. OP/1/B/6100/010G 1AD-6 B/7 page 24
2. OP-CN-PS-IPE page 23

K/A APE 027AK1.01: Knowledge of the operational implications of the following concepts as they apply to Pressurizer Pressure Control Malfunctions: Definition of saturation temperature 3.1/3.4 (CFR 41.8 / 41.10 / 45.3)

Objective PS-IPE-8/9:

8: List the nominal value for the alarms and control functions generated by the pressurizer pressure master controller, assuming the controller is set for 2235 psig

9: Describe all alarms, control functions, and interlocks which are generated by pressurizer pressure but not controlled by the master controller, including setpoint and pressure channel

Bank Question: 1144 ***Answer: D***

1 Pt(s) Unit 1 was operating at 100 % power. Given the following events and conditions:

- A runback causes a power reduction to 81%.
- Control rod H-8 in bank D failed to move with the rest of the bank.
- Rod control urgent failure alarm has NOT actuated
- 1AD-2 B/3 *(COMPARATOR P/R CHANNEL DEVIATION)* is lit
- Bank D is at 210 steps
- Rod H-8 in bank D is at 228 steps

Which one of the following statements correctly describes the crew's immediate actions, and the reason for the requirement to realignment rod H-8 within one hour?

A. Turbine power is held constant and reactor power is adjusted to match to the turbine. The core is in an unanalyzed condition and the safety analysis will be invalidated.

B. Reactor power is held constant and the turbine is adjusted to match reactor power. The core is in an unanalyzed condition and the safety analysis will be invalidated.

C. Turbine power is held constant and reactor power is adjusted to match to the turbine. Local xenon redistribution may become significant, causing excessive power peaking and DNBR will be degraded.

D. Reactor power is held constant and the turbine is adjusted to match reactor power. Local xenon redistribution may potentially cause power peaking and DNBR degradation.

Distracter Analysis: Note: an alternative distracter if A and B (safety analysis) is too close: **Shutdown margin will be significantly diminished and may not be sufficient early in core life.**

A. **Incorrect**: Reactor power is held constant. The concern is xenon peaking.
Plausible: Raising turbine power could be construed as non-conservative. The unanalyzed condition is the reason for the rod bank alignment TS, as opposed to the reason for the short action

statement. The core is analyzed for a single most reactive rod being stuck in the worst position.

B. **Incorrect**: The concern is xenon peaking.
Plausible: The unanalyzed condition is the reason for the rod bank alignment TS, as opposed to the reason for the short action statement. The core is analyzed for a single most reactive rod being stuck in the worst position.

C. **Incorrect**: Reactor power is held constant.
Plausible: Raising turbine power could be construed as non-conservative.

D. **Correct answer**

Level: RO Exam

KA: APE 005AK1.04 (3.0*/3.4*)

Lesson Plan Objective: IC-IRE SEQ 19/20

Source: New

Level of knowledge: memory

References:
1. AP/14 page 2
2. Tech Spec 3.1.4
3. TS Bases page B3.1.4-5

K/A APE 005AK1.04: Knowledge of the operational implications of the following concepts as they apply to Inoperable / Stuck Control Rod: Definitions of axial imbalance, neutron error, power demand, actual power tracking mode, ICS tracking 3.0*/3.4* (CFR 41.8 / 41.10 / 45.3)

Objective IC-IRE: 19 Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.

20 State from memory, the immediate actions required per AP/1/A/5500/14Control Rod Misalignment.

Bank Question: 1146 ***Answer: C***

1 Pt(s) Unit 1 is operating at 97% power when a reactor trip occurred. Given the following conditions:

Channel	Flux Level	SUR
PR N44	0 %	
PR N43	11%	
PR N42	0 %	
PR N41	12%	
IR N36	$9x10^{-11}$	-1/3 DPM
IR N35	$5x10^{-11}$	-1/3 DPM
SR N32	0 CPS	0 DPM
SR N31	0 CPS	0 DPM

Which one of the following statements correctly describes why the source range instruments are not indicating?

A. P-6 (*S/R Block Permissive*) status light is DARK.

B. Loss of power to bus 1ERPD.

C. P-10 (*Nuclear at Power*) status light is LIT.

D. Loss of power to bus 1ERPB.

Distracter Analysis:

A. **Incorrect**: 3 of 4 power range channels must be < 10% to auto-unblock SR NIs. Both intermediate range channels are below P6 at $1x10^{-10}$. When the P-6 permissive is DARK, the source range block permissive is removed and source range NIs will normally be energized. The P-10 permissive prevents this normal operation.
Plausible: If the candidate thinks that intermediate range NIs are not below P-6 or does not recognize that 3 of 4 power range channels must be < 10%.

B. **Incorrect**: Loss of 1ERPD does not affect source range.
Plausible: Loss of 1ERPD would cause N44 to read zero power. If the candidate thinks that loss of 1ERPD can deenergize P-10, and reverses the effect of P-10 on loss of power.

C. **Correct**: 3 of 4 power range channels must be < 10% to auto-unblock SR NIs. NI-43 and NI-41 are still above "NOT P-10".

D. **Incorrect**: Loss of 1ERPB would cause only N42 to read zero.

Plausible: If the candidate thinks that loss of 1ERPB can deenergize P-10, and reverses the effect of P-10 on loss of power.

Level: RO Exam

KA: APE 032AA2.05 (2.9*/3.2*)

Lesson Plan Objective: IC-ENB SEQ 6

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-IC-ENB page 10, 25, 41
2. OP-CN-IC-IPX page 37

K/A APE 032 AA2.05: Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Nature of abnormality, from rapid survey of control room data 2.9*/3.2* (CFR: 43.5 / 45.13)

Objective IC-ENB-6: Explain the function of all indications and controls associated with ENB.

Bank Question: 1147 ***Answer: D***

1 Pt(s) Unit 2 is operating at 93% power. Given the following events and conditions:

- There is a 10 gpm tube leak in steam generator (S/G) 2C.
- 2EMF-33 (Condenser Air Ejector Exhaust) Trip 2 alarms.

Which one of the following statements correctly describes the most sensitive EMF indication to identify the affected S/G and the type of activity monitored by that EMF?

A. 2EMF- 12 (*Steamline C*) monitors primarily N16 gamma emissions

B. 2EMF- 12 (*Steamline C*) monitors primarily gaseous activity emissions

C. 2EMF-34 (L) (*S/G Sample (Low Range)*) monitors primarily beta-gamma activity

D. 2EMF-73 (*S/G C Leakage*) monitors primarily N16 gamma emissions

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Distracter Analysis: 10 gpm is high enough to be detected by 2EMF-73 but low enough to not be detected by 2EMF-12.

A. **Incorrect**: 2EMF-12 does not primarily monitor N16 gamma flux.
Plausible: N16 gamma flux is the most sensitive indication of primary to secondary leakage at high power levels.

B. **Incorrect**: 2EMF-12 is not as sensitive as 2EMF-73 and alarms at higher levels of activity.
Plausible: If the candidate does not understand that 2EMF-73is far more sensitive to tube leak indications. This is also true at low power levels where 2EMF-73 is inaccurate.

C. **Incorrect**: 2EMF-34 is isolated by 2EMF-33 trip 2 actuation. 2EMF-34 does not monitor β activity.
Plausible: If the candidate disregards the 2EMF-33 actions.

D. **Correct**:

Level: RO Exam

KA: APE 061AK1.01 (2.5*/2.9)

Lesson Plan Objective: STM-SM SEQ 28

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-STM-SM pages 13-14
1. E-3 page 2

K/A APE 061 AK1.01: Knowledge of the operational implications of the following concepts as they apply to Area Radiation Monitoring (ARM) System Alarms: Detector limitations 2.5*/ 2.9? CFR 41.8 / 41.10 / 45.3)

Objective STM-SM-28: Describe the operation of the following radiation monitors associated with:
- Unit 1 Steam Line EMF26, 27, 28, 29
- Unit 2 Steam Line EMF10, 11, 12, 13
- Unit 1 Steam Line N16 Monitors 1EMF71, 72, 73, 74
- Unit 2 Steam Line N16 Monitors 2EMF71, 72, 73, 74

Bank Question: 1148.1 ***Answer: A***

1 Pt(s) Unit 1 was in mode 3 when a steam generator over pressure event occurred.
Given the following events and conditions:

- The crew has entered FR-H.2 (*Response to S/G Overpressure*).
- The 1B S/G pressure has reached 1235 psig and 99% NR level.
- The 1A, 1C and 1D S/G pressures are all 850 psig and 50% NR level.
- All feedwater isolation status lights are DARK.

Which one of the following statements correctly describes:
1. The **first** correct action to be taken, and
2. The reason for this action?

A. 1. Manually isolate feedwater to the 1B S/G
2. To prevent feedwater from over pressurizing the S/G

B. 1. Open the PORV on the 1B S/G
2. To immediately reduce pressure in the 1B S/G

C. 1. Dump steam from the 1B S/G to CA pump #1
2. To immediately reduce pressure in the 1B S/G

D. 1. Dump steam from the 1A, 1C and 1D S/Gs
2. To reduce NC system temperature and reduce pressure in the 1B S/G

Distracter Analysis:

A. **Correct**: The first action is to isolate feed to the 1B S/G

B. **Incorrect**: Opening the PORV to the 1B S/G is the second action to be taken. With S/G level > 92%, this action will not be accomplished because the operator will transition to FR-H.3 (*Response to S/G High Level*)
Plausible: If the candidate thinks that the quickest way to relieve pressure on the 1B S/G is to open the PORV.

C. **Incorrect**: With S/G level > 92%, this action will not be accomplished because the operator will transition to FR-H.3 (*Response to S/G High Level*)
Plausible: Dumping steam to the CA pump turbine will rapidly relieve pressure on the S/G. The CA pump turbine is extremely strong and can take slugs of water. The candidate may think that opening the PORV might cause problems.

D. **Incorrect**: Cooling down the NC system is not a major action or an effective way of reducing pressure.
Plausible: Cooling down the NC will reduce steam temperature in the 1B S/G which would reduce pressure.

Level: RO Exam

KA: W/E13 EK3.3 (3.2/3.4)

Lesson Plan Objective: EP-FRH SEQ 3; STM-SM SEQ 24

Source: New

Level of knowledge: comprehension

References:
1. FR-H.2 page 2-3
2. OP-CN-STM-SM page 17
3. FR-H.2 ERG Basis Document page 5
4. OP-CN-EP-FRH page 8
5. F-0 page 6

K/A W/E 13 EK3.3: Knowledge of the reasons for the following responses as they apply to the (Steam Generator Overpressure) Manipulation of controls required to obtain desired operating results during abnormal, and emergency situations. IMPORTANCE RO 3.2 SRO 3.4 (CFR: 41.5 / 41.10, 45.6, 45.13)

Objective: EP-FRH-3 Explain the Bases for all steps in each of Function Restoration procedures EP/1/A/5000/FR-H Series - Heat Sink
STM-SM-24 Discuss S/G overfill including:
- The conditions that could result in S/G overfill
- The potential consequences of S/G overfill
- Automatic actions that could preclude overfill

Bank Question: 1149 ***Answer: C***

1 Pt(s) Unit 1 is operating at 100% power when a spurious main steam isolation occurred. Given the following events and conditions:

- All 4 MSIVs closed
- S/G 1B faulted when the steam header failed inside containment
- S/G 1C faulted when one code safety valve opened and failed to reseat
- NS pump 1B did not start
- All other systems responded normally
- Containment temperature is 150°F
- Containment sump level is 2.5 feet
- Containment pressure is 3.5 psig, decreasing slowly
- Nominal T_{hot} is 250 °F
- Nominal T_{cold} is 245 °F, increasing slowly
- PZR level is 30%, increasing
- PZR pressure is 1700 psig, increasing

When the crew completes E-0 (*Reactor Trip*) what is the correct procedure transition to address this event?

A. **Enter ES-1.1 (*Safety Injection Termination)***

B. **Enter E-2 (*Faulted Steam Generator Isolation)***

C. **Enter FR-P.1 (*Response to Imminent Pressurized Thermal Shock).***

D. **Enter FR-Z.1 (*Response to High Containment Pressure).***

Distracter Analysis:

A. **Incorrect**: Must enter FR-P.1 on an orange path.
Plausible: If the candidate thinks E-2 was completed in E-0 and ignores/misreads F-0, this is the ultimate success path for this event.

B. **Incorrect**: Must enter FR-P.1 on an orange path.
Plausible: If the candidate ignores F-0 conditions this is the proper initial transition.

C. **Correct**:

D. **Incorrect**: Must enter FR-P.1 on an orange path. The conditions are not appropriate for an orange path on FR-P.1 – only a yellow path.
Plausible: If the candidate misreads the color or misunderstands the priority scheme, there is a yellow path to FR-Z.2.

Level: RO Exam

KA: W/E08 EA2.1 (3.4/4.2)

Lesson Plan Objective: EP-FRP SEQ 5

Source: New

Level of knowledge: comprehension

References:
1. EP/1/A/5000/F-0 pages 7-9
2. OP-CN-STM-SM page 18

K/A W/E08 EA2.1: Ability to determine and interpret the following as they apply to the (Pressurized Thermal Shock) Facility conditions and selection of appropriate procedures during abnormal and emergency operations. IMPORTANCE RO 3.4 SRO 4.2 (CFR: 43.5 / 45.13)

Objective EP-FRP-5: Given a set of specific plant conditions and required procedures, apply the rules of usage and outstanding PPRBs to identify the correct procedure flowpath and necessary actions

Bank Question: 1150 ***Answer: A***

1 Pt(s) Unit 1 is in a refueling outage and Unit 2 is operating at full power. Given the following conditions:

- VI has been manually isolated from VS due to high demand.
- The `A' VS compressor is aligned for base load service.
- The 'B' VS compressor is in standby.
- The SRO directs you to shift to the `B' VS compressor for base load service.

Which one of the following steps are the complete set of actions and control locations that will accomplish this task?

A.
1. Turn the both VS compressor mode select switches to OFF
2. Select the `B' VS compressor for base loading on the `A' VS compressor control panel
3. Turn the `B' VS compressor mode select switch to AUTO
4. Start the `B' compressor

B.
1. Start the `B' VS compressor
2. Select the `B' VS compressor for base loading on the `A' VS compressor control panel
3. Turn the `B' VS compressor mode select switch to AUTO
4. Turn the 'A' VS compressor mode select switch to OFF

C.
1. Turn the `B' VS compressor mode select switch to OFF
2. Select the `B' VS compressor for base loading on the `B' VS compressor control panel
3. Turn the `B' VS compressor mode select switch to AUTO
4. Turn the `A' VS compressor mode select switch to OFF

D.
1. Turn the `B' VS compressor mode select switch to AUTO
2. Select the `B' VS compressor for base loading on the `B' VS compressor control panel
3. Turn the `A' VS compressor mode select switch to OFF
4. Start the 'B' VS compressor

Distracter Analysis:

A. **Correct**:
B. **Incorrect**: The B compressor must be turned OFF first.

Plausible: If the candidate does not understand the control system it is reasonable not to secure both compressors. This is the correct location of the base load select switch.

C. **Incorrect**: Both VS compressors must first be stopped. The base load select switch is on the A control panel. The 'B' VS compressor must be started after all controls are aligned.
Plausible: If the candidate thinks that each compressor has a base load select switch and does not understand the starting sequence.

D. **Incorrect**: Both compressors must be turned OFF first and the base load select switch is on the A control panel.
Plausible: If the candidate does not understand the control system it is reasonable not to secure both compressors.

Level: RO Exam

KA: SYS 079G2.1.30 (3.9/3.4)

Lesson Plan Objective: None

Source: New

Level of knowledge: memory

References:
1. OP-CN-SS-VI page 23
2. OP/0/A/6450/013 Encl 4.3

K/A SYS 079G2.1.30: Station Air - Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)

Objective: None.

QUESTION DELETED.

Bank Question: 1154 ***Answer: B***

1 Pt(s) Unit 1 is operating at full power and Unit 2 is refueling. The 'C' waste decay tank is being released in accordance with an approved gaseous waste release permit.

Which one of the following alarms are valid indications that the release control valve 1WG-160 has closed to terminate the release?

A. 1RAD-1; B/3 (EMF-41 Aux Bldg Vent Hi Rad) alarms.

B. 1RAD-1; F/3 (EMF-50 Waste Gas Disch Loss of flow) alarms.

C. 1RAD-2; A/2 (1EMF 36 Unit Vent Gas Hi Rad) alarms.

D. 1RAD-2;D/5 (1EMF 35/36/37 Unit Vent Loss of Flow) alarms.

Distracter Analysis: When 1WG-160 closes due to EMF-50 trip 2 alarm, it cuts off flow to EMF-50 causing a low flow alarm.

A. **Incorrect**: 1WG-160 closing does not affect EMF-41.
Plausible: EMF-41 monitors the waste gas areas for radiation.

B. **Correct**:

C. **Incorrect**: This alarm does not confirm that 1WG-160 closed.
Plausible: EMF-36 provides a trip signal to close 1WG-160.

D. **Incorrect**: 1WG-160 closing does not affect unit vent flow.
Plausible: If the candidate confuses EMF-50 and EMF-36. EMF 35/36/37 provide trip signals to 1WG-160.

Level: RO Exam

KA: SYS 071A4.05 (2.6*/2.6*)

Lesson Plan Objective: WE-WG SEQ 4

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-WE-WG page 6
2. OP/1/B/6100/010X 1RAD-1; F/3 - 1RAD-2 A/2 - 1RAD-2 D/5 - 1RAD-2 C/4 - 1RAD-1 B/3

QUESTION DELETED

QUESTION DELETED

K/A SYS 071A4.05: Ability to manually operate and/or monitor in the control room: Waste gas decay tanks, including valves, indicators and sample lines. 2.6*/2.6* (CFR: 41.7 / 45.5 to 45.8)

Objective WE-WG-4: Describe the automatic action associated with the following EMFs related to termination of a waste gas release:

- WG Disch Monitor (EMF 50)
- Unit Vent Particulate Monitor (EMF-35)
- Unit Vent Gaseous Monitor (EMF-36)
- Unit Vent Iodine Monitor (EMF-37)

QUESTION DELETED

Bank Question: 1155.1 ***Answer: B***

1 Pt(s) Unit 1 is at 5% power preparing for a power increase following a refueling outage. Given the following events and conditions:

- The 1B ND pump has been red tagged to repair a packing leak. Estimated time of completion is 10 hours.
- Maintenance is scheduled to perform PMs to verify the limit switches for 1NI-173A (*ND TRN 1A HDR to COLD LEG ISOL*). Estimated time to complete this work is 30 minutes.
- The work order specifies 1NI-173A shall be red tagged shut.
- The SWM requests approval to tag-out 1NI-173A to perform the work.

Which one of the following statements correctly describes the operating restrictions and implications of tagging 1NI-173A?

A. 1NI-173A may be tagged out because it does not affect the operability of the ND A train.

B. 1NI-173A may not be tagged out because this would make both trains of ECCS inoperable.

C. 1NI-173A may be tagged out for up to one hour during entry into Tech Spec 3.0.3.

D. 1NI-173A may not be tagged out, but the valve can be cycled closed for valve testing for up to 2 hours.

Distracter Analysis:

A. **Incorrect**: Both trains of ND safety injection will be inoperable.
Plausible: If the candidate does not recognize that 1NI-173A disables the ND A train.

B. **Correct**: NI-173 isolates A-train flow and prevents B-train ND flow to all 4 loops. Both trains of ECCS would be inoperable.

C. **Incorrect**: The crew cannot deliberately enter Tech Spec 3.0.3 to conduct maintenance.
Plausible: Tech Spec 3.0.3 allows 1 hour to correct the condition before commencing a shutdown. Time to complete work is only 30 minutes.

D. **Incorrect**: Both trains of safety injection will be inoperable.
Plausible: Cycling valves for testing is allowed under some circumstances.

Level: RO Exam

KA: G2.2.24 (2.6/3.8)

Lesson Plan Objective: PS-ND SEQ 10

Source: New

Level of knowledge: comprehension

References:
1. Tech Spec & Bases 3.5.2
2. OP-CN-PS-ND page 12
3. Tech Spec 3.0.3

K/A G2.2.24: Ability to analyze the affect of maintenance activities on LCO status. (CFR: 43.2 / 45.13) IMPORTANCE RO 2.6 SRO 3.8

Objective PS-ND-10: Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.

Bank Question: 1158 ***Answer: B***

1 Pt(s) Unit 1 is operating at 77% power. Given the following events and conditions:

- CA pump 1A is out of service
- A tube rupture occurs in the 1B S/G
- The crew is isolating the 1B S/G in E-3 *(Steam Generator Tube Rupture)*
- At Step 4.b of E-3, the steam supply valve(s) to the CAPT is (are) isolated.

Which one of the following statements correctly describes the required action if the SRO dispatches operators to the auxiliary building to isolate the CAPT steam supply?

A. 1SA-1 (*Main Steam 1B to CAPT Maint Isol*) is closed in Room 227.

B. 1SA-3 (*S/G 1B SM to CAPT Stop Check*) is closed in Room 217.

C. 1SA-1 and 1SA-4 (*Main Steam 1C to CAPT Main Isol*) are closed in Room 227.

D. 1SA-3 and 1SA-6 (*S/G 1C SM to CAPT Stop Check*) are closed in Room 217.

Distracter Analysis:

A. **Incorrect**: SA-1 is in the doghouse not in room 227.
Plausible: Closing SA-1 will isolate the S/G 2B steam supply. Room 227 is the location for the 1SA-3 in Unit 2.

B. **Correct**:

C. **Incorrect**: SA-1 & 4 are in the doghouse not in room 227.
Plausible: If the candidate thinks both CAPT steam supplies must be isolated and confuses the valve locations. Room 227 is the correct location for the proper valve to be isolated (1SA-3) in Unit 2.

D. **Incorrect**: Only SA-3 is closed.
Plausible: If the candidate thinks that both steam supplies are isolated because the CAPT T&T valve is closed if both MDCA pumps are operable. This is the correct location for both valves.

Level: RO Exam

KA: G2.4.35 (3.3/3.5)

Lesson Plan Objective: EP-EP4 SEQ 13

Source: New

Level of knowledge: memory

References:
1. E-3 page 3
2. E-3 Bkgd Document pages 4-7

K/A G2.4.35 Knowledge of local auxiliary operator tasks during emergency operations including system geography and system implications. (CFR: 43.5 / 45.13)
IMPORTANCE RO 3.3 SRO 3.5

Objective EP-EP4 SEQ 5 Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/E-2 (Faulted Steam Generator Isolation)

Bank Question: 1159 ***Answer: D***

1 Pt(s) Unit 1 is in the process of shutting down for a refueling outage. Given the following conditions and events:

Time	**0200**	**0201**	**0202**	**0203**
NI-41	11%	9%	8%	7%
NI-42	12%	11%	9%	8%
NI-43	11%	9%	8%	7%
NI-44	12%	11%	10%	9%

Which one of the following statements correctly describes the required action, time and reason for this action?

A. **Manually unblock the power range neutron flux-low (25%) trip at 0201. This trip provides protection against exceeding DNBR and is required in Modes 1 through 3 but is not required in modes 4 and 5.**

B. **Manually unblock the power range neutron flux-low (25%) trip at 0202. This trip provides protection against a reactivity excursion while in low power or subcritical conditions in Modes 1 and 2 but is not required in modes 3-5.**

C. **Verify the power range neutron flux-low trip (25%) is automatically unblocked at 0201. This trip provides protection against exceeding DNBR and is required in Modes 1 through 3 but is not required in modes 4 and 5.**

D. **Verify the power range neutron flux-low trip (25%) is automatically unblocked at 0202. This trip provides protection against a reactivity excursion while in low power or subcritical conditions in Modes 1 and 2 but is not required in modes 3-5.**

Distracter Analysis:

A. **Incorrect**: Cannot manually unblock the power range neutron flux-low trip. The power range neutron flux-low trip is automatically unblocked at < 10% (3 of 4 PR NI channels) at 0202. The trip is not required below mode 2. The low power trip provides protection against a reactivity excursion while in low power or subcritical conditions in Modes 1 and 2 does not prevent exceeding DNBR.

Plausible: The power range neutron flux-low trip is manually unblocked > 10% (2 of 4 PR NI channels) – if the candidate confuses the system response to an increase in power.

B. **Incorrect**: The trip is automatically blocked – not manually blocked.
Plausible: All other parts are correct except the manual action vs. automatic action.

C. **Incorrect**: The auto-unblock occurs when 3 of 4 PR NI < 10% not 2 of 4. The trip is not required below mode 2. The low power trip does not prevent exceeding DNBR.
Plausible: If candidate reverses the power increase vs. power decrease logic requirement and does not understand that these trips are not required below mode 2.

D. **Correct**: The lower power trips are auto-unblocked at < 10% on ¾ PR NI channels.

Level: RO Exam

KA: SYS 045 K5.18 (2.7/3.2)

Lesson Plan Objective: IC-IPX-9

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-IC-ENB page 10
OP-CN-IC-IPX pages 11-12, 18-19
2. Tech Spec 3.3.1 bases page B3.3.1-9

K/A SYS 045K5.18: Knowledge of the operational implications of the following concepts as they apply to the MT/B System: Purpose of low-power reactor trips (limited to 25% power). 2.7/3.2 (CFR: 41.5 / 45.7)

Objective IC-IPX-9: List all permissive and control "P" and "C" interlocks and their function, setpoint and logic.

Bank Question: 1160 ***Answer: B***

1 Pt(s) Unit 2 is preparing to conduct a plant heat up in mode 4 during the winter. Given the following containment parameters as shown below:

Containment	**1500**	**1800**	**2100**	**2400**
Temperature (°F)				
Upper	60	59	58	57
Lower	64	63	62	61
Containment pressure (psig)	-0.09	-0.1	-0.11	-0.12

What is the first time at which Technical Specification limits are exceeded?

References Provided: Tech Spec 3.6.4 and Tech Spec 3.6.5

A. 1500

B. 1800

C. 2100

D. 2400

Distracter Analysis:

A. **Incorrect**: No containment Tech Spec LCOs are exceeded.
Plausible: If the candidate does not see the note in Tech Spec 3.6.5 that allows minimum Tech Spec containment average air temperature to be reduced to 60°F, the upper containment air temperature has dropped below the normal Tech Spec limit of 75°F and lower containment air temperature is < 100°F.

B. **Correct**: Upper containment temperature exceeds the 60°F temperature limit.

C. **Incorrect**: Upper containment temperature exceeded the 60°F temperature limit at 1800.
Plausible: Containment pressure first exceeds the –0.1 psig limit at 2100.

D. **Incorrect**: Upper containment temperature exceeded the 60°F temperature limit at 1800.
Plausible: If the candidate misreads the note in Tech Spec 3.6.5 and averages upper and lower containment temperatures, this is the first time that the average of these two parameters is < 60°F.

Level: RO Exam

KA: SYS 103 A1.01 (3.7/4.1)

Lesson Plan Objective: CNT-CNT-25

Source: New

Level of knowledge: memory

References:
1. OP-CN-CNT-CNT pages 10-11
2. Tech Spec 3.6.4
3. Tech Spec 3.6.5

K/A SYS103A1.01: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the containment system controls including: Containment pressure, temperature, and humidity 3.7/4.1 (CFR: 41.5 / 45.5)

Objective CNT-CNT-25: State from memory all Tech Spec actions for the applicable systems, subsystems and components which require remedial action to be taken in less than 1 hour.

Bank Question: 1161.1 ***Answer: B***

1 Pt(s) Unit 2 was operating at 71% power. Given the following events and conditions:

- Charger 2ECD is red tagged out of service for repairs.
- Charger 2ECS is aligned to 2EDD by procedure OP/1/A/6350/008 (*125VDC / 120 VAC Vital Instrument & Control Power System*).
- When battery 2EBD's output breaker is opened, the MSIVs close

Which one of the following statements correctly describes the additional cause of this event?

A. Loss of power to load center 2EMXA.

B. Loss of power to load center 2EMXB

C. Loss of charger 2ECA

D. Loss of charger 2ECB

Distracter Analysis: MSIV control power comes from 2EPA (train A) and 2EPD (train B). Loss of either panel board will cause MSIVs to close. In this question, the spare battery charger 2ECS is aligned to power 2EPD. 2ECS is normally powered from 2EMXA – but must be aligned to 2EMXB when 2ECS is aligned to a train B load.

A. **Incorrect**: When 2ECS is powering 2EDD and 2EPD, 2EMXB must be aligned to power 2ECS for train separation under OP/1/A/6350/008.
Plausible: If the candidate does not know the DC distribution system and assumes 2ECS is powered from 2EMXA – which is the normal alignment.

B. **Correct**: When 2ECS supplied power to 2EDD, then power to 2ECS must come from 2EMXB not 2EMXA.

C. **Incorrect**: If charger 2ECA is lost, then battery 2EBA will power 2EPA.
Plausible: If the candidate does not know the DC distribution system and thinks that the loss of charger 2ECA causes a loss of 2EPA.

D. **Incorrect**: Charger 2ECB does not provide power to 2EDD/2EPD if charger 2ECS is powering these loads.
Plausible: 2EDB and 2EDD can be connected and are often cross connected. But if 2ECS is powering 2EDD, you cannot connect

2EDB and 2EDD. In addition, battery 2EBD is still powering bus 2EDD and connecting 2EDB and 2EDD would cause battery 2EBD and 2EBB to be in parallel.

Level: RO Exam

KA: SYS063K3.02 (3.5/3.7)

Lesson Plan Objective: EP-EPL SEQ 15

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-EP-EPL pages 9-11, 23
2. AP-29 Encl 7 page 70

K/A SYS 063 K3.02: DC Electrical - Knowledge of the effect that a loss or malfunction of the DC electrical system will have on the following: Components using DC control power 3.5/3.7 (CFR: 41.7 / 45.6)

Objective EP-EPL-15: Evaluate the impact a failure of any Vital I & C component will have on unit operation

Bank Question: 1162.1 ***Answer: B***

1 Pt(s) Unit 1 was operating at 100% power when a VI header rupture occurred. Given the following events and conditions:

- The reactor was tripped
- The VI system was isolated from the VS system
- VI pressure was 5 psig.
- The steam generators pressures were at 1125 psig and increasing

Which one of the following statements correctly describes the capability to control the S/G pressure control?

A. The PORVs will cycle in AUTO mode to maintain S/G pressure between 1125 and 1092 psig using backup N_2 pressure.

B. The PORVs are controlled in MANUAL from the control room using backup N_2 pressure to maintain S/G pressure.

C. The PORVs are controlled in MANUAL from the CAPT Panel in "Local" control using backup N_2 pressure to maintain S/G pressure.

D. The PORVs cannot be operated from either the control room or the CAPT panel. The S/Gs pressure will be controlled by the lowest set safety valve lifting at 1175 psig and reseating.

Distracter Analysis:

A. **Incorrect**: The N_2 supply to the PORVs is not available in AUTO mode.
Plausible: The N2 supply is used to operate the PORVs manually.

B. **Correct**:

C. **Incorrect**: When a loss of VI occurs, the S/G PORVs can only be operated in manual using N2 from the control room.
Plausible: If the candidate reverses the fact that N2 is available for manual control in the control room but only VI is available at the CAPT Panel.

D. **Incorrect**: When a loss of VI occurs, the S/G PORVs can only be operated in manual using N2 from the control room.
Plausible: If the candidate forgets about the N2 backup accumulators .

Level: RO Exam

KA: SYS 035 A3.02 (3.7?/3.5?)

Lesson Plan Objective:

Source: New

Level of knowledge: memory

References:
1. OP-CN-STM-SM page 9

K/A SYS 035 A3.02: Ability to monitor automatic operation of the S/G including: MAD valves 3.7?/3.5? (CFR: 41.7 / 45.5)

Objective STM-SM-6: Describe the controls and indications for the S/G PORVs

Bank Question: 1164 ***Answer: C***

1 Pt(s) Unit 1 was operating at 100% power. Given the following events and conditions:

- The following CA control valves associated with CA pump #1 are closed in preparation for a pump performance test:
  - 1CA-64 (*CA Pump #1 Flow to S/G 1A*)
  - 1CA-52 (*CA Pump #1 Flow to S/G 1B*)
  - 1CA-48 (*CA Pump #1 Flow to S/G 1C*)
  - 1CA-36 (*CA Pump #1 Flow to S/G 1D*)
- 1SA-5 (*S/G 1C SM to CAPT*) opens
- CA Pump #1 starts

1. What is the reason that 1SA-5 opened and the CAPT started?
2. What is the status of the CA flow control valves?

A. 1. Failure of the 1B S/G WR level transmitter offscale low.
2. CA flow control valves remain closed.

B. 1. Failure of the 1B S/G WR level transmitter offscale low.
2. CA flow control valves reposition to full open.

C. 1. Loss of power to the SSF.
2. CA flow control valves remain closed.

D. 1. Loss of power to the SSF.
2. CA flow control valves reposition to full open.

Distracter Analysis:

A. **Incorrect**: Failure of a single WR S/G transmitter will not cause 1SA-5 to open.
Plausible: Failure of 2/4 S/G WR level channels will cause 1SA-5 to open. Partially correct - CA flow control valves would remain closed.

B. **Incorrect**: Failure of a single WR S/G transmitter will not cause 1SA-5 to open. CA flow control valves would not reposition.
Plausible: Failure of 2/4 S/G NR level channels will also cause 1SA-5 to open.

C. **Correct**: Loss of power to the SSF does not cause a CA auto-start signal but does cause 1SA-5 to open when the valve solenoid is deenergized.

D. **Incorrect**: CA flow control valves would not reposition.
Plausible: Partially correct – 1SA-5 will open and the CAPT will start if power to SSF is lost.

Level: RO Exam

KA: SYS 061 K2.01 (3.2*/3.3)

Lesson Plan Objective: CF-CA

Source: New

Level of knowledge: memory

References:
1. OP-CN-CF-CA pages 9-10

KA SYS 061K2.01 061 Auxiliary/Emergency Feedwater K2 Knowledge of bus power supplies to the following: K2.01 AFW system MOVs 3.2* 3.3 (CFR: 41.7)

Objective CF-CA 4: List the automatic start signals (including setpoint) for the motor driven and turbine driven CA pumps

Bank Question: 1165 ***Answer: C***

1 Pt(s) Unit 1 had just attained 100% power following a restart one day after a reactor trip. Given the following events and conditions:

- Xenon is burning out rapidly

Which one of the following statements correctly describes:
1. The change in AFD, and
2. The reactor trip protective feature that will protect the core from exceeding thermal limits due to excessive local power density if ΔI is not corrected?

A. 1. AFD is becoming more negative
2. Neutron high flux trip will trip the reactor if AFD is not corrected.

B. 1. AFD is becoming more positive
2. Neutron high flux trip will trip the reactor if AFD is not corrected.

C. 1. AFD is becoming more negative
2. OPΔT trip will trip the reactor if AFD is not corrected.

D. 1. AFD is becoming more positive
2. OPΔT trip will trip the reactor if AFD is not corrected.

Distracter Analysis:

A. **Incorrect**: The neutron high flux reactor trip will protect the reactor only after neutron level exceeds 109%. There is no direct input from ΔI.
Plausible: Partially correct – AFD becomes negative as Xenon burns out.

B. **Incorrect**: The neutron high flux reactor trip will protect the reactor only after neutron level exceeds 109%. There is no direct input from ΔI. ΔI becomes more negative not positive as Xenon burns out.
Plausible: If the candidate does not understand the effects of Xenon burnout on reactor power density.

C. **Correct**:

D. **Incorrect**: AFD becomes more negative not positive as Xenon burns out.

Plausible: Partially correct - OPΔT will protect the reactor from a local power density problem caused by ΔI.

Level: RO Exam

KA: SYS 012 K5.02 (3.1*/3.3*)

Lesson Plan Objective: IC-IPX 7

Source: New

Level of knowledge: memory

References:
1. OP-CN-IC-IPX pages 12-14

KA SYS 012 Reactor Protection K5 Knowledge of the operational implications of the following concepts as the apply to the RPS: K5.02 Power density 3.1* 3.3* (CFR: 41.5 / 45.7)

Objective IC-IPX 7 Explain the derivation of the reactor trip setpoints.

Bank Question: 1167 ***Answer: A***

1 Pt(s) Unit 1 was operating at 100% power when a small break LOCA occurred. Given the following events and conditions:

- Cooldown and depressurization is in progress in ES-1.2 (*Post Cooldown and Depressurization*)
- NC system pressure has stabilized at 410 psig
- FWST level is 70% and slowly decreasing
- The operators attempt to place 1A ND train in the RHR mode
- 1ND-1B and 1ND-2A (*ND Pump 1A Suct from Loop B*) will not open

Which one of the following statements correctly describes why 1ND-1B and 1ND-2A will not open?

A. The NC system pressure is too high

B. 1NI-185A (*ND pump 1A Suct from CNMT Sump*) is closed

C. ECCS has not been reset

D. 1NI-147B (*NI Pumps Recirc to FWST Isol*) is open

Distracter Analysis:

A. **Correct**: If NC system pressure is > 385 psig, these valves will not open

B. **Incorrect**: NI-185A being **closed** will not prevent 1ND-1B and 1ND-2A from opening – the closed position makes up the interlock.
Plausible: Reverse logic - If 1NI-185A were **open**, it would prevent 1ND-1B and 1ND-2A from opening

C. **Incorrect**: ECCS does not have to be reset for 1ND-1B and 1ND-2A to open
Plausible: Resetting ECCS is usually done as an operational matter before starting an ND train in RHR mode.

D. **Incorrect**: This is not a valve interlock with 1ND-1B and 1ND-2A
Plausible: 1NI-147B being open is a valve interlock for ND-28A and NI-136B – if the candidate confuses the valve interlocks.

Level: RO Exam

KA: SYS 005 K4.02 (3.2/3.5*)

Lesson Plan Objective: PS-ND 9

Source: Bank #ND-002-A

Level of knowledge: memory

References:
1. OP-CN-PS-ND pages 8, 13

KA SYS 005 Residual Heat Removal K4 Knowledge of RHRS design feature(s) and/or interlock(s) which provide or the following: K4.02 Modes of operation 3.2 3.5* (CFR: 41.7)

Objective PS-ND 9 Describe ND system operations

- Describe ND system startup
- Describe ND system operation in parallel mode
- Describe establishing pressurizer spray from the ND system
- Describe ND system shutdown and standby alignment

Bank Question: 1168 ***Answer: D***

1 Pt(s) Unit 1 was operating at 100% when a turbine trip occurred. Given the following conditions and events:

- The turbine trip caused a reactor trip
- The transient caused a large break in the NC cold leg
- A subsequent loss of all ECCS results in transition to FR-C.2 (Response to Degraded Core Cooling)
- The Hydrogen analyzers have been placed in service
- The ice condenser AHUs have been secured
- Hydrogen concentration is 6.9%

Which one of the following statements correctly describes the proper approach for reducing Hydrogen concentration?

A. Energize the Hydrogen igniters ONLY

B. Dispatch operators to place the Hydrogen recombiners in service ONLY

C. Energize the Hydrogen Igniters AND dispatch operators to place the Hydrogen recombiners in service

D. Do NOT energize the Hydrogen igniters or place the Hydrogen recombiners in service. Consult with Station management to evaluate the correct mitigation strategy.

Distracter Analysis:

A. **Incorrect**: Per FR-C.2, the Hydrogen igniters and recombiners are not to be energized/placed in service if containment H2 concentration exceeds 6.0% to prevent a Hydrogen fire/explosion in containment.
Plausible: If the candidate does not know the 6% upper limit on H2

B. **Incorrect**: Per FR-C.2, the Hydrogen igniters and recombiners are not to be energized/placed in service if containment H2 concentration exceeds 6.0% to prevent a Hydrogen fire/explosion in containment.
Plausible: If the candidate does not know the 6% upper limit on H2

C. **Incorrect**: Per FR-C.2, the Hydrogen igniters and recombiners are not to be energized/placed in service if containment H2

concentration exceeds 6.0% to prevent a Hydrogen fire/explosion in containment.
Plausible: If the candidate does not know the 6% upper limit on H2

D. **Correct**:

Level: RO Exam

KA: SYS 006 K3.03 (4.2/4.4)

Lesson Plan Objective: CNT-VX 4

Source: New

Level of knowledge: memory

References:
1. FR-C.2 page 8
2. OP-CN-CNT-VX pages 9-10

KA SYS 006 Emergency Core Cooling K3 Knowledge of the effect that a loss or malfunction of the ECCS will have on the following: K3.03 Containment 4.2 4.4 (CFR: 41.7 / 45.6)

Objective CNT-VX 4 Describe the automatic and manual operations performed to control the hydrogen concentration in containment.

Bank Question: 1169 ***Answer: C***

1 Pt(s) Unit 1 is in mode 5 preparing for a plant startup.

- The NC system is aligned for vacuum refill in preparation for drawing a bubble in the pressurizer.
- Current PRT level is 8%

Which one of the following statements correctly describes the effect of drawing a bubble in the pressurizer on the PRT?

A. Normal input lines from the NC system are isolated for vacuum refill. Any leakage through these lines will cause backflow from the waste gas system into the PRT.

B. Normal input lines from the NC system are isolated for vacuum refill. Any leakage through these lines will cause PRT level to decrease as water is drawn from the PRT into the NC system.

C. All Pzr PORVs and reactor vessel head vents are open during vacuum refill. PRT pressure will equalize with NC system pressure.

D. All Pzr PORVs and reactor vessel head vents are open during vacuum refill. PRT level will decrease as water is drawn from the PRT into the NC system.

Distracter Analysis:

A. **Incorrect**: The PRT is isolated from the WG system during vacuum refill and is tied to the NC system through open PORVs and head vents.
Plausible: If the candidate does not understand the vacuum refill lineup.

B. **Incorrect**: The PRT is tied to the NC system through the PORVs and head vents, however the inputs come into the top of the PRT and therefore the water level is low enough that it would not be pulled into those lines.
Plausible: If the candidate does not understand the vacuum refill lineup.

C. **Correct**:

D. **Incorrect**: The PRT is tied to the NC system through the PORVs and head vents, however the inputs come into the top of the PRT and

therefore the water level is low enough that it would not be pulled into those lines.
Plausible: If the candidate does not understand the vacuum refill lineup.

Level: RO Exam

KA: SYS 007 K5.02 (3.1/3.4)

Lesson Plan Objective: PS-NC 3

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-PS-NC pages 21-22, 28
2. OP/1/A/6150/001 Encl 4.16 pages 5, 7

KA SYS 007 Pressurizer Relief/Quench Tank K5 Knowledge of the operational implications of the following concepts as the apply to PRTS: K5.02 Method of forming a steam bubble in the PZR 3.1 3.4 (CFR: 41.5 / 45.7)

Objective: 3 Be able to describe and understand the NC System interfaces with Pzr, PRT, NV, NI, and ND.
Explain how normal system parameters are maintained in the NC System.
- Describe the purpose and operation of the Pzr.
- Identify the purpose of the Pzr relief valves and safety valves.
- Identify the power supply to the Pzr heaters.
- List the system parameters and setpoints associated with NC System relief

Bank Question: 1170 ***Answer: B***

1 Pt(s) Unit 1 is in mode 3 with all shutdown banks withdrawn in preparation for startup when the following occur:

- 1AD-6 E/3 (*NCP Thermal Barrier KC Outlet Hi/Lo Flow*) is lit
- The BOP determines from OAC indications that KC flow to NCP 1C is 75 gpm.

What effects will this have on NCP 1C and what action should be taken to address the alarm?

A. NCP 1C seal cooling is being maintained. Verify 1KC-345A (*NC Pump 1C Therm Bar Otlt*) closes immediately.

B. NCP 1C seal cooling is being maintained. Verify 1KC-345A (*NC Pump 1C Therm Bar Otlt*) closes after a 30 second time delay.

C. All seal cooling to NCP 1C is lost. Open the #1 seal bypass valve for the 1C NCP to restore cooling.

D. All seal cooling to NCP 1C is lost. Trip NCP 1C to prevent seal failure.

Distracter Analysis: The normal flow to the KC thermal barrier is 40 gpm per NCP. The high flow alarm is set at 60 gpm per NCP.

A. **Incorrect**: 1KC-345A does not close immediately.
Plausible: This would be correct except the valve closes after a 30 second delay

B. **Correct**: NCP seal cooling is being maintained by NV. 1KC-345A closes after a 30 second time delay.

C. **Incorrect**: All seal cooling is not lost. The seal bypass valve is on a common line from all 4 NCPs – not just the 1C NCP.
Plausible: If the candidate thinks that seal cooling is lost, opening the seal bypass valve would enhance seal cooling to the NCP.

D. **Incorrect**: This would be correct if all seal cooling is lost in this mode.
Plausible: If the candidate does not understand that seal cooling is supplied by the NV with this alarm.

Level: RO Exam

KA: SYS 008 K3.03 (4.1/4.2)

Lesson Plan Objective:

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-PSS-KC page 12
2. OP-CN-PS-NCP pages 15-19

KA SYS 008 Component Cooling Water K3 Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: K3.03 RCP .4.1 4.2 (CFR: 41.7)

Objectives PS-NCP 3 & 9:

3: Explain the operation of the NC pump seals including injection flow paths, flow rates, discharge flow paths, and pressure drops.

9: Given appropriate plant conditions, apply limits and precautions associated with related station procedures.

Bank Question: 1171 ***Answer: B***

1 Pt(s) Unit 1 was operating at 100% power. Given the following events and conditions:

- The pressurizer pressure master controller slowly drifts over the course of 30 minutes such that NC system pressure was being controlled at 2285 psig.
- A secondary system transient causes actual NC system pressure to increase from 2285 to 2325 psig.

What is the status of the pressurizer pressure control system?

A. Pzr spray valve closed, Pzr PORVs closed

B. Pzr spray valves throttled, Pzr PORVs closed

C. Pzr spray valves full open, Pzr PORVs closed

D. Pzr spray valves full open, Pzr PORVs open

Distracter Analysis: The Pzr master controller is controlling at 2285 – 50 psig higher than normal setpoint at 2235 psig. All corresponding actuation setpoints that are controlled from the master controller signal will be shifted by +50 psig.

A. **Incorrect**: If the students think that spray begins to throttle at 2310 psig.
Plausible: 2310 psig is actually the MAX Pzr spray setpoint

B. **Correct**:

C. **Incorrect**: With the pressurizer master controller controlling 50 psig low (2285 instead of 2235 psig), the spray valves throttling characteristics would be
Plausible: This would be correct if the Pzr pressure master were correctly calibrated for 2235 psig

D. **Incorrect**: Even though pressure is within the range of 2315 – 2335 psig, the PORVs do not open until they reach 2335 psig and based on the setup, the actual open setpoint would be 2385 psig. Also, the Pzr spray valves are throttled – not full open.
Plausible: If the candidate remembers that PORVs cycle between 2315 and 2335 psig.

Level: RO Exam

KA: SYS 010 A4.01 (3.7/3.5)

Lesson Plan Objective: IC-IPE 8, 9

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-PS-IPE pages 7-9

KA SYS 010 Pressurizer Pressure Control A4 Ability to manually operate and/or monitor in the control room: A4.01 PZR spray valve 3.7 3.5 (CFR: 41.7 / 45.5 to 45.8)

Objective IC-IPE 8, 9

8 List the nominal value for the alarms and control functions generated by the pressurizer pressure master controller, assuming the controller is set for 2235 psig

9 Describe all alarms, control functions, and interlocks, which are generated by pressurizer, pressure but not controlled by the master controller, including setpoint and pressure channel

Bank Question: 1173 ***Answer: C***

1 Pt(s) Unit 1 as operating at 80% power and steady awaiting NI calibrations. Given the following events and conditions:

- The CF heater bypass valve on the high pressure heater strings is inadvertently left partially open following a refueling outage due to a limit switch problem.
- An operator on rounds notes locally that valve indicates mid-position and notifies the control room.
- The control room operator places rods in manual and does not move them during the evolution.
- The control room instructs the operator to manually close the valve.

What is the effect on the reactor power and reactor coolant temperature as the valve is closed?

A. Reactor power increases - NC T_{avg} increases

B. Reactor power increases - NC T_{avg} decreases

C. Reactor power decreases - NC T_{avg} increases

D. Reactor power decreases - NC T_{avg} decreases

Distracter Analysis:

A. Incorrect:
Plausible: If the student believes that because Tavg is increasing, reactor power must also be increasing.

B. Incorrect:
Plausible: This would be true if the valve were opened further

C. Correct:

D. Incorrect:
Plausible: If the student thinks that because reactor power is decreasing, Tavg is also decreasing

Level: RO Exam

KA: SYS 059 K1.05 (3.1*/3.3)

Lesson Plan Objective: BNT RT-08 #25

Source: New

Level of knowledge: comprehension

References:
1. BNT- Reactor Theory

KA SYS 059K1.05 Main Feedwater K1 Knowledge of the physical connections and/or cause effect relationships between the MFW and the following systems: K1.05 RCS 3.1* 3.2 (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective: BNT-RT-08 Explain the difference between steam flow and reactor power given specific conditions.

Bank Question: 1174.1 ***Answer: A***

1 Pt(s) Unit 1 is operating at 65% power and preparing to increase power using OP/1/A/6100/003 (*Controlling Procedure for Operations*). Given the following events and conditions:

- 1A and 1B CFPT are running
- Condensate pump status is as follows:
  - Hotwell Pumps
    - 1A – Running
    - 1B – Not running, control switch in "AUTO"
    - 1C – Running
  - Condensate Booster Pumps
    - 1A – Running
    - 1B – Not running, control switch in "AUTO"
    - 1C – Running
- The 1C hotwell pump breaker trips due to an overcurrent relay actuation

Which one of the following statements correctly describes:

1. The plant response, and
2. The required procedure?

A. 1. 1B hotwell pump will automatically start and clear the low condensate pressure condition within the 20-second time delay. The CFPTs will continue to run and the plant will stay at power.
2. Remain in OP/1/A/6100/003.

B. 1. 1B hotwell pump will automatically start but not quickly enough to clear the low condensate pressure condition within the 20-second time delay; The CFPTs will trip. The turbine will automatically trip and the reactor will stay at power.
2. Enter AP-2 (*Turbine Generator Trip*).

C. 1. 1B hotwell pump will not start. The CFPTs will trip on low suction pressure after 20 seconds. The turbine will trip automatically but the reactor will remain at power.
2. Enter AP-2 (*Turbine Generator Trip*).

D. 1. 1B hotwell pump will not start. The CFPTs will trip on low suction pressure after 20 seconds. Both the turbine and reactor will automatically trip.
2. Enter E-0 (*Reactor Trip of Safety Injection*)

Distracter Analysis: The hotwell pump has valve interlocks, which prevent it from starting unless all discharge flowpaths are isolated (for the first

pump started) to prevent water hammer. If only one hotwell pump was running (for low power scenarios), all flowpaths would be isolated so the 1B hotwell pump will not start. At power levels > 50%, 2 hotwell pumps are required and the valve interlock would not be a problem.

A. **Correct**:
Plausible:

B. **Incorrect**: The 1B hotwell pump starts automatically and clears the low suction pressure signal in time to prevent the unit from tripping.
Plausible: The CFPTs would trip and the turbine would trip if the power was below 50% and only one hotwell pump was running.

C. **Incorrect**: The 1B hotwell pump will start.
Plausible: Partially correct – if the CFPT tripped on low suction pressure, the turbine would trip. AP-2 would be the correct procedure. This sequence occurs if the power level is < 50% and only one hotwell pump is running. Valve interlocks prevent the standby hotwell pump from starting under these conditions.

D. **Incorrect**:
Plausible: This sequence occurs if the power level is < 50% and only one hotwell pump is running. Valve interlocks prevent the standby hotwell pump from starting under these conditions. If the turbine tripped, the reactor would trip > P-9 (69%) and the correct procedure would be E-0.

Level: RO Exam

KA: SYS 056 A2.04 (2.6/2.8*)

Lesson Plan Objective: CF-CM 4

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-CF-CM pages 10-11
2. OP-CN-IC-IPX page 18
3. OP-CN-CF-CA page 9
4. OP-CN-CF-FPT page 17

KA SYS 056 Condensate A2 Ability to (a) predict the impacts of the following malfunctions or operations on the Condensate System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.04 Loss of condensate pumps 2.6 2.8* (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective: CF-CM 4 State the interlocks, controls, trip signals and protection features associated with these condensate and condensate storage system - Hotwell Pumps

Bank Question: 1175 ***Answer: D***

1 Pt(s) Unit one was operating at 100% power.

Which one of the following protective interlocks prevents an inadvertent start of the air return fans?

A. The fans will not start for 9 minutes thereby providing time to reverse an inadvertent start action.

B. The fans will not start if the isolation damper is not open, requiring two separate actions before an inadvertent start.

C. The fans will not start if there is > 0.5 psid across the isolation damper indicating the potential to open the lower ice condenser doors.

D. The fans will not start without a valid CPCS permissive signal indicating an actual need for air return system operation.

Distracter Analysis:

A. **Incorrect**: The time delay is bypassed for manual start.
Plausible: There is a time delay for automatic operation.

B. **Incorrect**: There is no interlock with the isolation damper.
Plausible: There is an interlock on this damper that requires the fan to be running before the damper can be opened – the reverse of this situation.

C. **Incorrect**: The 1 psid interlock affects the damper not the fan.
Plausible: There is a D/P interlock on the damper and the ice condenser inlet doors will open with a 1 psid pressure.

D. **Correct**: must satisfy a 0.4 psig containment pressure CPCS interlock.

Level: RO Exam

KA: SYS025A4.02 (2.7*/2.5*)

Lesson Plan Objective: CNT-VX SEQ 4/5

Source: New

Level of knowledge: memory

References:
1. OP-CN-CNT-VX pages 7-8

K/A SYS025 A4.02: Ability to manually operate and/or monitor in the control room: Containment vent fans 2.7*/2.5* (CFR: 41.7 / 45.5 to 45.8)

Objective CNT-VX-4/5: 4 Describe the automatic and manual operations performed to control … containment.
5 Describe the conditions necessary for automatic operation of the Containment Air Return …System.

Bank Question: 1176 ***Answer: B***

1 Pt(s) Unit 1 was operating at 100%. Given the following events and conditions:

- The 1C S/G develops a large tube leak
- The leak rate slowly increases until the tube finally ruptures
- The operators do not reduce turbine power.

Which one of the following statements correctly describes the steam flow and feedwater flow characteristics of the ruptured S/G prior to the reactor trip and safety injection?

A. Steam flow decreases, feedwater flow increases.

B. Steam flow increases, feedwater flow decreases.

C. Steam flow decreases, feedwater flow increases.

D. Steam flow decreases, feedwater flow decreases.

Distracter Analysis:

A. **Incorrect**: Feedwater flow decreases as S/G level increases due to the increasing S/G water level due to the NCS leakage into the S/G.
Plausible: Partially correct – steam flow increases as S/G increases due to the hot NCS water in the S/G.

B. **Correct**: Steam flow will increase due to the hot NCS water entering the ruptured S/G but this trend is hard to spot at 100% power. Feedwater flow will decrease as S/G level increases and the DFCS cuts back on feedwater flow to lower S/G level.

C. **Incorrect**: Steam flow increases and feedwater flow decreases
Plausible: psychometrically balanced

D. **Incorrect**: Steam flow increases as S/G pressure increases from the hot NCS water entering the S/G
Plausible: Partially correct – feedwater flow decreases

Level: RO Exam

KA: EPE 038 EA1.02 (4.2/4.1)

Lesson Plan Objective: none

Source: New

Level of knowledge: comprehension

References:
1. AP/1/A/5500/010 page 1

KA EPE 038 Steam Generator Tube Rupture EA1 Ability to operate and monitor the following as they apply to a SGTR: EA1.02 Steam and feedwater flow, for mismatched condition. 4.2 4.1 (CFR 41.7 / 45.5 / 45.6)

Objective: none

Bank Question: 1178 ***Answer: B***

1 Pt(s) Unit 1 is operating at 100% power. Given the following events and conditions:

- "A" and "B" RL pumps are in service.
- "C" RL pump is tagged out while the pump is being rebuilt.
- RL Pressure Controller malfunctions and causes all turnaround valves to fail full open.

Which one of the following statements correctly describes the consequences of this situation?

A. RL flow to the KR heat exchangers increases resulting in the temperature control valves closing to maintain KR temperature constant.

B. RL flow to the KR heat exchangers decreases resulting in the temperature control valves opening to maintain KR temperature constant.

C. RL flow to the IPB air coolers will increase which may result in condensation in the IPBs during low load conditions.

D. RL flow to the IPB air coolers will decrease which may require a load reduction to prevent the IPBs from overheating.

Distracter Analysis:

A. **Incorrect**: Flow decreases to the KR Hx due to the turnaround valves robbing flow from the other components. The turnaround valves act as a RL load "bypass".
Plausible: If the candidate is not familiar with the cooling water alignment in the turbine building – thinks that the temperature control valves increase flow in response to a high temp condition.

B. **Correct**:

C. **Incorrect**: RL does not flow through the exciter air cooler; KR does, which is cooled by RL.
Plausible: If the candidate is not familiar with the cooling water alignment in the turbine building

D. **Incorrect**: RL does not supply the IPB coolers, KR does.
Plausible: If the candidate is not familiar with the cooling water alignment in the turbine building

Level: RO Exam

KA: SYS 076 A1.02 (2.6*/2.6*)

Lesson Plan Objective: SS-KR 14

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-SS-KR pages 7-10

KA SYS 076 Service Water A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including: A1.02 Reactor and turbine building closed cooling water temperatures 2.6* 2.6* (CFR: 41.5 / 45.5)

Objective: SS-KR 14 Identify the controls and indications for the KR system, which are available in the Control Room.

Bank Question: 1179 ***Answer: D***

1 Pt(s) Unit 1 was operating at 100% power with all operating parameters in a stable condition. Given the following events and conditions:

- The pressurizer pressure and level control systems are in a normal alignment.
- 1NV-294 and 1NV-309 are in auto control
- The spray valve develops a slight seat leak
- Pressurizer pressure stabilizes at 2215 psig with all heaters on.

If the operators take all required procedural actions, what changes will occur for the valve positions on 1NV-294 and 1NV-309?

A. 1NV-294 opens – 1NV-309 opens

B. 1NV-294 opens – 1NV-309 closes

C. 1NV-294 closes – 1NV-309 opens

D. 1NV-294 closes – 1NV-309 closes

Distracter Analysis: With steady state pressurizer pressure lowered from 2235 to 2220 psig, the charging pump flow will increase and letdown will decrease causing pressurizer level to increase. This will cause 1NV-294 to throttle down to reduce charging flow to bring pressurizer level back to the level setpoint. 1NV-309 will close to increase flow to the NCP seals as pressure downstream of 1NV-294 decreases.

A. **Incorrect**: 1NV-294 closes
Plausible: Partially correct – 1NV-309 opens

B. **Incorrect**: This is backwards to what actually happens
Plausible: If the candidate reverses the logic of the system – this would occur if pressure increased.

C. **Incorrect**: 1NV-309 closes to increase seal flow.
Plausible: If the candidate reverses the control logic for 1NV-309.

D. **Correct**:

Level: RO Exam

KA: SYS 010 K1.06 (2.9/3.1)

Lesson Plan Objective: none

Source: New

Level of knowledge: analysis

References:
1. OP-CN-PS-NV pages 25-26, 58
2. OP-CN-IC-IPE pages 7-10

KA SYS 010 Pressurizer Pressure Control K1 Knowledge of the physical connections and/or cause-effect relationships between the PZR PCS and the following systems: K1.06 CVCS 2.9 3.1 (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective: PS-NV 6, 7
6 Describe the operation and flowpath of normal charging.
7 Describe the operation and flowpath of NV seal injection.

Bank Question: 1180 ***Answer: C***

1 Pt(s) Unit 1 was operating at 80% power when a small steam leak occurred in the turbine building. Given the following events and conditions:

- Control rods are in manual
- The steam leak cannot be isolated

What trends will occur for Tavg and reactor power 10 minutes after the leak starts?

A. Tavg is higher - reactor power is higher

B. Tavg is higher – reactor power remains constant

C. Tavg is lower – reactor power is higher

D. Tavg is lower – reactor power remains constant

Distracter Analysis: The main turbine is operated with the "MW IN" feedback loop selected to OUT for reactivity management concerns. This is a change to past practice where MW IN was selected below 90% power.

A. **Incorrect**: Tavg will be lower.
Plausible: Partially correct – reactor power will increase

B. **Incorrect**: The additional steam load will cause Tavg to increase and reactor power to increase
Plausible: Partially correct – Tavg increases. If the candidate does not understand the effect of a small steam leak on the reactor.

C. **Correct**: Tavg decreases as the added steam load cools the NC temperature. MTC causes reactor power to increase.

D. **Incorrect**: Tavg increases not decreases
Plausible: Psychometric balance.

Level: RO Exam

KA: SYS 039 K1.04 (3.1/3.1)

Lesson Plan Objective: BNT-RT-08 #25

Source: New

Level of knowledge: comprehension

References:
1. BNT Reactor Theory

KA SYS 039 K1.04 Main and Reheat Steam K1 Knowledge of the physical connections and/or cause-effect relationships between the MRSS and the following systems: K1.04 RCS temperature monitoring and control 3.1 3.1 (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective: ???

Bank Question: 1181 ***Answer: A***

1 Pt(s) Unit 1 was operating at 100%. NC system pressure increases. Given the following conditions and events:

- The pressurizer pressure master develops an output bias that results in a step increase of +30 psig over the nominal value.
- NC system pressure stabilizes at 2265 psig.
- 1NV-294 (*NV Pumps A&B Disch Flow Ctrl*) is in manual control and set at 87 gpm.
- 1NV-148 (*Letdn Press Control*) is in manual and set to 350 psig.
- 1NV-849 (*Letdn Var Orif Ctrl*) is set to control at 75 gpm.

Which one of the following statements correctly describes the initial effect of this pressure increase on the charging / letdown balance with no operator action?

A. The charging / letdown balance changes because the increase in NC pressure causes charging flow to decrease and letdown flow to increase.

B. The charging / letdown balance changes because the increase in NC pressure causes charging flow to increase and letdown flow to decrease.

C. The charging / letdown balance does not change because the increase in NC pressure causes charging flow and letdown flow to decrease by the same amount.

D. The charging / letdown imbalance does not effect charging flow and letdown flow as the NV system automatically compensates for the change in pressure.

Distracter Analysis: The increase in NC system pressure causes charging flow to decrease because 1NV-294 is in manual control. The charging pump discharge characteristics will show a reduction in discharge output as pressure increases. The letdown system flow will increase because 1NV-849 (L/D manual control valve) is set to control at a fixed throttling position by the manual loader. 1NV-849 does not control based on flow rate. In addition, with 1NV-148 set to manual control, the letdown system will not compensate for the change in NC system pressure.

A. **Correct**:

B. **Incorrect**: The charging flow decreases and the letdown flow increases.
Plausible: If the candidate reverses the effects

C. **Incorrect**: The charging flow decreases and the letdown flow increases.
Plausible: If the candidate thinks that letdown flow will decrease due to the increase in pressure.

D. **Incorrect**: The charging flow decreases and the letdown flow increases.
Plausible: Charging flow would normally be adjusted by the position of 1NV-294 when operated in auto control. The candidate could think that 1NV-849 controls letdown based on a flow signal. In both cases, the candidate would think that the change in pressure is compensated by the controllers. The candidate could also think that a small change in NC system pressure would not change the pump discharge characteristics or the throttling characteristics.

Level: RO Exam

KA: APE 028 AK3.02 (2.9/3.2)

Lesson Plan Objective: PS-NV 5, 6

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-PS-NV pages 12-14, 24-26

KA APE 028 Pressurizer Level Malfunction AK3. Knowledge of the reasons for the following responses as they apply to the Pressurizer Level Control Malfunctions: AK3.02 Relationships between PZR pressure increase and reactor makeup/letdown imbalance 2.9 3.2 (CFR 41.5,41.10 / 45.6 / 45.13)

Objectives: PS-NV 5, 6
5 Describe the operation and flowpath of NV letdown from NC.
6 Describe the operation and flowpath of normal charging.

Bank Question: 1182 ***Answer: B***

1 Pt(s) Units 1 and 2 were operating at 100% power with a liquid release from the WL system in progress. Given the following events and conditions:

- EMF-49(L) (*Liquid Waste Disch (Lo Range*) (a RP86A digital module) shows the following indications:
  - Green light - LIT
  - Amber light - LIT
  - Red light – NOT LIT

Which one of the following statements correctly describes the dose rate being monitored by this digital module?

A. The dose rate is below the TRIP 1 setpoint

B. The dose rate is between the TRIP 1 and TRIP 2 setpoints

C. The dose rate is above the TRIP 2 Setpoint

D. The EMF module has malfunctioned and the dose rate is unknown

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Distracter Analysis:

A. **Incorrect**: The amber light is lit when the module exceeds the trip-1 setpoint.
Plausible: If the candidate does not know the new digital EMF module light sequence.

B. **Correct**:

C. **Incorrect**: If the dose rate was above the trip-2 setpoint, the red light would be lit in addition to the amber light.
Plausible: If the candidate does not know the new digital EMF module light sequence.

D. **Incorrect**: The green light is lit indicating that the module is functioning.
Plausible: If the candidate does not know the new digital EMF module light sequence

Level: RO Exam

KA: SYS 068 K5.03 (2.6/2.6)

Lesson Plan Objective: none

Source: Bank INPO #20939

Level of knowledge: memory

References:
1. OP-CN-SFAM-EMF pages 8-9

KA SYS 068 Liquid Rad Waste K5 Knowledge of the operational implication of the following concepts as they apply to the Liquid Radwaste System: K5.03 Units of radiation, dose, and dose rate . 2.6 / 2.6 (CFR: 41.5 / 45.7)

Objective SFAM-EMF 1: Locate and describe the function of all switches, indications, and alarms associated with the EMFs.

Bank Question: 1183 ***Answer: C***

1 Pt(s) Unit 1 is in the process of performing a reactor startup. Given the following conditions and events:

- Control Bank "A" is at 28 steps withdrawn when the following alarms are received:
  - 1AD-6, A/5 (*NCP HI VIBRATION*)
  - 1AD-6, B/5 (*NCP HI-HI VIBRATION*)
- The BOP validates that the 1C NC Pump vibration level on the frame is at 6.5 mils using the NC Pump vibration monitor panel.

Which one of the following selections is the list of the correct actions based on this situation?

A. Reinsert Control Bank "A" rods.
Trip 1C NC Pump.
Go to AP-4 (*Loss of Reactor Coolant Pump*).

B. Trip 1C NC Pump.
Go to AP-4 (*Loss of Reactor Coolant Pump*).

C. Trip the reactor.
Trip 1C NC Pump.
Go to E-0 (*Reactor Trip or Safety Injection*).

D. Pump trip criteria is not yet met.
Go To AP-8 (*Reactor Coolant Pump Malfunction*).

Distracter Analysis: The correct action is to trip the reactor (based on being in Mode 2), trip the reactor coolant pump, and enter E-0 due to the reactor trip.

A. **Incorrect**: if student thinks that they are not yet in Mode 2 and it would be conservative to drive rods in since they are just beginning to pull them. With the plant in mode, E-0 is the correct procedure.
Plausible: This would be correct response in Mode 3 with all control banks in.

B. **Incorrect**: With the plant in mode, E-0 is the correct procedure.
Plausible: This would be correct if plant were in Mode 3.

C. **Correct**:

D. **Incorrect**: The pump trip criteria is > 5 mils on the frame.

Plausible: If trip criteria were not met, this would be the correct response.

Level: RO Exam

KA: SYS 003 G2.4.50 (3.3/3.3)

Lesson Plan Objective: PS-NCP 12

Source: New

Level of knowledge: memory

References:
1. OP/1/B/6100/01G 1AD-6 B/5

KA SYS 003 Reactor Coolant Pump G2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 45.3)

Objective PS-NCP 12: Evaluate NCP operations including:
- When immediate trip of the NCP is required

Bank Question: 1184 ***Answer: C***

1 Pt(s) Tech Spec 3.1.1 requires adequate shutdown margin shall be maintained when shutdown cooling is in service in modes 4 and 5 in order to mitigate a boron dilution accident. Fill in the blanks to correctly complete the following sentence regarding this accident.

The most limiting boron dilution accident is one initiated from Mode (___A___) at (___B___) of core life.

A. **4** **Beginning**

B. **4** **End**

C. **5** **Beginning**

D. **5** **End**

Distracter Analysis:

A. **Incorrect**: Mode 5 is more limiting than mode 4 because of the lower RCS liquid volume, which results in a faster dilution and the lower SDM limit, which provides higher NC system boron concentration – so a dilution event has a greater positive reactivity rate.
Plausible: Mode 4 is at higher temperature and greater thermal energy. Most accidents are more limiting at end of core life.

B. **Incorrect**: Not the limiting event. Mode 5 is more limiting than mode 4 because of the lower RCS liquid volume, which results in a faster dilution
Plausible: Partially correct – mode 5 is the most limiting mode for this event.

C. **Correct**:

D. **Incorrect**: End of core life is not the limiting condition for this event.
Plausible: This is a limiting condition for many other accidents.

Level: RO Exam

KA: APE 025 G2.2.25 (2.5/3.7)

Lesson Plan Objective: none

Source: New

Level of knowledge: comprehension

References:
1. Tech Spec bases B3.1.1 pages 1-4

KA APE 025 Loss of RHR System 2.2.25 Knowledge of bases in technical specifications for limiting conditions for operations and safety limits. (CFR: 43.2)

Objective: none – ROs are not required to memorize Tech Spec bases at the Catawba Nuclear Station. The NRC refused our request to shift this K/A to a more job-relevant K/A.

Bank Question: 1185 ***Answer: C***

1 Pt(s) Unit 1 was operating at 100% power when a small break LOCA occurred. Given the following events and conditions:

- Containment pressure reaches 0.5 psig

Which one of the following statements correctly describes the response of the containment ventilation system?

A. Upper containment air handling units and return fans go to MAX cool.

B. Lower containment air handling units shift to high speed.

C. Lower containment air handling units cooling bypass valves open.

D. Incore air handling units are placed in MAX cool.

Distracter Analysis:

A. **Incorrect**: This requires operator action to shift to MAX cool
Plausible: If the candidate confuses the UCAHUs and the LCAHUs.

B. **Incorrect**: The fans do not shift to fast speed.
Plausible: If the fans are shifted to fast speed, the full flow valves will automatically open up – the reverse of condition "c".

C. **Correct**: If containment pressure exceeds 0.5 psig, the cooling bypass valve (full flow valve) automatically open

D. **Incorrect**: Incore AHUs do not shift to MAX cool – requires operator action.
Plausible: If the candidate confuses the LCAHUs and in the incore AHUs.

Level: RO Exam

KA: EPE 009 EA1.07 (3.7/3.9)

Lesson Plan Objective: CNT-VV 5

Source: Bank #VV-022-D

Level of knowledge: memory

References:
1. OP-CN-CNT-VV pages 7-11

KA EPE 009 Small Break LOCA EA1 Ability to operate and monitor the following as they apply to a small break LOCA: EA1.07 CCS 3.7 3.9 (CFR 41.7 / 45.5 / 45.6)

Objective CNT-VV 5 Describe the operation of the Lower Containment Ventilation Units for the following modes or conditions:

- High and Low Speed
- MAX Cool
- 0.5 psig in Containment

Bank Question: 1199 ***Answer: C***

1 Pt(s) Unit 1 was operating at 100% power when a large leak on the RC piping in the turbine building resulted in flooding of the lower elevations of the turbine building basement. Given the following conditions and sequence of events:

- All Turbine Building Sump Pumps are operating.
- 1EMF-31 (*Turbine Building Sump Monitor*) TRIP-2 light is LIT due to a detector failure.
- 1RAD-1, F/5 (*CABINET 1-2 TROUBLE*) is LIT.

Which one of the following selections correctly describes:
1. The current status of the turbine building sump pumps, and
2. The action (if any) is available to the Control Room team to continue with flood mitigation?

A. **1. Turbine building sump pumps continue to run.**
2. No additional action is required.

B. **1. Turbine building sump pumps are off.**
2. Manually start the turbine building sump pumps from the control room.

C. **1. Turbine building sump pumps are off.**
2. Coordinate with RP to override 1EMF-31 and then restart the turbine building sump sumps.

D. **1. Turbine building sump pumps are off.**
2. The turbine building sump pumps cannot be restarted. Contact maintenance to set up temporary pumps.

Distracter Analysis: A 1EMF-31 detector failure will cause the above symptoms on the EMF module – which matches the K/A.

A. **Incorrect**: The WP pumps trip on 1EMF-31 trip-2.
Plausible: Student may not remember auto action.

B. **Incorrect**: The module has suffered a detector failure causing a Trip-2 condition. The module cannot be reset with this failure.
Plausible: Other signals and actions can be "reset".

C. **Correct**:

D. **Incorrect**: The EMF signal can be overridden by coordination with RP – needs a key to reset.
Plausible: If the student is not aware of the override capability provided to EMF-31.

Level: RO Exam

KA: SYS 073 A2.02 (2.7/3.2))

Lesson Plan Objective: none

Source: New

Level of knowledge: comprehension

References:
1. HP/0/B1004/004
2. OP/1/B/6100/010X (A5)

K/A SYS073 Process Radiation Monitoring A2.02: Ability to (a) predict the impacts of the following malfunctions or operations on the PRM system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Detector failure 2.7/3.2 (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective: none

Bank Question: 1201 ***Answer: C***

1 Pt(s) Which one of the following statements correctly describes the purpose of the Inadequate Core Cooling Monitor system?

Designed to provide indication of insufficient cooling of the core by monitoring Reactor Coolant (NC) system parameters and giving indication on a plasma display terminal of _____?

A. **Reactor natural circulation flow, hot leg temperature and subcooling margin.**

B. **Reactor vessel level, natural circulation flow, and core saturation conditions.**

C. **Reactor vessel coolant inventory, core exit temperatures, and subcooling margin.**

D. **Reactor vessel saturation conditions, core exit temperatures, and decay heat output**

Distracter Analysis: The CCM lesson plan states that the purpose of the ICCM system is:
"Designed to provide indication of insufficient cooling of the core by monitoring Reactor Coolant (NC) system parameters and giving indication on a plasma display terminal of reactor vessel coolant inventory, core exit temperatures, and subcooled margin."

A. **Incorrect**: Natural circulation flow is not determined by ICCM system and is not part of the purpose of the system.
Plausible: Natural circulation flow is a necessary condition to maintain core cooling. Hot leg temperature are monitored by the ICCM.

B. **Incorrect**: Natural circulation flow is not determined by ICCM system and is not part of the purpose of the system.
Plausible: Partially correct. Natural circulation flow is a necessary condition to maintain core cooling. The other conditions are part of the purpose.

C. **Correct**: This is the definition of the ICCM system from the lesson plan.

D. **Incorrect**: The ICCM does not measure decay heat output directly.
Plausible: Decay heat is the direct cause of the need to have an ICCM system.

Level: RO Exam

KA: EPE 074 G2.1.27 (2.8/2.9)

Lesson Plan Objective: PS-CCM-1

Source: New

Level of knowledge: memory

References:
1. OP-CN-PS-CCM page 5

K/A EPE 074 G2.1.27: Inadequate Core Cooling - Knowledge of system purpose and or function. 2.8/2.9 (CFR: 41.7).

Objective PS-CCM-1: State the purpose of the ICCM

Bank Question: 1202 ***Answer: A***

1 Pt(s) Unit 1 was operating at 100% power. Given the following events and conditions:

- A large steam break occurs on the 1C S/G, inside containment.
- After completion of the emergency procedure immediate actions the OATC notes the following:
  - CA SYSTEM VLV CTRL TRN A "RESET" light is DARK
  - CA SYSTEM VLV CTRL TRN B "RESET" light is DARK
  - 1FO-1, D/5 "*HI CONT PRESS S/I RX TRIP*" – LIT AND RED
  - 1FO-1, C/6 "*PZR LO PRESS S/I RX TRIP*" - LIT
  - 1FO-1, B/3 "*S/G C LO-LO LEVEL RX TRIP*" - LIT

Which one of the following selections correctly describes:
1. The signal that caused the CA SYSTEM VLV CTRL "RESET" lights to go DARK, and
2. The current status of CAPT #1?

A. 1. Safety Injection actuation
2. CAPT #1 is off.

B. 1. Safety Injection actuation
2. CAPT#1 is running.

C. 1. Lo-Lo Steam Generator level on "C" S/G
2. CAPT #1 is off.

D. 1. Lo-Lo Steam Generator level on "C" S/G
2. CAPT #1 is running.

Distracter Analysis: The CAPT starts on a blackout signal or 2/4 S/G lo-lo level. The Lo-Lo S/G level and the S/I signal cause a CA auto-start which would darken the RESET lights, however, the Hi cont pressure in RED indicates that it is the "first out". Therefore, it is the signal that initiated the CA auto-start.

A. **Correct**: The high containment pressure S/I does not start the CAPT.

B. **Incorrect**: The CAPT is not running.
Plausible: If student thinks that either of these signals caused the CAPT to start.

C. **Incorrect**: Safety injection actuated before the lo-lo S/G level signal occurred.
Plausible: If student doesn't recognize that the S/I signal was the "first out" this would be the correct answer.

D. **Incorrect**: Safety injection actuated before the lo-lo S/G level signal occurred.
Plausible: If the student doesn't understand the facts presented in B and C distracters. If the student thinks that a lo-lo S/G level condition on a single S/G will start the CAPT (this condition only starts the MD CA pumps).

Level: RO Exam

KA: APE 054 AA2.04 (4.2/4.3)

Lesson Plan Objective: CF-CA 4

Source: MOD

Level of knowledge: comprehension

References:
1. OP-CN-CF-CA pages 9-10

K/A 054AA2.04: Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): Proper operation of AFW pumps and regulating valves 4.2/4.3 (CFR: 43.5 / 45.13)

Objective CF-CA-4: List the automatic start signals (including setpoint) for the motor driven and turbine driven CA pumps

Bank Question: 1203 ***Answer: B***

1Pt(s) Unit 1 was operating at 100% when a tornado caused a loss of all offsite power. Given the following events and conditions:

- The transient resulted in a reactor trip.
- The 1A D/G failed to start.
- The 1B D/G started and is sequencing on loads.
- As the crew is performing immediate actions in the current procedure, the 1B D/G trips on Lo-Lo lube oil pressure.
- The crew is currently at the step which reads:

"*Verify 1ETA and 1ETB – ENERGIZED*"

What is the next action required of the crew?

A. GO TO ECA-0.0 (Loss of All AC Power); start the standby makeup pump.

B. GO TO ECA-0.0 (Loss of All AC Power); verify reactor tripped.

C Stay in the current procedure; concurrently implement AP/07 (Loss of Normal Power) to attempt to restore power to de-energized switchgear.

D. Stay in the current procedure; verify S/I is actuated.

Distracter Analysis:

A. **Incorrect**: This is not the first step of ECA-0.0
Plausible: This is the correct procedure

B. **Correct**:

C. **Incorrect**: Transition to ECA-0.0 is required
Plausible: The next step in E-0 appears to address the power problem

D. **Incorrect**: Transition to ECA-0.0 is required
Plausible: The next step in the E-0 appears to address the power problem

Level: RO Exam

KA: G2.4.1(4.3/4.6)

Lesson Plan Objective: EP-EP5 Obj: 10, 11

Source: New

Level of knowledge: memory

References:
1. ECA-0.0 pages 1-2
2. OP-CN-EP-EP5 page 5

K/A G2.4.1: Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13) IMPORTANCE RO 4.3 SRO 4.6

Objectives: EP-EP5-10: Given a set of specific plant conditions and all required procedures, use the rules of usage and outstanding PPRBs to identify the correct procedure flowpath

EP-EP5- 11: State from memory the Immediate Actions of EP/1/A/5000/ECA-0.0 (Loss of All A/C Power)

Bank Question: 1204 ***Answer: C***

1 Pt(s) Unit 1 was operating to 100% power when the running NV pump trips.

Which one of the following selections correctly describes:
1. The effect on the NV system, and
2. The procedures used to address this situation?

A. **1. 1B NV Pump auto-starts, letdown remains in service.**
2. Crew should verify proper operation per OP/1/A/6200/001 (*Chemical and Volume Control System*).

B. **1. All charging is lost, letdown remains in service.**
2. Crew should enter AP/1/A/5500/012 (*Loss of Charging or Letdown*), Case I (*Loss of Charging*).

C. **1. All charging is lost, letdown will automatically isolate.**
2. Crew should enter AP/1/A/5500/012 (*Loss of Charging or Letdown*), Case I (*Loss of Charging*).

D. **1. All charging is lost, letdown will automatically isolate.**
2. Crew should enter AP/1/A/5500/012 (*Loss of Charging or Letdown*), Case II (*Loss of Letdown*).

Distracter Analysis:

A. **Incorrect**: The 1B NV pump does not auto-start, letdown isolates
Plausible: If student believes the alternate NV pump auto-starts. Many systems have alternate pumps that auto-start. If the 1B NV pump auto-started, letdown would not isolate.

B. **Incorrect**: Letdown isolates.
Plausible: If the student does not realize that letdown auto- isolates on loss of both charging pumps.

C. **Correct**: Restoring charging is the priority.

D. **Incorrect**: Need to restore charging before restoring letdown.
Plausible: If student thinks that restoring letdown is a higher priority than restoring charging.

Level: RO Exam

KA: SYS 004 K6.04 (2.8/3.1)

Lesson Plan Objective: PS-NV 29, 36

Source: New

Level of knowledge: memory

References:
1. OP-CN-PS-NV pages 10-12, 24, 28
2. AP-12 pages 1-3

SYS 004 K6.04 (2.8/3.1) 004 Chemical Volume Control K6 Knowledge of the effect of a loss or malfunction on the following CVCS components: K6.04 Pumps 2.8 3.1(CFR: 41.7 / 45.7)

Objective: PS-NV-29: Given a set of specific plant conditions and required procedures, apply the rules of usage and outstanding PPRBs to identify the correct procedure flowpath and necessary actions.

PS-NV-36: Given a change in NV and/or NI pump availability, identify the resulting changes in operating strategy and evaluate changes in operating margins.

Bank Question: 1210 ***Answer: D***

1 Pt(s) Unit 1 is shutting down for refueling. Given the following sequence of events and conditions:

- NC temperature is 215°F.
- Both trains of ND are in service.
- A complete loss of offsite power occurs.
- The crew is responding using AP/1/A/5500/007 (*Loss of Normal Power*), Case I (*Loss of Normal Power to an Essential Train*)

Assuming all automatic actions occur as designed, what is the minimum action required to restore forced cooling to the NC System?

A. Verify the ND pumps are restarted by the D/G sequencer.

B. Depress the "ON" pushbutton for both ND Pumps.

C. Depress both D/G Sequencer "RESET" pushbuttons.

D. Depress both D/G Sequencer "RESET" pushbuttons, then, depress the "ON" pushbutton for both ND Pumps.

Distracter Analysis:

A. **Incorrect**: The ND pumps are not started by the D/G sequencer on a LOOP when there is no concurrent SI signal.
Plausible: The ND pumps are automatically sequenced on for a LOCA when an SI signal is present.

B. **Incorrect**: The D/G sequencer must first be reset before the ND pumps can be restarted.
Plausible: If the candidate things that they can be restarted manually.

C. **Incorrect**: Must also manually start the ND pumps.
Plausible: Partially correct – this action is 1 of 2 actions that must be done.

D. **Correct**: Per AP-7 step 8.

Level: RO Exam

KA: APE 056 G2.1.23 (3.9/4.0)

Lesson Plan Objective: none

Source: New

Level of knowledge: comprehension

References:
1. AP-7 page 3

K/A APE 056 AG2.1.23: Loss of Offsite Power - 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 45.2 / 45.6)

Objective: none

Bank Question: 1211.1 ***Answer: B***

1 Pt(s) Unit 1 is operating at 100% power when a main steam line ruptures inside containment.

Which one of the following selections is a complete list of valve groups that would receive a close signal?

A. MSIVs and MSIV bypass valves

B. MSIVs, MSIV bypass valves and S/G PORVs

C. MSIVs, MSIV bypass valves, S/G PORVs and S/G PORV block valves

D. MSIVs, MSIV bypass valves, S/G PORVs and CAPT steam supply valves

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Distracter Analysis:

A. **Incorrect**: MSI also closes S/G PORVs
Plausible: partially correct list.
B. **Correct**: This is the complete list.
C. **Incorrect**: MSI does not close S/G PORV block valves
Plausible: Closes S/G PORVs
D. **Incorrect**: MSI does not close CAPT steam supply valves
Plausible: This is an open path from the S/G and could be the source of a steam line rupture.

Level: RO Exam

KA: SYS 040 AK2.01 (2.6*/2.5)

Lesson Plan Objective: STM-SM 16

Source: New

Level of knowledge: memory

References:
1. OP-CN-STM-SM page 15

K/A SYS 040AK2.01: Knowledge of the interrelations between the Steam Line Rupture and the following: Valves 2.6*/2.5 (CFR 41.7 / 45.7)

Objective STM-SM-16 Describe the response of the SM system to a SM Isolation Signal

Bank Question: 1212 ***Answer: C***

1 Pt(s) Unit 1 was operating at 100% power. Given the following sequence of events:

0200 – 1A D/G Battery Charger 1DGCA fails.
0700 – D/G 1A panel annunciator *E/5* (*Loss of DC Control Power*) alarms
0900 - A tornado results in a complete loss of the switchyard.

Assuming no actions have been taken to address the failed charger, which one of the following statements correctly describes the operating status of the 1A D/G and the reason for this status?

A. The 1A D/G starts because the auto-start function is not dependent on DC control power.

B. The 1A D/G starts because the loads of the failed charger are supplied from vital power through auctioneering diode 1VADA.

C. The 1A D/G did not start because it has lost all control power.

D. The 1A D/G started but did not tie to the bus because the sequencer has lost all control power.

Distracter Analysis:

A. **Incorrect**: D/G will not start. DC control power is required for the D/G to start.
Plausible: If the candidate thinks that the battery will carry DC control power loads for > 2 hours.

B. **Incorrect**: D/G will not start.
Plausible: if student thinks that control power to the D/G is available thru VADA. This is reversed, the DGCA supplies power thru VADA to the sequencer.

C. **Correct**:

D. **Incorrect**: D/G will not start.
Plausible: The sequencer has normal power available thru 1EDA (from vital power)

Level: RO Exam

KA: APE 058 AK1.01 (2.8/3.1*)

Lesson Plan Objective: DG-DG1-14, 19

Source: New

Level of knowledge: comprehension

References:
1. OP-CN-DG-DG1 pages 13-16, 26

K/A APE 058AK1.01: Knowledge of the operational implications of the following concepts as they apply to Loss of DC Power: Battery charger equipment and instrumentation. 2.8/3.1* (CFR 41.8 / 41.10 / 45.3)

Objective: DG-DG1-14: Given a one-line diagram, explain how the EPQ system provides DC power to the major DC Loads.

DG-DG1 19: Explain the effect of a loss of DC control power on the Diesel Generator while it is shutdown.

Level: RO Exam

KA: G2.2.34 (2.8/3.2*)

Lesson Plan Objective: RT-RB-8, 9

Source: new

Level of knowledge: comprehension

References:
1. BNT-RT06

K/A G2.2.34: Knowledge of the process for determining the internal and external effects on core reactivity. (CFR: 43.6) IMPORTANCE RO 2.8 SRO 3.2*

Objectives RT-RP 8: Construct a drawing of xenon concentration versus power, for any power history; show Xe concentration changes, with response following a startup and shutdown.

RT-RP-9: Describe samarium production and removal, list values for samarium worth at equilibrium and peak after shutdown including formulas.