Draft Submittal
(Pink Paper)

CATAWBA DECEMBER 2005 EXAM

05000413/2005301 & 05000414/2005301

DECEMBER 5 - 8, 2005
DECEMBER 14, 2005 (WRITTEN)

RO/SRO

Reactor Operator Written Exam

1-50

12/19/05

Question: 05-01

1 Pt(s)

In each of the four accidents below, the control room operators take prompt actions and manually trip the reactor BEFORE any automatic trip setpoint is reached.

Considering only the manual trip signal, and its associated outputs; which effect on the unit is minimized or reduced by additional ~~an~~ automatic system response?

Consider each accident separately.

A. Reactor coolant system temperature decrease due to excessive steam flow.

B. Reactor power excursion due to excessive feedwater flow.

C. Pressurizer pressure decrease due to a LOCA.

D. Steam generator level decrease due to a main feedwater piping rupture.

Question: 05-01 *Answer: A*

LEVEL:	RO / SRO

K/A	EPE007	Title	Reactor Trip
	G2.1.27	Description	Knowledge of system purpose and or function. **(CFR: 41.7)**
		Importance	2.8/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CF-CF rev 035 page 25 of 32
Objectives	8
REFERENCES	Lesson plan information (See Below)
Author	RJK
Time	7/1/2005 3:59 PM 42 minutes

Distracter Analysis:

All automatic reactor trips perform their function automatically inserting control rods based on plant conditions reaching a proscribed setpoint. When inserted heir function is then complete. The follow up actions of the reactor trip are based on the presence of the P-4 signal from the trip system.

In the case of the 4 accidents, the manually generated P-4 provides the following additional actions:

- Turbine Trip
- **Feedwater Isolation less than Low Tave(564°F)**
- Arms condenser dumps
- Allows block of Safety Injection Signal after time delay
- **Runs back CF pumps on reactor trip**

Based on these signals, the only accident to benefit from the trip Choice A. The CF system is removed to prevent a challenge to NC system integrity from excessive cooldown.

Question: 05-01

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1 Pt(s) Which of the following correctly describes the reason that feedwater isolation occurs following a reactor trip when Tavg decreases to less than 564 ºF?

A. To prevent a challenge to NC system integrity.

B. To prevent a challenge to S/G integrity.

C. To prevent a challenge to S/G heat removal capabilities.

D. To prevent a challenge to NC system heat removal capabilities.

Question*: 05-01** ***Answer: A

LEVEL:	RO / SRO

K/A	EPE007	**Title**	Reactor Trip
	G2.1.27	**Description**	Knowledge of system purpose and or function. **(CFR: 41.7)**
		Importance	2.8/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CF-CF rev 035 page 25 of 32
Objectives	8
REFERENCE S	Lesson plan information (See Below)
Author	RJK
Time	7/1/2005 3:59 PM 42 minutes

Distracter Analysis:

A. Correct:

B. Incorrect: Not a challenge to the S/Gs, but since CF is a connected system to the S/Gs, this could lead an operator to use this reason.

C. Incorrect: Not a challenge to heat removal. But removing CF from the steam generators would affect heat removal if the backup systems (CA) were to fail.

D. Incorrect: Not a challenge to NC heat removal, but isolating CF from the S/Gs is logical on an trip/accident since CA is the backup and CF is not a safety related system.

Events which result in a CF Isolation fall into 3 categories.

NC System integrity (breached or in jeopardy)
NC System heat removal (lost or in jeopardy)
Containment integrity in jeopardy.

CF ISOLATIONS FROM:

Hi Hi S/G Level (Challenges NC heat removal & integrity)
Reactor Trip W/Lo Tave (challenges NC integrity)
Safety Injection (S_S)

Low Pzr Press. (challenges NC Integrity)
Hi Containment Pressure (challenges containment)

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
8	Discuss the CF System's major components response to the following conditions: • Loss of one CFP with greater than 56% load. • Full Load Rejection from Rated Power. • Hi Hi Doghouse Level (Inner or Outer) (Train A or B) • CF Isolation Signal (Train A or B) • Hi Hi S/G Level (P-14) • Safety Injection Signal (S_S) • Auto start of CA • Transfer of controls to the SSF • Transfer of controls to the ASP			X	X	X
9	Describe the operation of the ATWS Mitigation System Actuation Circuitry.			X	X	X
10	Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
11	State the system designator and nomenclature for major components	X				

5. Reactor Trip W/Lo Tave (Obj. #8)
    a) CF Isolation on a Reactor Trip with Lo Tave ensures that NC overcooling will not continue due to CF flow to S/G. Lo Tave could have been result of SM Line break or other excess steam demand or an overfeed resulting in overcooling.
    b) CF Isolation based on Reactor Trip with Lo Tave occurs when Reactor Trip breakers are open and 2/4 Tave are less the 564^{O}F. The Tave setpoint is based on terminating the CF and thereby limiting the cooldown to greater than the Tave value assumed in the FSAR for assurance of minimum SDM.
    c) The response of Unit 1 and Unit 2 to Reactor Trip W/Lo Tave
        1) CF Isolation signal generated, closing appropriate valves.
        2) Affected units CF pumps runback to min speed (2975 rpm) on Rx Trip.
6. Safety Injection Signal (Ss) (Obj.#8)
    a) CF Isolation on any condition which generates a Safety Injection Signal (Ss) ensures that the "Non Safety" CF System is not being used to feed S/G.
    b) The response of Unit 1 and Unit 2 to Ss.
        1) CF Isolation signal generated, closing appropriate valves.
        2) The affected units CF Pumps trip directly on S_S.

F. Auto Start of CA (Obj.#8)
1. To prevent loss of S/G inventory due to backflow, certain CF components receive auto close signals on Auto Start of CA.
2. On Unit 1 and Unit 2 the "S/G CF Containment Isol. Bypass Valves" and the "S/G CA Nozzle Tempering Isolations" Close.

G. Transfer to SSF (Obj. #8)
1. During postulated sabotage and fire events when the SSF is manned, certain CF components receive Auto Close signals on Transfer to SSF to prevent loss of S/G inventory.
2. The Unit 1 and Unit 2 valves receiving auto close signals are the "S/G CF Cont Isol. Bypass" valves and the "S/G CA Nozzle Tempering Isolations.

H. Transfer to the ASP (Obj # 8)
1. The Unit 1 and Unit 2 valves receiving auto close signals are the “S/G CF Bypass to CA Nozzle”, “S/G CF Ctrl”, “S/G CF Byp Ctrl”, and the “S/G CF Cont Isol”.

Question*: *05-02

1 Pt(s) Given the following:

- Indicated pressurizer level rapidly increases to 100%.
- Containment pressure and humidity are increasing.
- Pressurizer pressure is slowly decreasing.

Which ONE of the following events is the cause for these indications?

A. Pressurizer level transmitter diaphragm rupture.

B. Pressurizer surge line break.

C. Pressurizer impulse line break.

D. Pressurizer reference leg break.

Question: 05-02 *Answer: D*

LEVEL:	RO

K/A	APE00 8	**Title**	Pressurizer Vapor Space Accident
	AK2.02	**Description**	Knowledge of the interrelations between the Pressurizer Vapor Space: **(CFR 41.7 / 45.7)** Sensors and detectors
		Importance	2.7/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-PS-ILE rev 23 page 17 of 24
Objectives	6
REFERENCES	Lesson plan
Author	RJK
Time	7/5/2005 12:52 PM 93 minutes

Distracter Analysis: When the steam space is ruptured, the effect on the transmitter level is described below, Indicated level increases above actual. If you include the other parameters that accompany a break in the NCS/PRZ then you have a analysis/diagnostic determination per the K/A.

A. **Incorrect**: This causes equalization with an indicated level increasing to 100% but does not cause the containment conditions listed.

B. **Incorrect**: Level would be lower. If the leak grows, eventually there would be a rapid level decrease, but as a leak grows, it may act like level on "impulse side".

C. **Incorrect**: This causes a low level only but this can easily be confused with reference leg failures.

D. **Correct**:

Page 17 of 24 Mechanical Faults

Break in reference Leg

Removes high pressure reference side of transmitter.
Results in indicated level to read high.
Results in the indicated level being higher than actual level.

Break on PZR line to transmitter [low pressure (impulse) side]

Allows actual level pressure to be removed from diaphragm.
Reference leg pressure to be removed from diaphragm. (delta P Maximum)
Results in indicated level to decrease to zero.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Pressurizer Level Control (ILE) System.			X	X	
2	Describe the pressurizer level control program including values and signal sources for program development.			X	X	X
3	Describe why a cold calibrated channel is required.			X	X	
4	Describe the response of ILE system to a deviation of pressurizer level from program value.			X	X	X
5	Discuss control room controls and indications associated with ILE.			X	X	X
6	Describe all automatic functions, alarm and control, that occur when pressurizer level deviates from program level, including setpoint changes and level channel failures.			X	X	X
7	Describe protection signals, trips, interlocks and permissives associated with ILE including setpoints.			X	X	X
8	Describe the actions which must be taken to restore pressurizer heater operation following a pressurizer low level heater cutoff.			X	X	X
9	Explain ILE system operation during startup, shutdown and normal operation.			X	X	
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X

TIME: 2.0 HOURS

g) T_{avg} fail high

1) No effect at 100% power

2) Less than 100% power, level will rise steadily to 55% Pzr lvl. Depending on severity may receive PZR Low Level Deviation Ann (-5%)

3) Operator action - Defeat defective T_{avg} channel

h) T_{avg} fail low

1) No effect (auctioneered Hi is used by the circuitry)

2) Operator action - Defeat defective T_{avg} channel

2. Mechanical Faults

a) Break in reference Leg

1) Removes high pressure reference side of transmitter.

2) Results in indicated level to read high.

b) Low level in reference leg.

1) Decreases high pressure reference side of transmitter.

2) Results in indicated level increase.

3) Caused by insufficient steam condensing in reference pot or small leak.

c) Adverse Containment Conditions (greater than 3 PSIG in Containment)

1) Can result in reference leg temp. increase.

2) Causes the transmitter high pressure side to be at a lower pressure due to reduced water density.

3) Results in the indicated level being higher than actual level.

d) Break on PZR line to transmitter [low pressure (impulse) side]

1) Allows actual level pressure to be removed from diaphragm.

2) Reference leg pressure to be removed from diaphragm. (delta P Maximum)

3) Results in indicated level to decrease to zero.

Question: 05-03

1 Pt(s) Which one the following design features ensures that primary coolant leakage is isolated or contained during a small break LOCA?

A. High flow from the reactor coolant pump seal leakoffs closes the seal return isolation valves.

B. High flow from the reactor coolant pump thermal barrier closes the outlet isolation valve.

C. 1EMF-46A/B (Train A/B KC System Rad Monitor) Trip 2 automatically closes the KC surge tank vent isolation valves.

D. High flow from the seal return heat exchanger closes the seal return isolation valves.

Question*: 05-03** ***Answer: B

LEVEL:	RO/SRO

K/A	EPE009	**Title**	Small Break LOCA
	EK3.15	**Description**	Knowledge of the reasons for the following responses as the apply to the small break LOCA: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Closing of RCP thermal barrier outlet valves
		Importance	3.2/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-KC rev 51
Objectives	15
REFERENCES	Lesson plan page 12
Author	RJK
Time	7/5/2005 3:07 PM 6 minutes plus 44 from original.

Distracter Analysis: The KC outlet valves from the thermal barrier heat exchanger will automatically close when a high flow condition occurs. No other signal directly isolates this water flow.

A. **Incorrect**: There are no auto actions for this, but these valves do close on a LOCA.
B. **Correct**:
C. **Incorrect**: This used to be a design feature but was deleted via mod. It is plausible because many plants still have this feature and a seal water HX leak would cause this indication.
D. **Incorrect**: High flow does not close these valves, but these valves do close automatically on a LOCA (St).

Outlet valve auto closed @ 60 gpm after 30 seconds. (30 sec. time delay - Prevents Valve from Closing on Surge, From Pump

Question: 05-03

1 Pt(s) Which one the following design features ensures that primary coolant leakage is isolated or contained during a small break LOCA?

A. High flow from the reactor coolant pump seal leakoffs close the seal return isolation valves.

B. High flow from the reactor coolant pump thermal barrier closes the outlet isolation valve.

C. 1EMF-46A/B (Train A/B KC System Rad Monitor)Trip 2 automatically closes the KC surge tank vent isolation valves.

D. High level in the ventilation unit drain collecting tank closes the discharge valve to the liquid waste system.

Question*: 05-03** ***Answer: B

LEVEL:	RO/SRO

K/A	EPE009	**Title**	Small Break LOCA
	EK3.15	**Description**	Knowledge of the reasons for the following responses as the apply to the small break LOCA: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Closing of RCP thermal barrier outlet valves
		Importance	3.2/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-KC rev 51
Objectives	15
REFERENCES	Lesson plan page 12
Author	RJK
Time	7/5/2005 3:07 PM 23 minutes plus 44 from original.

Distracter Analysis: The KC outlet valves from the thermal barrier heat exchanger will automatically close when a high flow condition occurs. No other signal directly isolates this water flow.

A. **Incorrect**: There are no auto actions for this, but these valves do close on a LOCA.
B. **Correct**:
C. **Incorrect**: This used to be a design feature but was deleted via mod. It is plausible because many plants still have this feature and a seal water HX leak would cause this indication.
D. **Incorrect**: there are no level related isolation signals, but this tank is isolated on a LOCA

Outlet valve auto closed @ 60 gpm after 30 seconds. (30 sec. time delay - Prevents Valve from Closing on Surge, From Pump Start).

Question: 05-03

1 Pt(s) Which one the following design features ensures that primary coolant leakage is isolated or contained during a small break LOCA?

A. High flow from the reactor coolant pump seal leakoffs close the seal return isolation valves.

B. High flow from the reactor coolant pump thermal barrier closes the outlet isolation valve.

C. High level in the component cooling surge tank closes the reactor building non-essential header isolation valves.

D. High level in the ventilation unit drain collecting tank closes the discharge valve to the liquid waste system.

Question: 05-03 ***Answer: B***

LEVEL:	RO/SRO

K/A	EPE009	**Title**	Small Break LOCA
	EK3.15	**Description**	Knowledge of the reasons for the following responses as the apply to the small break LOCA: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Closing of RCP thermal barrier outlet valves
		Importance	3.2/3.2

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LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-KC rev 51
Objectives	15
REFERENCES	Lesson plan page 12
Author	RJK
Time	7/5/2005 3:07 PM 23 minutes plus 44 from original.

Distracter Analysis: The KC outlet valves from the thermal barrier heat exchanger will automatically close when a high flow condition occurs. No other signal directly isolates this water flow.

A. **Incorrect**: There are no auto actions for this, but these valves do close on a LOCA.
B. **Correct**:
C. **Incorrect**: There are no hi level auto actions but this does happen on a LO-LO tank level.
D. **Incorrect**: there are no level related isolation signals, but this tank is isolated on a LOCA

Outlet valve auto closed @ 60 gpm after 30 seconds. (30 sec. time delay - Prevents Valve from Closing on Surge, From Pump Start).

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
14	Discuss the supplementary actions for the loss of KC AP.			X	X	X
15	State the function of all KC System controls, interlocks, instrumentation, and minimum flow requirements.			X	X	X
16	Recognize the effect on the KC System when going to local at either Aux. Shutdown Panel.			X	X	X
17	Recognize and apply the necessary actions applicable to all KC System Annunciators.			X	X	X
18	State the system designator and nomenclature for major components.	X				

3. Components Cooled
   a) NC Pumps
      1) Thermal Barrier Hx
         (a) The inlet is a check valve and the outlet valve is auto closure capable.
         (b) All piping between the check valve inlet and outlet valve and the valves themselves are rated for NCS pressure and temp.
         (c) Relief set at 2485 psig. Output directed to the Containment Floor and Equipment Sump.
         (d) Outlet valve auto closed @ 60 gpm after 30 seconds. (30 sec. time delay - Prevents Valve from Closing on Surge, From Pump Start).
         (e) This arrangement of an inlet check valve and auto closed outlet valve should isolate any Thermal Barrier HX leak.
         (f) Flow manually throttled to 40 gpm/pump.
         (g) High flow alarm at 60 gpm, low flow alarm at 35 gpm.
      2) Pump Bearings
         (a) Upper Bearing
            (1) flow controlled to 165 gpm/pump
            (2) high flow alarm at 200 gpm
            (3) low flow alarm at 140 gpm
            (4) Flow controller for upper bearing located in Aux. building on 543' elevation.
         (b) Lower Bearing
            (1) manually adjusted for 6 gpm/pump
            (2) high flow alarm at 9.5 gpm
            (3) low flow alarm at 4 gpm
      3) KC Supply Header Flow to NCP's Low alarm @ 425 GPM. Annunciator alarm on AD20/21 requires verification of flowpath and monitoring motor bearing temperatures. Refer to AP/021 (Loss of KC) if alarm is due to a loss of flow. (OBJ. #14)
      4) NC Pump thermal barrier and oil cooler flows can be read on gauges on the 543 elevation of Aux building.

***Question*: 05-04**

1 Pt(s) At what point, during a large LOCA, is adequate core cooling by natural circulation lost?

A. As soon as water level in the reactor vessel decreases to less than 100%.

B. As soon as water level in the pressurizer decreases to less than 0%.

C. As soon as saturated conditions are reached in the reactor coolant loops.

D. As soon as steam voiding occurs in the steam generator tubes.

Question*: 05-04** ***Answer: D

LEVEL:	RO/SRO

K/A	EPE011	**Title**	Large Break LOCA
	EK1.01	**Description**	Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA: **(CFR 41.8 / 41.10 / 45.3)** Natural circulation and cooling, including reflux boiling.
		Importance	4.1/4.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-THF-HT rev
Objectives	17
REFERENCES	Lesson plan pages 10 and 11
Author	RJK
Time	7/6/2005 10:00 AM 63 minutes

Distracter Analysis:

A. **Incorrect**: Vessel level by itself would not necessary impede NC flow. The heat source is already lower than the heat sink. Steaming would still occur. But a low vessel level is one indication used for determining if there is adequate core cooling.

B. **Incorrect**: Once the tubes are covered, the height of the heat sink is set and will not improve or degrade. S/Gs levels in the emergency procedures are prevented from going above 50% to avoid overfill issues.

C. **Incorrect**: Saturated conditions in the loops will not impede NC heat transfer. Procedures assume a problem with core cooling when subcooling is lost and this may be viewed as a loss of cooling.

D. **Correct**: When the tubes void, this is a condition were reflux boiling would begin. This is not sufficient for adequate long term heat removal.

HT lesson plan pages 10 and 11

Detriments to Natural Circulation (Obj. #17)

1. Loss of heat sink
   Loss of S/G feed
   Loss of steam release capability
2. Overfeeding S/G
   Feeding S/G too fast Causes cold slug in Th side of U-tubes which reduces flow.
3. Gases in NC legs or S/G tubes
   Blocks flow path
4. Voiding in NC legs (two phase flow)
   - This will occur when the liquid in the loops reaches saturation.
   - When saturation is reached, the amount of energy transferred to each lbm of liquid will increase. As this occurs the density of the liquid will decrease and result in a higher delta P causing flow rate to increase.
   - This mode of natural circulation is sufficient to ensure heat removal.
   - [redacted] Steam rises up the hot leg is condensed in the S/G tubes and falls back down the hot leg to the core.

Question: 05-04

1 Pt(s) At what point, during a large LOCA, is adequate core cooling by natural circulation lost?

A. Water level in the reactor vessel decreases to less than 100%.

B. Water level in the pressurizer decreases to less than 0%.

C. Saturated conditions are reached in the reactor coolant loops.

D. Steam voiding occurs in the steam generator tubes.

Question: 05-04 ***Answer: D***

LEVEL:	RO/SRO

K/A	EPE011	**Title**	Large Break LOCA
	EK1.01	**Description**	Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA: **(CFR 41.8 / 41.10 / 45.3)** Natural circulation and cooling, including reflux boiling.
		Importance	4.1/4.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-THF-HT rev
Objectives	17
REFERENCES	Lesson plan pages 10 and 11
Author	RJK
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Distracter Analysis:

A. **Incorrect**: Vessel level by itself would not necessary impede NC flow. The heat source is already lower than the heat sink. Steaming would still occur. But a low vessel level is one indication used for determining if there is adequate core cooling.

B. **Incorrect**: Once the tubes are covered, the height of the heat sink is set and will not improve or degrade. S/Gs levels in the emergency procedures are prevented from going above 50% to avoid overfill issues.

C. **Incorrect**: Saturated conditions in the loops will not impede NC heat transfer. Procedures assume a problem with core cooling when subcooling is lost and this may be viewed as a loss of cooling.

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Detriments to Natural Circulation (Obj. #17)

1 Loss of heat sink
  Loss of S/G feed
  Loss of steam release capability
2 Overfeeding S/G
  Feeding S/G too fast Causes cold slug in Th side of U-tubes which reduces flow.
3 Gases in NC legs or S/G tubes
  Blocks flow path
4 Voiding in NC legs (two phase flow)
  - This will occur when the liquid in the loops reaches saturation.
  - When saturation is reached, the amount of energy transferred to each lbm of liquid will increase. As this occurs the density of the liquid will decrease and result in a higher delta P causing flow rate to increase.
  - This mode of natural circulation is sufficient to ensure heat removal.
  - If severe voiding occurs, the S/G tubes will void and the heat removal will be by reflux cooling. Steam rises up the hot leg is condensed in the S/G tubes and falls back down the hot leg to the core.

Question: 05-04

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1 Pt(s) At which point, during a large LOCA, is adequate core cooling by natural circulation lost?

A. Liquid level begins to decrease in the reactor vessel.

B. Levels increase above no-load levels in the steam generators.

C. Saturated conditions are reached in the reactor coolant loops.

D. Steam voiding occurs in the steam generator tubes.

Question: 05-04 ***Answer: D***

LEVEL:	RO/SRO

K/A	EPE011	**Title**	Large Break LOCA
	EK1.01	**Description**	Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA: **(CFR 41.8 / 41.10 / 45.3)** Natural circulation and cooling, including reflux boiling.
		Importance	4.1/4.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
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Objectives	17
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Distracter Analysis:

A. **Incorrect**: Vessel level by itself would not necessary impede NC flow. The heat source is already lower than the heat sink. Steaming would still occur. But a low vessel level is one indication used for determining if there is adequate core cooling.

B. **Incorrect**: Once the tubes are covered, the height of the heat sink is set and will not improve or degrade. S/Gs levels in the emergency procedures are prevented from going above 50% to avoid overfill issues.

C. **Incorrect**: Saturated conditions in the loops will not impede NC heat transfer. Procedures assume a problem with core cooling when subcooling is lost and this may be viewed as a loss of cooling.

D. **Correct**: When the tubes void, this is a condition were reflux boiling would begin. This is not sufficient for adequate long term heat removal.

HT lesson plan pages 10 and 11

Detriments to Natural Circulation (Obj. #17)

1. Loss of heat sink
   Loss of S/G feed
   Loss of steam release capability
2. Overfeeding S/G
   Feeding S/G too fast Causes cold slug in Th side of U-tubes which reduces flow.
3. Gases in NC legs or S/G tubes
   Blocks flow path
4. Voiding in NC legs (two phase flow)
   - This will occur when the liquid in the loops reaches saturation.
   - When saturation is reached, the amount of energy transferred to each lbm of liquid will increase. As this occurs the density of the liquid will decrease and result in a higher delta P causing flow rate to increase.
   - This mode of natural circulation is sufficient to ensure heat removal.
   - If severe voiding occurs, the S/G tubes will void and the heat removal will be by reflux cooling. Steam rises up the hot leg is condensed in the S/G tubes and falls back down the hot leg to the core.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Define 'Heat Transfer'.			X	X	X
2	State the three ways heat is transferred in a nuclear power plant.			X	X	X
3	Define 'Conduction' heat transfer.			X	X	X
4	Explain the variables that affect the rate of conduction.			X	X	X
5	List the formulas used for conduction.			X	X	X
6	Give an example of where conduction heat transfer occurs in the power plant.			X	X	X
7	Given a set of parameters, be able to work conduction problems.			X	X	X
8	Define 'Convection' heat transfer.			X	X	X
9	Explain the variables that affect the rate of convection.			X	X	X
10	List the formulas used for convection.			X	X	X
11	Give an example of convection heat transfer in the power plant.			X	X	X
12	Given a set of parameters, be able to work convection problems.			X	X	X
13	Define 'Natural Circulation'.			X	X	X
14	List the characteristics of a power plant that are required for natural circulation.			X	X	X
15	Describe the parameters used to determine if natural circulation exists.			X	X	X
16	Explain what plant conditions the operator maintains to enhance natural circulation.			X	X	X
17	Describe what plant conditions can impede natural circulation.			X	X	X
18	Define 'Radiation' heat transfer.			X	X	X
19	Explain the variables that affect the rate of radiation heat transfer.			X	X	X
20	Give an example of radiation heat transfer in the power plant.			X	X	X
21	Define 'Departure From Nucleate Boiling'.			X	X	X
22	Explain how DNB occurs in a nuclear reactor.			X	X	X
23	Describe the undesirable effects of DNB.			X	X	X
24	List the parameters that effect DNB.			X	X	X

c) A complete flow path - NC piping

d) Difference in height with sink above source - S/G is higher than core.

1) The centerline of the core (source) to the centerline of S/G (sink).

(a) The sink is considered to be the centerline of the heat xfer area.

(b) In a OTSG this can be varied significantly by varying the S/G water level. In a U-tube S/G, however, the centerline will stay constant as long as water level is kept in the NR, which is above the tubes.

C. Verification of Natural Circulation (Obj. #15)

1. In the NC system, when we lose forced convection cooling, natural circulation will be established "naturally" if all of our systems respond correctly.

2. When the NCP's trip, the Reactor will trip or will be tripped. The decay heat in the core will have to be removed and will be the heat source. We will still be drawing steam either thru the auxiliaries or steam dumps or both. The S/G levels will be maintained either by CF or CA. Heat added in the core will cause the NC fluid to rise to the S/G where heat is removed. The cooler water will then fall to the core to be reheated.

3. An operator must be able to verify that this occurs by looking at his plant instrumentation.

Indicators of natural circulation are: (Per Emergency Procedures)

a) NC Subcooling: > 0°F

b) Th steady or decreasing

c) Core exit thermocouple: stable or decreasing

d) S/G pressure constant (or decreasing with Th).

e) NC T-cold (Wide Range): near saturation temperature for S/G pressures.

4. If any of the above indications are outside the expected indication, natural circulation may not exist and there may be a blockage in the NC system.

5. Adequate time must be allowed to verify actions (steam dumping) have been effective. NC Loop Transit time will be increased to approximately 2 to 6 minutes. It may also take 15 to 30 minutes before Natural Circulation flow is fully established. This will be seen as a 'sluggish' NC system response to changes in steam demand.

D. Detriments to Natural Circulation (Obj. #17)

1. Loss of heat sink

a) Loss of S/G feed

b) Loss of steam release capability

2. Overfeeding S/G

   a) Feeding S/G too fast

      1) Causes cold slug in Th side of U-tubes which reduces flow.

3. Gases in NC legs or S/G tubes

   a) Blocks flow path

4. Voiding in NC legs (two phase flow)

   a) This will occur when the liquid in the loops reaches saturation.

   b) When saturation is reached, the amount of energy transferred to each lbm of liquid will increase. As this occurs the density of the liquid will decrease and result in a higher delta P causing flow rate to increase.

   c) This mode of natural circulation is sufficient to ensure heat removal.

   d) If severe voiding occurs, the S/G tubes will void and the heat removal will be by re-flux cooling.

      1) Steam rises up the hot leg is condensed in the S/G tubes and falls back down the hot leg to the core.

E. Enhancing Natural Circulation (Obj. #16)

1. The operator can maintain plant conditions to enhance natural circulation. These are:

   a) Maintain heat sink

      1) Keep S/G level adequate per procedures.

      2) Keep feed flow equal to steam flow

   b) Prevent NC system blockages.

      1) Prevent boiling-

         (a) Keep NC press > saturation pressure for hottest spot in NC system (keep subcooled)

2. Indications used:

   a) Th, Tc wide range

   b) Core Exit Thermocouple

   c) NC pressure

   d) S/G level

   e) S/G pressure

2.5 (Obj. #18) Radiation Heat Transfer - the emission of heat energy in the form of electromagnetic radiation from a body by virtue of its temperature.

Question: 05-05

1 Pt(s) Given the following conditions:

- Unit 2 is at 10% power
- 2A reactor coolant pump motor bearing temperature is 200°F and slowly increasing.

What is the correct course of action per AP/1/A/5500/008 (Malfunction of Reactor Coolant Pump)?

A. 2A NCP trip criteria are not currently met. Monitor 2A NCP and if pump trip criteria are exceeded, trip the reactor, and then trip 2A NCP.

B. Trip 2A NCP, then shutdown the reactor to Mode 3.

C. Trip the reactor, verify reactor power less than 5%, then trip 2A NCP.

D. Reduce reactor power to less than 5% (without tripping the reactor), then trip 2A NCP.

Question: 05-05 ***Answer: C***

LEVEL:	RO

K/A	APE015	**Title**	Reactor Coolant Pump (RCP) Malfunctions
	AA1.20	**Description**	Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions(Loss of RC Flow) **(CFR 41.7 / 45.5 / 45.6)** RCP bearing temperature indicators
		Importance	2.7/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PS-NCP
Objectives	12
REFERENCES	AP/2/A/5500/008 revision 13
Author	RJK
Time	7/6/2005 10:43 AM 72 minutes

Distracter Analysis:

A. **Incorrect**: This temperature is above the trip criteria, but an operator may think they have not yet reached a shutdown condition.

B. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. Since no automatic trip exists an operator may shutdown the pump first.

C. **Correct:**

D. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. But it is a recent NEW requirement prior to tripping any NCP.

Lesson plan Page 10/27

e) NCP must be secured if any motor brg temp greater than or equal to 195□F (Obj #12)

AP-08 Case 3 step 2 RNO

a. IF in Mode 1 or 2, THEN:

__ 1) IF all NC pumps affected, THEN place steam dumps in pressure mode.

__ 2) Trip reactor.

3) WHEN reactor power less than 5%, THEN perform the following:

__ a) Trip the affected NC pump(s).

Question: 05-05

1 Pt(s) Given the following conditions:

- Unit 2 is at 10% power
- 2A reactor coolant pump motor bearing temperatures is 217°F.

What is the correct course of action per AP/1/A/5500/008 (Malfunction of Reactor Coolant Pump)?

A. Continue monitoring 2A NCP until trip criteria is met.

B. Trip 2A NCP, then shutdown the reactor to Mode 3.

C. Trip the reactor, verify reactor power less than 5%, then trip 2A NCP.

D. Reduce reactor power to less than 5% (without tripping the reactor), then trip 2A NCP.

Question: 05-05 ***Answer: C***

LEVEL:	RO

K/A	APE015	**Title**	Reactor Coolant Pump (RCP) Malfunctions
	AA1.20	**Description**	Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions(Loss of RC Flow) **(CFR 41.7 / 45.5 / 45.6)** RCP bearing temperature indicators
		Importance	2.7/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PS-NCP
Objectives	12
REFERENCES	AP/2/A/5500/008 revision 13
Author	RJK
Time	7/6/2005 10:43 AM 72 minutes

Distracter Analysis:

A. **Incorrect**: These temperatures are above trip criteria, but an operator may think they have not yet reached a shutdown condition.

B. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. Since no automatic trip exists an operator may shutdown the pump first.

C. **Correct:**

D. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. But it is a recent NEW requirement prior to tripping any NCP.

Lesson plan Page 10/27

e) NCP must be secured if any motor brg temp greater than or equal to 195□F (Obj #12)

AP-08 Case 3 step 2 RNO

a. IF in Mode 1 or 2, THEN:

__ 1) IF all NC pumps affected, THEN place steam dumps in pressure mode.

__ 2) Trip reactor.

3) WHEN reactor power less than 5%, THEN perform the following:

__ a) Trip the affected NC pump(s).

Question: 05-05

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1 Pt(s) Given the following conditions:

- Unit 2 is at 10% power
- 2A reactor coolant pump (NCP) stator winding temperature is 319°F.
- 2A reactor coolant pump motor bearing temperatures is 217°F.

What is the correct course of action?

A. Continue monitoring 2A NCP until trip criteria is met.

B. Trip 2A NCP, then shutdown the reactor to Mode 3.

C. Trip the reactor, verify reactor power less than 5%, then trip 2A NCP.

D. Reduce reactor power to less than 5%, then trip 2A NCP.

Question*: 05-05** ***Answer: C

LEVEL:	RO

K/A	APE015	**Title**	Reactor Coolant Pump (RCP) Malfunctions
	AA1.20	**Description**	Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions(Loss of RC Flow) **(CFR 41.7 / 45.5 / 45.6)** RCP bearing temperature indicators
		Importance	2.7/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PS-NCP
Objectives	12
REFERENCES	AP/2/A/5500/008 revision 13
Author	RJK
Time	7/6/2005 10:43 AM 72 minutes

Distracter Analysis:

A. **Incorrect**: These temperatures are above trip criteria, but an operator may think they have not yet reached a shutdown condition.

B. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. Since no automatic trip exists an operator may shutdown the pump first.

C. **Correct:**

D. **Incorrect**: This is not allowed at CNS, the reactor must first be tripped. But it is a recent NEW requirement prior to tripping any NCP.

Lesson plan Page 10/27

e) NCP must be secured if any motor brg temp greater than or equal to 195°F (Obj #12)

AP-08 Case 3 step 2 RNO

a. **IF** in Mode 1 or 2, **THEN**:

__ 1) **IF** all NC pumps affected, **THEN** place steam dumps in pressure mode.

__ 2) Trip reactor.

3) **WHEN** reactor power less than 5%, **THEN** perform the following:

__ a) Trip the affected NC pump(s).

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
11	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
12	Evaluate NCP operations including: • NCP operability verification • NCP Starting duties • NCP malfunction • When immediate trip of the NCP is required			X	X	X
13	State the Immediate Actions of AP/04 from memory.			X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor Enclosure 1 (Foldout Page).**	
2. **Verify the following parameters for all NC Pumps:** __ • Stator winding temperature - LESS THAN 311°F __ • Motor bearing temperature - LESS THAN 195°F.	**Perform the following:** a. **IF** in Mode 1 or 2, **THEN**: __ 1) **IF** all NC pumps affected, **THEN** place steam dumps in pressure mode. __ 2) Trip reactor. 3) **WHEN** reactor power less than 5%, **THEN** perform the following: __ a) Trip the affected NC pump(s). __ b) Ensure the normal spray valve associated with the tripped NC pump(s) - IN MANUAL AND CLOSED. __ 4) **GO TO** EP/1/A/5000/E-0 (Reactor Trip Or Safety Injection). __ b. Trip the affected NC pump(s). __ c. Ensure the normal spray valve associated with the tripped NC pump(s) - IN MANUAL AND CLOSED. __ d. **GO TO** AP/1/A/5500/004 (Loss of Reactor Coolant Pump).
3. **Verify the following annunciators - DARK:** __ • 1AD-20, A/1 "KC SUPPLY HDR FLOW TO NCP BRGS LOW" __ • 1AD-21 A/1 "KC SUPPLY HDR FLOW TO NCP BRGS LOW".	__ **REFER TO AP/1/A/5500/021 (Loss Of Component Cooling).**

Question: 05-06

1 Pt(s) Given the following initial conditions:

- 1NV-294 (NV Pmps A&B Disch Flow Ctrl) in manual.
- 1NV-309 (Seal Water Injection Flow) in manual.
- pressurizer pressure is 2235 psig
- total seal water flow is 32 gpm
- charging line flow is 89 gpm

If pressurizer pressure is increased to 2300 psig, which one of the following sets of system parameter changes is correct?

A. Charging line flow decreases and total seal water flow decreases.

B. Charging line flow decreases and total seal water flow remains approximately the same.

C. Charging pump discharge header pressure increases and total seal water flow increases.

D. Charging pump discharge header pressure increases and total seal water flow remains approximately the same.

Question: 05-06 ***Answer: A***

LEVEL:	RO/SRO

K/A	APE022	**Title**	Loss of Reactor Coolant Makeup
	AK1.02	**Description**	Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Pump Makeup: **(CFR 41.8 / 41.10 / 45.3)** Relationship of charging flow to pressure differential between charging and RCS
		Importance	2.7/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-THF-FF rev 07
Objectives	12, 13, 14, 15
REFERENCES	Lesson plan: centrifugal pump laws. Pages 9 & 16
Author	RJK
Time	8/15/2005 3:50 PM 9 minutes

Distracter Analysis: Centrifugal pump laws require that the discharge header pressure increase and PZR pressure increases. This will not maintain the previous flow rates. Both charging line flow and total sealwater flow will decrease while pump discharge pressure increases.

A. Correct:
B. Incorrect:
C. Incorrect:
D. Incorrect:

***Question*: 05-06**

1 Pt(s) Given the following initial conditions:

- 1NV-294 (NV Pmps A&B Disch Flow Ctrl) in manual.
- 1NV-309 (Seal Water Injection Flow) in manual.
- Pressurizer pressure is 2235 psig.
- Total seal water flow 32 gpm
- Charging line flow 89 gpm

Pressurizer pressure is increased to 2300 psig, which of the following parameters will also increase?

1. Charging pump discharge header pressure
2. Total Seal Water Flow
3. Charging Line Flow

A. 1

B. 1, 2

C. 2, 3

D. 1, 2, 3

Question*: 05-06** ***Answer: A

LEVEL:	RO/SRO

K/A	APE022	**Title**	Loss of Reactor Coolant Makeup
	AK1.02	**Description**	Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Pump Makeup: **(CFR 41.8 / 41.10 / 45.3)** Relationship of charging flow to pressure differential between charging and RCS
		Importance	2.7/3.1

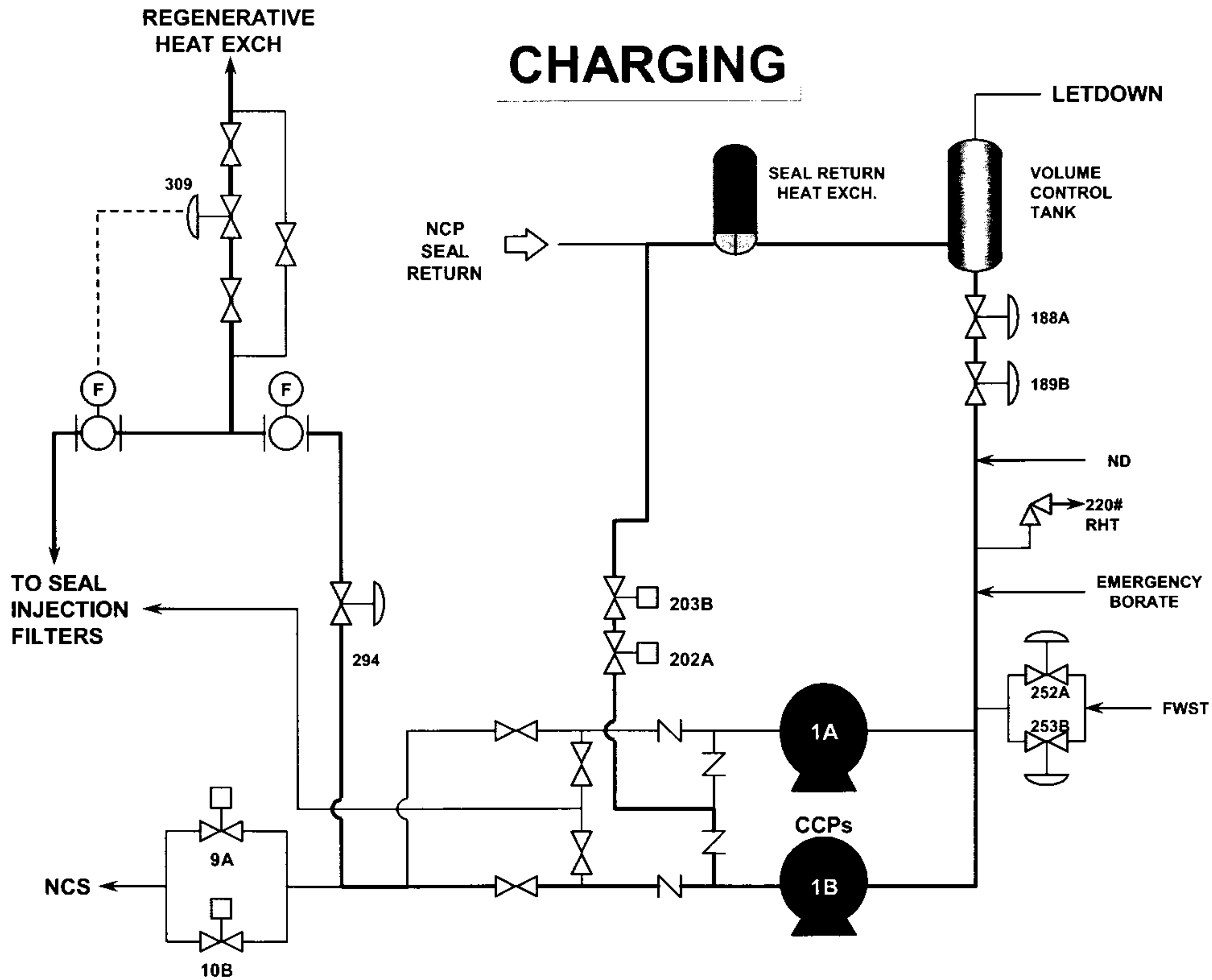
SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-THF-FF rev 07
Objectives	12, 13, 14, 15
REFERENCES	Lesson plan: centrifugal pump laws. Pages 9 & 16
Author	RJK
Time	8/15/2005 3:50 PM 9 minutes

Distracter Analysis: Centrifugal pump laws require that the discharge header pressure increase and PZR pressure increases. This will not maintain the previous flow rates.

A. Correct: See above.
B. Incorrect: Without an adjustment to NV-294, total flow decreases, but since pump discharge pressure is higher, that might equate to higher flow.
C. Incorrect: Without an adjustment no flows can increase. Higher pressure can be associated with higher flow rates.
D. Incorrect: The flows will decrease even if pump pressure increases, but higher discharge pressure can be equated with higher flow rates.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Define headloss.			X	X	X
2	Define friction.			X	X	X
3	Explain how a change in friction factor will affect friction Head Loss.			X	X	X
4	Explain how a change in pipe length will affect friction Head Loss.			X	X	X
5	Explain how a change in pipe diameter will affect friction Head Loss.			X	X	X
6	Explain how a change in fluid velocity will affect friction Head Loss.			X	X	X
7	Describe Laminar flow.			X	X	X
8	Describe Turbulent flow.			X	X	X
9	Sketch a typical system characteristic curve of head loss vs flow rate.			X	X	X
10	Explain the purpose of a pump.			X	X	X
11	State the different types of pumps.			X	X	X
12	Explain the theory of operation for a centrifugal pump.			X	X	X
13	Define pump head.			X	X	X
14	Explain how flowrate, head, and power vary with pump speed.			X	X	X
15	Given a set of parameters, be able to use the centrifugal pump laws.			X	X	X
16	Sketch a typical head vs flow curve for one centrifugal pump, 2 pumps in series and 2 pumps in parallel.			X	X	X
17	Determine from a curve, the operating point for a centrifugal charging pump in a given system.			X	X	X
18	Define NPSH available and NPSH required.			X	X	X
19	Explain the variables that affect NPSH.			X	X	X
20	Define Cavitation.			X	X	X
21	List the conditions and parameters that affect cavitation.			X	X	X
22	Explain how cavitation is detected.			X	X	X
23	Explain how cavitation is prevented or stopped.			X	X	X
24	Define pump runout.			X	X	X
25	Explain the problems associated with runout.			X	X	X

CHARGING


REGENERATIVE HEAT EXCH
309
NCP SEAL RETURN
SEAL RETURN HEAT EXCH.
LETDOWN
VOLUME CONTROL TANK
188A
189B
ND
220# RHT
EMERGENCY BORATE
TO SEAL INJECTION FILTERS
294
203B
202A
252A
253B
FWST
1A
1B
CCPs
9A
10B
NCS

2.3 System Characteristic curves (Obj #9)

A. The terms in the headloss equation can be graphically represented by what is called a headloss or system characteristic curve.

B. The headloss curve shows headloss vs. volume flow rate. The curve itself will be for a given set of conditions for F, L and D. The velocity squared term which is proportional to mass flow rate gives the curve its exponential shape.

1. The headloss vs. flow curve for a closed system is different than for an open system where static pressure is present in addition to the system headloss curve. The static pressure would be from a difference in height or pressure between the starting point and the discharge point.

2. System curve = h_L + static pressure

3. PUMPS AND PUMP OPERATIONS (Obj #10)

3.1 Centrifugal Pumps (Obj #11, 12)

A. Principle of Operation - As Fluid enters the suction of the pump, it undergoes a pressure drop. The impeller then increases the velocity of the fluid as the fluid moves along the impeller vanes. The fluid also sees an increase in area which will convert some of the velocity to pressure ($A\uparrow \rightarrow v\downarrow \rightarrow p\uparrow$). The fluid then passes into the volute where the rest of the velocity increase from the impeller is converted to pressure by another area increase.

B. Characteristics (Obj #13, 14)

1. For a given speed the pump head will decrease as volume flow rate increases. (Where pump head = discharge press - suction pressure)

2. Since most curves represent a fixed condition of h_p versus, volumetric flow rate (V) we need to change the pump speed or the number of stages within the pump to change its characteristic curve.

3. We can combine the h_L and h_p curves on one set of axis to determine where our system operating point is. The point where the two curves meet, is the point where the system operates.

4. Centrifugal Pump Laws (Obj #15)

a) The change in $\dot{V}$ α the change in speed. ($\Delta V \alpha \Delta N$)

$$\dot{V}_1 / \dot{V}_2 = N_1 / N_2$$

where: N = speed or RPM

$\dot{V}$ = ft^3/time

3.3 Open System Pump Operation

A. Definition: An open system is one in which both mass and energy may cross a system boundary.

B. Characteristics

1. A good example is the Condensate and Feed Systems

a) The condensate system starts at the hotwell and ends at the feedwater pump suction.

b) The feed system starts at the feed pump suction and ends at the nozzles in the steam generator.

2. A pump, in order to work properly, must overcome two types of pressures.

a) System headloss due to the components in the system for a given volume flow rate.

b) Static pressure due to a height change or external pressurizing force.

C. Feed Pump Operation

1. The feedwater pump must develop sufficient Delta P to maintain the level in the steam generator.

2. The feedwater pump has a variable speed feature to maintain adequate flow rates.

D. Emergency Core Cooling Pump vs. System Characteristic Curves

1. Upon the receipt of an ESF actuation, the charging pumps, Safety Injection and Decay Heat Removal Pumps all start.

2. By design, some pumps create enough Delta P to inject water into the core and some cannot.

3. As the reactor pressure decreases (caused by leak) the static head is reduced low enough for the lower head pumps to begin delivering water to the core.

4. Since some pumps are initially deadheaded, a recirc. line allows some flow through the pump until the pump begins to develop a volume flow rate.

3.4 Positive Displacement Pumps

A. Principle of Operations (Obj #30) - the pump is usually a reciprocating piston device which draws the fluid into a chamber on one stroke and then compresses the trapped fluid before releasing it into the system.

Question: 05-07

1 Pt(s) Unit 1 experienced a safety Injection due to a LOCA.

- All equipment operated correctly with the exception of 1A1 and 1A2 KC pumps which are not running.
- A transfer to cold leg recirculation is in progress when 1AD-07 F/8, KC TRAIN B TWO PUMP RUNOUT alarms.

Which of the following valve failure(s) could have caused the "B" train KC pump runout condition?

A. Reactor Building non-essential header isolation valves failed to close.

B. "A" and "B" train ND heat exchanger inlet valve failed open.

C. "B" train KC pump miniflow valve failed to close.

D. Auxiliary Building non-essential header isolation valves failed to close.

Question: 05-07 ***Answer: D***

LEVEL:	RO/SRO

K/A	APE026	**Title**	Loss of Component Cooling Water (CCW)
	AK3.04	**Description**	Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: **(CFR 41.5,41.10 / 45.6 / 45.13)** Effect on the CCW flow header of a loss of CCW
		Importance	3.5/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PSS-KC rev 51
Objectives	17
REFERENCES	OP/1/A/6100/010J Lesson plan page 9
Author	RJK
Time	7/7/2005 12:40 PM 75 minutes

Distracter Analysis: When FWST level reaches 37% coincident with a Ss signal the following automatic actions occur in the KC system: ND heat exchanger inlet isolation valves OPEN, Reactor Building NON-Essential header valves CLOSE, Auxiliary building NON-essential header isolation valves CLOSE.

A. **Incorrect**: This failure does not rob enough flow to cause 2 pump runout.
B. **Incorrect**: This is normal for both trains even if "A" train loses its KC pumps. But a high flow condition may be assumed if these valves open.
C. **Incorrect**: Miniflow failing open will not increase enough, but it is an abnormal condition requiring the operator to manually close this valve.
D. **Correct:**

KC lesson plan 2.1 E.3.e)
Whenever the ND Heat Exchanger is automatically aligned for flow during accident conditions (Sp or Low Level in FWST following Ss), the Aux. Building and Rx. Building Non-Essentials Headers will be automatically isolated to prevent running out the KC Pumps.

Question: 05-07

1 Pt(s) Given the following sequence of events:

- Unit 1 safety injection due to a LOCA
- Only "B" train component cooling (KC) pumps are operating.
- Transfer to cold leg recirculation is in progress
- 1AD-07 F/8, KC TRAIN B TWO PUMP RUNOUT - LIT

Which of the following valve failure(s) could have caused the "B" train KC pump runout condition?

A. "A" train ND heat exchanger inlet valve failed open.

B. "A" and "B" ND heat exchanger inlet valves failed open.

C. "B" train KC pump miniflow valve failed to close.

D. Non-essential header isolation valves failed to close.

***Question*: 05-07** ***Answer:* D**

LEVEL:	RO/SRO

K/A	APE026	**Title**	Loss of Component Cooling Water (CCW)
	AK3.04	**Description**	Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: **(CFR 41.5,41.10 / 45.6 / 45.13)** Effect on the CCW flow header of a loss of CCW
		Importance	3.5/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PSS-KC rev 51
Objectives	17
REFERENCES	OP/1/A/6100/010J Lesson plan page 9
Author	RJK
Time	7/7/2005 12:40 PM 75 minutes

Distracter Analysis: When FWST level reaches 37% coincident with a Ss signal the following automatic actions occur in the KC system: ND heat exchanger inlet isolation valves OPEN, Reactor Building NON-Essential header valves CLOSE, Auxiliary building NON-essential header isolation valves CLOSE.

A. **Incorrect**: This is normal. But high flow through the heat exchanger may be assumed if these valves are opened.

B. **Incorrect**: This is normal for both trains even if "A" train loses its KC pumps. But a high flow condition may be assumed if these valves open.

C. **Incorrect**: Miniflow failing open will not increase enough, but it is an abnormal condition requiring the operator to manually close this valve.

D. **Correct:**

KC lesson plan 2.1 E.3.e)
Whenever the ND Heat Exchanger is automatically aligned for flow during accident conditions (Sp or Low Level in FWST following Ss), the Aux. Building and Rx. Building Non-Essentials Headers will be automatically isolated to prevent running out the KC Pumps.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
14	Discuss the supplementary actions for the loss of KC AP.			X	X	X
15	State the function of all KC System controls, interlocks, instrumentation, and minimum flow requirements.			X	X	X
16	Recognize the effect on the KC System when going to local at either Aux. Shutdown Panel.			X	X	X
17	Recognize and apply the necessary actions applicable to all KC System Annunciators.			X	X	X
18	State the system designator and nomenclature for major components.	X				

D. EMF's (OBJ. #11)

1. Sample Flow is taken from the KC supply header.
2. EMF46A and B monitor the KC System and provide an alarm on high radiation. (No auto action associated with the EMF's.)
3. High radiation in the KC System is indicative of:
   a) NC in-leakage
   b) Possible KC activation

E. Essential Header (OBJ. #3 & 4)

1. Provides cooling to ESF Components
2. Any manual valves are normally open.
3. The only component normally isolated on essential header is ND HX.
   a) The ND HX inlet opens on:
      1) Sp or
      2) Low Level in FWST (37%) following S_S.
   b) Normal KC flow for the ND HX is 5000 gpm
   c) Low Flow Alarm at 4300 gpm (Annunciator)
   d) High flow alarm at 5600 gpm (Computer)
   e) Whenever the ND Heat Exchanger is automatically aligned for flow during accident conditions (Sp or Low Level in FWST following Ss), the Aux. Building and Rx. Building Non-Essentials Headers will be automatically isolated to prevent running out the KC Pumps.
   f) ND HX outlet valve is normally open and set to maintain 5000 gpm. This valve receives a fail open on Ss or loss of VI.
   g) Controls provided for isolation and flow control by the operator during Normal operations.
   h) S_s resets on MC-11 for 57 and 82 (ND HX outlet)

F/8

KC TRAIN B TWO PUMP RUNOUT

SETPOINT: 10,800 gpm increasing

ORIGIN: 1KCFT-5540

PROBABLE CAUSE:
1. **NOT** enough flow restriction in the KC Pump flow path.
2. Pipe rupture.
3. Both ND Heat Exchanger Inlet Isolation valves, 1KC-56A and 1KC-81B are open, KC cross-connects 1KC-1A, 1KC-2B, 1KC-50A, 1KC-53B, 1KC-3A, 1KC-18B, 1KC-230A, and 1KC-228B are open, and only one train of KC is in operation.
4. Loss of power at power panelboard 1EKPB Breaker #34.

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS:
1. Ensure pumps miniflow valves are closed.
2. **IF NOT** required to be in service, isolate ND Heat Exchanger(s).
3. **IF** both ND Heat Exchangers are required to be in service, start additional A Train KC Pump(s) as required per OP/1/A/6400/005 (Component Cooling System).
4. **IF** both ND Heat Exchangers are required to be in service **AND** A Train KC Pumps will **NOT** start, close KC cross-connects:
   - 1KC-1A (Aux Bldg Non-Ess Ret Hdr Isol)
   - 1KC-50A (Aux Bldg Non-Ess Hdr Isol)
   - 1KC-3A (Rx Bldg Non-Ess Ret Hdr Isol)
   - 1KC-230A (Rx Bldg Non-Ess Hdr Isol)
5. Verify 1EKPB Breaker #34 is "ON" (AB-560, FF-56, in 1EMXB).

SUPPLEMENTARY ACTIONS:
1. Monitor flow and discharge pressure.
2. **IF** pipe rupture is found, isolate if possible or secure B Train KC Pumps.
3. Refer to AP/1/A/5500/021 (Loss of Component Cooling).
4. Refer to Tech Spec 3.7.7.

REFERENCES:
1. CNEE-0142-01.58
2. CNEE-0142-01.35
3. CNEE-0142-01.60
4. NSM CN-11372

Question: 05-08

1 Pt(s) Unit 1 is operating at 100% power with the following conditions:

- Channel III pressurizer pressure has failed low.
- "Pzr Press Ctrl Select" switch is in the "1-2" position

How will a failure of the pressurizer pressure master to its maximum output affect pressurizer pressure?

A. Pressurizer heaters will energize. No PORVs will open. Pressure will increase to the reactor trip setpoint.

B. Pressurizer heaters will energize. 1NC-32B (Pzr PORV) and 1NC-36B (Pzr PORV) will cycle to maintain pressure between 2315 and 2335 psig.

C. Pressurizer sprays will open. 1NC-34A (Pzr PORV) will open and remain open. Pressure will decrease to the reactor trip setpoint.

D. Pressurizer sprays will open. 1NC-34A will open and reclose at 2185 psig. Pressure will decrease to the reactor trip setpoint.

Question: 05-08 ***Answer: A***

LEVEL:	RO

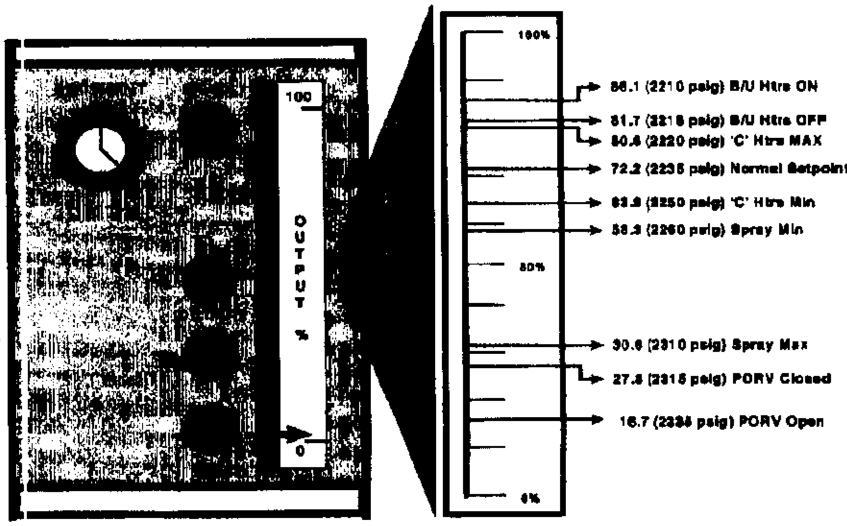
K/A	APE027	**Title**	Pressurizer Pressure Control System (PZR PCS) Malfunction
	AK2.03	**Description**	Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: **(CFR 41.7 / 45.7)** Controllers and positioners
		Importance	2.6/2.8

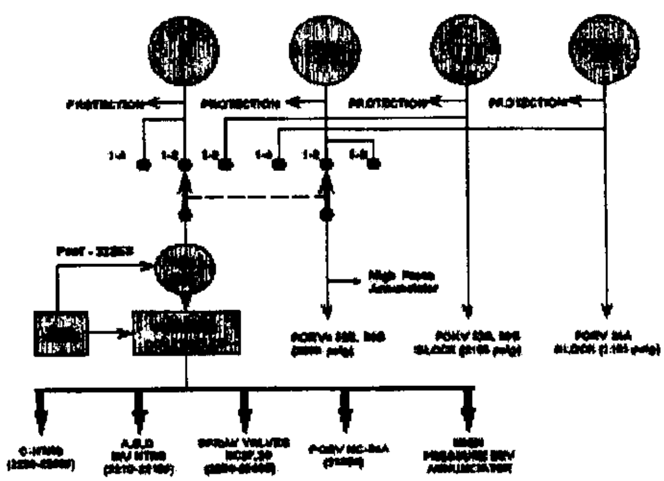
SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-IPE rev 27
Objectives	8 and 10
REFERENCES	Lesson plan information 25 and 26 and drawing below.
Author	RJK
Time	7/7/2005 1:40 PM 71 minutes pus 98 from original.

Distracter Analysis: The pressure master controls all heaters sprays and 1NC-34A. At 100% output, all heaters are stuck on. Pressure will cycle at the PZR PORV lift setpoint of 2335 using NC32/36. Without operator action this will go on and on. However, with Channel 3 PZR pressure already failed low, NC32/36 are blocked, therefore no PORVs are available. The pressure master 100% demand is counterintuitive in that 100% demand means pressure is too low instead of too high. This confusion makes C and D distractors to appear potentially correct.

A. **Correct:**
B. **Incorrect.**
C. **Incorrect:**
D. **Incorrect:**

PZR PRESSURE MASTER





***Question*: 05-08**

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1 Pt(s) Unit 1 is operating at 100% power when the pressurizer pressure master fails to its maximum output. Based on this failure what is the effect on pressurizer pressure?

A. Increase to reactor trip setpoint.

B. Cycle between 2310 and 2335 psig.

C. Cycle between 2210 and 2250 psig.

D. Decrease to reactor trip setpoint.

Question*: 05-08** ***Answer: B

LEVEL:	RO

K/A	APE027	**Title**	Pressurizer Pressure Control System (PZR PCS) Malfunction
	AK2.03	**Description**	Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: **(CFR 41.7 / 45.7)** Controllers and positioners
		Importance	2.6/2.8

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-IPE rev 27
Objectives	8 and 10
REFERENCES	Lesson plan information 25 and 26 and drawing below.
Author	RJK
Time	7/7/2005 1:40 PM 9 minutes pus 98 from original.

Distracter Analysis: At 100% output, all heaters are stuck on. Pressure will cycle at the PZR PORV lift setpoint of 2335. Without operator action this will go on and on.

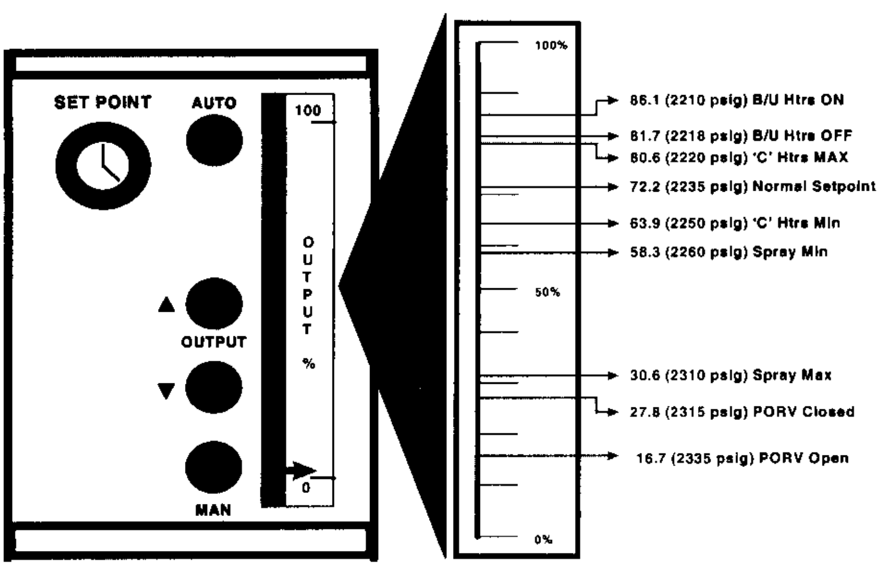
A. **Incorrect**: PORVs will open at 2335 without a trip, but max output may be thought of as maximum pressure being generated.

B. **Correct.**

C. **Incorrect**: Pressure is higher than this but it is the range of the cycling heaters.

D. **Incorrect**: Pressure increases with output, but a PORV opening may connect to a possible reactor trip on low pressure.

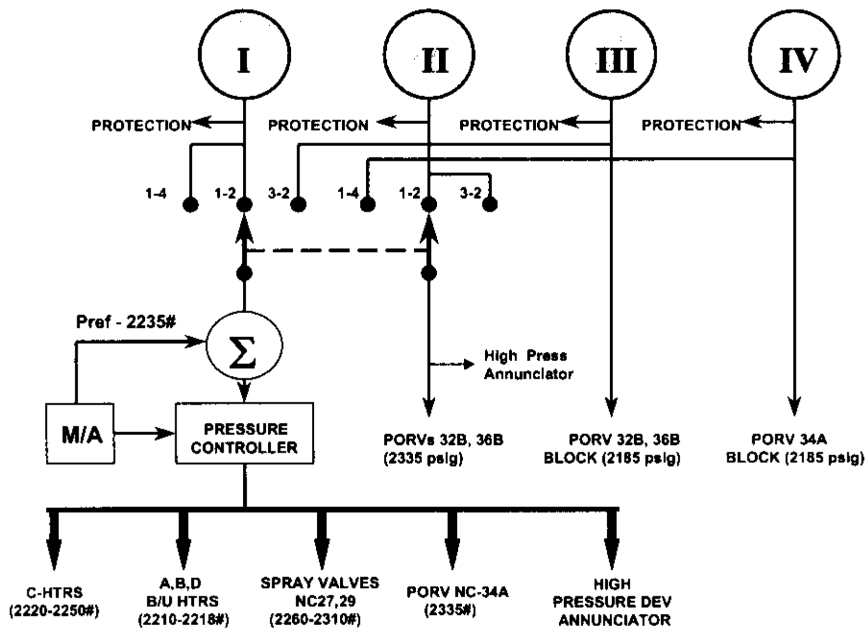
PZR PRESSURE MASTER



OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Pressurizer Pressure Control (IPE) System			X	X	
2	Describe the operation of the pressurizer spray valves			X	X	
3	Explain the purpose of the spray bypass flow			X	X	
4	Describe the operation of the pressurizer heaters			X	X	
5	Describe the operation of the PORVs and the PORV motor operated isolation valves			X	X	
6	List the power sources (electrical and pneumatic) for the pressurizer pressure control devices			X	X	
7	Describe the controls and indications associated with IPE			X	X	X
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			X	X	X
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			X	X	X
10	Describe the effect of adjusting the potentiometer on the pressurizer pressure master controller while the controller is in automatic			X	X	X
11	Describe the effect the integral function has on the output of the pressurizer pressure master controller			X	X	X
12	Describe how pressurizer pressure can be controlled in manual			X	X	X
13	List the protection signals and permissives, including setpoints, that are generated by pressurizer pressure			X	X	X
14	Describe the effect a failure of a pressurizer pressure channel (high or low) has on pressurizer pressure control			X	X	X
15	List the prerequisites which must be met to enable Low Temperature Overpressure protection (LTOP)			X	X	X
16	For each train of LTOP list the PORV used and which channels of temperature and pressure are used to generate an actuation signal including setpoints			X	X	X

2.6 Abnormal Operation (**OBJ. #14**)



A. Controlling Channel Fails High

1. Results

a) Sprays full on

b) PORV 34 opens

c) PORV 34 closes @ 2185 psig due to BLOCK from Chan 4

d) Low Pressure Rx trip @ 1945 psig, however, the criteria for an OTΔT Rx trip will likely be satisfied before reaching the 1945 psig setpoint.

e) Low Pressure SI @ 1845 psig

2. Operator should select an alternate channel for control (Refer to Immediate actions of AP/1(2)/A/5500/11 (Pressurizer Pressure Anomalies)

B. Controlling Channel Fails Low

1. Results

a) All heaters on

b) PORV NC34 will not actuate

c) Pressure rises

d) PORV's 32 and 36 open

e) Pressure will mod. between 2335 and 2315 psig.

2. Operator should select an alternate channel for control. (Refer to Immediate actions of AP/1(2)/A/5500/11 (Pressurizer Pressure Anomalies)

C. Backup Channel Fails High
   1. PORV 32 and 36 open
   2. Closed @ 2185 psig due to BLOCK from Chan 3

D. Backup Channel Fails Low
   1. PORV 32 and 36 will not actuate.

E. Channel 1 Fails High/Lo
   1. If selected as Controlling Channel then Controlling Channel Failed Hi/Lo
   2. If not selected no control effect

F. Channel 2 Fails Hi/Lo
   1. If selected as B/U Channel then B/U Channel Failed Hi/Lo
   2. If not selected no control effect

G. Channel 3 Fails High
   1. PORV's 32 and 36 won't block
   2. If selected as Controlling Channel then Controlling Channel Fails Hi

H. Channel 3 Fails Low
   1. PORV's 32 and 36 will not actuate
   2. If selected as Controlling Channel then Controlling Channel Fails Lo, but since no PORVs actuate, pressure will rise to safeties lifting.

I. Channel 4 fails high
   1. PORV 34 won't block
   2. If selected as B/U Channel then B/U Channel Fails hi

J. Channel 4 fails low
   1. PORV 34 won't actuate
   2. If selected as B/U Channel then B/U Channel Fails Lo

K. Reactor Trip
   1. When a reactor trip occurs Tavg is reduced very quickly as the rods fall into the core.
   2. This decrease in Tavg causes PZR level to decrease proportionately. As a result of the PZR level decrease, the steam space/water space ratio has greatly increased in the PZR which causes PZR pressure to decrease.
   3. PZR pressure control system should respond as required to bring PZR pressure back to normal operating pressure over a period of time.

Question: 05-09

1 Pt(s) Unit 2 has initiated bleed and feed per EP/2/A/5000/FR-H.1, Response to Loss of Heat Sink. Current S/G conditions are as follows:

S/G	pressure (psig)	WR level
2A	200, decreasing	2%, decreasing
2B	700, stable	10%, decreasing
2C	700, stable	7%, decreasing
2D	1000, increasing	14%, increasing

Once a source of feedwater is available which one of these is the most desirable steam generator to establish feedwater flow to?

A. 2A

B. 2B

C. 2C

D. 2D

Question*: 05-09** ***Answer: B

LEVEL:	RO/SRO

K/A	APE05 4	**Title**	Loss of Main Feedwater (MFW)
	AK1.02	**Description**	Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): **(CFR 41.8 / 41.10 / 45.3)** Effects of feedwater introduction on dry S/G
		Importance	3.6/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	application
Lesson	OP-CN-EP-FRH
Objectives	2 and 3
REFERENCE S	WOG Background for FR-H see attached statements.
Author	RJK
Time	7/7/2005 2:40 PM 72 minutes

Distracter Analysis: It is most desirable to choose a S/G that is neither faulted or ruptured. Among intact S/Gs the one with the highest level is used first.

A. **Incorrect**: This S/G is faulted based on indications provided.
B. **Correct**:
C. **Incorrect**: This S/G appears to be intact, however, it is not the highest level.
D. **Incorrect**: This S/G is ruptured based on indications provided.

FR-H.1 Background
Re-establishment of feed flow to a S/G may result in thermal or mechanical shocks to the S/G tubes that could result in tube leakage or tube rupture. If feed flow is re-established to a faulted steam generator and tube leakage resulted, control of the leakage would not be possible until the steam generator secondary boundary was restored. Flow restoration to a nonfaulted S/G will provide an effective and controllable secondary heat sink.

Question: 05-09 ***Answer: B***

LEVEL:	RO/SRO

K/A	APE054	**Title**	Loss of Main Feedwater (MFW)
	AK1.02	**Description**	Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): **(CFR 41.8 / 41.10 / 45.3)** Effects of feedwater introduction on dry S/G
		Importance	3.6/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	application
Lesson	OP-CN-EP-FRH
Objectives	2 and 3
REFERENCES	WOG Background for FR-H see attached statements.
Author	RJK
Time	7/7/2005 2:40 PM 72 minutes

Distracter Analysis: It is most desirable to choose a S/G that is neither faulted or ruptured. Among intact S/Gs the one with the highest level is used first.

A. **Incorrect**: This S/G is faulted based on indications provided.
B. **Correct**:
C. **Incorrect**: This S/G appears to be intact, however, it is not the highest level.
D. **Incorrect**: This S/G is ruptured based on indications provided.

FR-H.1 Background

Re-establishment of feed flow to a S/G may result in thermal or mechanical shocks to the S/G tubes that could result in tube leakage or tube rupture. If feed flow is re- [illegible] Flow restoration to a nonfaulted S/G will provide an effective and controllable secondary heat sink.

Question*: *05-09

1 Pt(s) Unit 2 has initiated bleed and feed per EP/2/A/5000/FR-H.1, Response to Loss of Heat Sink. Current S/G conditions are as follows:

S/G	condition	WR level
2A	intact	10%
2B	faulted	0%
2C	intact	0%
2D	ruptured	28%

Once a source of feedwater is available which of these is the least desirable steam generator to establish feedwater flow to?

A. 2A

B. 2B

C. 2C

D. 2D

Question: 05-09 ***Answer: B***

LEVEL:	RO/SRO

K/A	APE05 4	**Title**	Loss of Main Feedwater (MFW)
	AK1.02	**Description**	Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): **(CFR 41.8 / 41.10 / 45.3)** Effects of feedwater introduction on dry S/G
		Importance	3.6/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-FRH
Objectives	2 and 3
REFERENCES	WOG Background for FR-H see attached statements.
Author	RJK
Time	7/7/2005 2:40 PM 72 minutes

Distracter Analysis:

A. **Incorrect**: Intact is always more desirable than faulted, with level at 10%, may choose the other intact with 0% to fill first.

B. **Correct**:

C. **Incorrect**: Intact is always more desirable than faulted, with level at 0%, may choose the other intact with 10% to fill first to avoid tube damage.

D. **Incorrect**: This is acceptable as compared to a faulted if neither intact s/g is available.

FR-H.1 Background

Re-establishment of feed flow to a S/G may result in thermal or mechanical shocks to the S/G tubes that could result in tube leakage or tube rupture. If feed flow is re-established to a faulted steam generator and tube leakage resulted, control of the leakage would not be possible until the steam generator secondary boundary was restored. Flow restoration to a nonfaulted S/G will provide an effective and controllable secondary heat sink.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	STA	PTRQ
1	State the purpose of Function Restoration procedures EP/1/A/5000/FR-H Series - Heat Sink			X	X	X	X
2	State the Bases for all NOTES and CAUTIONS in Function Restoration procedures EP/1/A/5000/FR-H Series - Heat Sink			X	X	X	X
3	Explain the Bases for all steps in each of Function Restoration procedures EP/1/A/5000/FR-H Series - Heat Sink			X	X	X	X
4	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			X	X	X	X

STEP 2 CAUTION 1 : IF a non-faulted S/G is available, THEN feed flow should only be established to non-faulted S/G(s) in subsequent steps.

PURPOSE:

To alert the operator to not re-establish feed flow to a faulted S/G if an intact or ruptured steam generator is available to receive the feed flow.

APPLICABLE ERG BASIS:

Re-establishment of feed flow to a S/G may result in thermal or mechanical shocks to the S/G tubes that could result in tube leakage or tube rupture. If feed flow is re-established to a faulted steam generator and tube leakage resulted, control of the leakage would not be possible until the steam generator secondary boundary was restored. Flow restoration to a nonfaulted S/G will provide an effective and controllable secondary heat sink.

PLANT SPECIFIC INFORMATION:

KNOWLEDGE/ABILITY:

Question: 05-10

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1 Pt(s) A caution statement in EP/1/A/5000/E-3, Steam Generator Tube Rupture, states that safety injection must be terminated when termination criteria is met to avoid ____________________.

A. over-filling the pressurizer

B. over-filling the ruptured steam generator

C. over-pressurizing the reactor coolant system

D. over-pressurizing the ruptured steam generator

Question*: 05-10** ***Answer: B

LEVEL:	RO/SRO

K/A	EPE038	**Title**	Steam Generator Tube Rupture
	EK3.09	**Description**	Knowledge of the reasons for the following responses as the apply to the SGTR: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Criteria for securing/throttling ECCS
		Importance	4.1/4.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-E4
Objectives	13
REFERENCES	WOG Background for E-3 procedure (see attached statement)
Author	RJK
Time	7/8/2005 12:12 PM 25 minutes

Distracter Analysis:

A. **Incorrect**: Not a priority in tube ruptures, but is an issue with SLB induced safety injections.

B. **Correct**: See attached statements below.

C. **Incorrect**: Not possible in tube ruptures, but is an issue with SLB induced safety injections.

D. **Incorrect**: This would only occur AFTER the S/G level is increased to the relief valves. Though pressures would increase with NC hot water.

WOG Background statement for Caution in EP-E-3

STEP 23 CAUTION 1 : S/I must be terminated when termination criteria are satisfied to prevent overfilling the ruptured S/G(s).

PURPOSE:

To alert the operator that primary-to-secondary leakage will continue until S/I flow is terminated.

APPLICABLE ERG BASIS:

As previously demonstrated (see Step 20), S/I termination is necessary to control reactor coolant inventory and stop primary-to-secondary leakage. If S/I flow is not terminated, leakage into the secondary will eventually fill the steam generator with water and lift the atmospheric relief valves. This could damage the relief valve and main steamline which would complicate subsequent recovery and aggravate the radiological consequences. Hence, S/I must be terminated when the criteria in subsequent steps are satisfied to prevent steam generator overfill.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the Purpose of EP/1/A/5000/E-3 (Steam Generator Tube Rupture)			X	X	X
2	State the Purpose of EP/1/A/5000/ES-3.1 (Post-SGTR Cooldown Using Backfill)			X	X	X
3	State the Purpose of EP/1/A/5000/ES-3.2 (Post-SGTR Cooldown Using Blowdown)			X	X	X
4	State the Purpose of EP/1/A/5000/ES-3.3 (Post-SGTR Cooldown Using Steam Dump)			X	X	X
5	State the Purpose of EP/1/A/5000/ECA-3.1 (SGTR With Loss of Reactor Coolant-Subcooled Recovery Desired)			X	X	X
6	State the Purpose of EP/1/A/5000/ECA-3.2 (SGTR With Loss of Reactor Coolant-Saturated Recovery Desired)			X	X	X
7	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/E-3 (Steam Generator Tube Rupture)			X	X	X
8	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-3.1 (Post-SGTR Cooldown Using Backfill)			X	X	X
9	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-3.2 (Post-SGTR Cooldown Using Blowdown)			X	X	X
10	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-3.3 (Post-SGTR Cooldown Using Steam Dump)			X	X	X
11	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ECA-3.1 (SGTR With Loss of Reactor Coolant-Subcooled Recovery Desired)			X	X	X
12	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ECA-3.2 (SGTR With Loss of Reactor Coolant-Saturated Recovery Desired)			X	X	X
13	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/E-3 (Steam Generator Tube Rupture)			X	X	X

STEP 23 CAUTION 1 : S/I must be terminated when termination criteria are satisfied to prevent overfilling the ruptured S/G(s).

PURPOSE:

To alert the operator that primary-to-secondary leakage will continue until S/I flow is terminated.

APPLICABLE ERG BASIS:

As previously demonstrated (see Step 20), S/I termination is necessary to control reactor coolant inventory and stop primary-to-secondary leakage. If S/I flow is not terminated, leakage into the secondary will eventually fill the steam generator with water and lift the atmospheric relief valves. This could damage the relief valve and main steamline which would complicate subsequent recovery and aggravate the radiological consequences. Hence, S/I must be terminated when the criteria in subsequent steps are satisfied to prevent steam generator overfill.

PLANT SPECIFIC INFORMATION:

KNOWLEDGE/ABILITY:

Voiding in the upper head region should not preclude S/I termination. Such a void is expected to be confined to the upper head region and will not expand below the top of the hot legs if NC System subcooling is maintained at the core exit. Although an upper head void may hinder pressurizer pressure and level control, it is not a sufficient safety concern to prevent S/I termination if the specified criteria are met.

Question: 05-11

1 Pt(s) What is the minimum length of time that each vital instrument and control system battery is designed to carry its own loads and the loads of the other train related vital bus?

A. 1 hours

B. 2 hours

C. 4 hours

D. 8 hours

Question: 05-11 ***Answer: B***

LEVEL:	RO/SRO

K/A	EPE05 5	**Title**	Station blackout
	EK3.01	**Description**	Knowledge of the reasons for the following responses as the apply to the Station Blackout: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Length of time for which battery capacity is designed
		Importance	2.7/3.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPL
Objectives	21
REFERENCES	Lesson plan pages 6 and 7
Author	RJK
Time	7/8/2005 12:39 PM 23 minutes

Distracter Analysis: Stated capacity per lesson plan information

- **A. Incorrect** 1 hour is for SSF batteries
- **B. Correct**:
- **C. Incorrect**:
- **D. Incorrect**: 8 hours is the time it takes to recharge a battery.

Lesson plan pages 6 & 7

Each battery is sized to carry the following continuous emergency loads for a two hour period: (An emergency would be a complete loss of AC power or a battery charger failure). its own vital buss and the loads of another battery.

The two-hour period is the conservative estimate of the time required to restore power to the battery chargers under the most adverse conditions.

Each battery is also capable of supplying the anticipated momentary loads during this two-hour period.

***Question*: 05-11**

1 Pt(s) What is the maximum length of time that each vital instrument and control system battery is designed to carry its own loads and the loads of the other train related vital bus?

A. 2 hours

B. 4 hours

C. 6 hours

D. 8 hours

Question*: 05-11** ***Answer: A

LEVEL:	RO/SRO

K/A	EPE05 5	**Title**	Station blackout
	EK3.01	**Description**	Knowledge of the reasons for the following responses as the apply to the Station Blackout: **(CFR 41.5 / 41.10 / 45.6 / 45.13)** Length of time for which battery capacity is designed
		Importance	2.7/3.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPL
Objectives	21
REFERENCE S	Lesson plan pages 6 and 7
Author	RJK
Time	7/8/2005 12:39 PM 23 minutes

Distracter Analysis: Stated capacity per lesson plan information

A. Correct
B. Incorrect:
C. Incorrect:
D. Incorrect: 8 hours is the time it takes to recharge a battery.

Lesson plan pages 6 & 7

Each battery is sized to carry the following continuous emergency loads for a two hour period: (An emergency would be a complete loss of AC power or a battery charger failure). its own vital buss and the loads of another battery.

The two-hour period is the conservative estimate of the time required to restore power to the battery chargers under the most adverse conditions.

Each battery is also capable of supplying the anticipated momentary loads during this two-hour period.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
19	Using the Annunciator Alarm Response Procedure for 1AD-11, correctly describe the annunciator alarms associated with the Vital I & C System			X	X	X
20	Given a set of specific plant conditions and access to reference material, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
21	Summarize DC battery operation under loaded conditions • State where to obtain accurate indication of a battery's condition • State actions to be taken to minimize the drain on a battery • Describe the operational characteristics when subjected to heavy loads for long periods of time	X	X	X	X	X
22	State from memory all Technical Specification actions for the applicable Systems, subsystems and components which require remedial action to be taken in less than 1 hour.			X	X	

2. Each charger is designed to;
   a) Carry its own individual load plus the DC & AC Panelboards of a train related channel.
   b) Charge its associated battery within eight hours after discharge while supplying its normal loads.
   c) Maintain battery terminal voltage greater than or equal to 125 volts DC on float charge during normal plant operation.
3. A charger should not be connected to a bus unless a battery is connected. The chargers lack sufficient voltage stability to serve as the sole power source to a DC System.
4. Power supplies
   a) ECA-EMXA
   b) ECB-EMXJ
   c) ECC-EMXI
   d) ECD-EMXB
   e) ECS-EMXA/EMXJ
5. Plant Response due to a Charger Failure (Obj. #15)
   a) No effect on plant since the battery is providing backup power to the chargers busses.
   b) Receive Annunciator 1(2) AD-11; H (1-4) for the applicable Battery Charger (A, B, C or D).
   c) Refer to Annunciator Response for appropriate corrective action.
6. Battery Charger Protective Relaying
   a) Overvoltage sensor provides a signal to the output circuit breaker
   b) Should a charger overvoltage condition occur with the "FLOAT/EQUALIZE" switch in "FLOAT", the DC output breaker will open to protect the battery and equipment from damage.

B. 125 VDC Batteries (Obj. #4)
1. Four per unit, designated as follows:
   a) EBA - Channel A
   b) EBB - Channel B
   c) EBC - Channel C
   d) EBD - Channel D
2. Each battery is sized to carry the following continuous emergency loads for a two hour period: (An emergency would be a complete loss of AC power or a battery charger failure).

a) its own vital buss

b) and the loads of another battery.

The two-hour period is the conservative estimate of the time required to restore power to the battery chargers under the most adverse conditions.

3. Each battery is also capable of supplying the anticipated momentary loads during this two-hour period.

   a) The battery terminal voltage shall be greater than or equal to 110.4 volts DC during Design Basis Events.

4. DC battery operation under loaded conditions (Obj. # 21) (SER 3-99, PIP C-00-1223)

   a) When batteries consisting of more than one cell are discharged for an extended period of time, the potential exists for individual cells to drop below the voltage of the battery bank. Under loaded conditions the most accurate indication of a battery's condition (voltage) is taken at each individual cell and not at the distribution center or any meter which measures voltage across the entire bank of batteries.

   b) When a battery is under a heavily loaded condition for a long period of time a phenomena known as cell reversal may occur. Cell reversal is a condition where an individual battery cell reverses polarity. The positive lead becomes the negative lead and the negative lead becomes the positive lead. When this happens, the cell becomes a load on the battery and causes the battery's voltage to decrease rapidly. This phenomena occurs at approximately 80-85% of normal battery voltage. Once a cell has undergone cell reversal, it cannot be recovered.

   c) Low battery voltage can cause damage to the remaining cells in a battery bank and damage the equipment being supplied from the battery.

   d) To prevent cell reversal and damage to equipment being supplied by a battery we have to minimize the drain on the battery. Actions taken to minimize the drain on a battery include removing non-vital loads from the DC bus, placing AC portions of these systems on alternate power sources, and consulting station management for recommended loads to remove from a DC bus.

   e) Anytime battery voltage drops below 105 VDC, the battery is removed from the bus.

Question: 05-12

1 Pt(s) Unit 1 is at 50% power with the following events:

- AC power instrument buss 1ERPA is de-energized
- Pressurizer level control system input is swapped to channel 3-2
- Operators have implemented AP/1/A/5500/029, Loss of Vital or Aux Control Power.

During the time 1ERPA is de-energized, how is pressurizer level being controlled using 1NV-294, NV Pmps A&B Disch Flow Ctrl.

A. 1NV-294 in automatic with normal letdown

B. 1NV-294 in automatic with excess letdown

C. 1NV-294 in manual with excess letdown

D. 1NV-294 in manual with normal letdown

Question*: *05-12 ***Answer: C***

LEVEL:	RO/SRO

K/A	APE057	**Title**	Loss of Vital AC Instrument Buss
	AA1.02	**Description**	Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: **(CFR 41.7 / 45.5 / 45.6)** Manual control of PZR level
		Importance	3.8/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-IC-ILE
Objectives	6
REFERENCES	AP/1/A/5500/029 steps 6 and 9 Revision 13
Author	RJK
Time	7/8/2005 1:26 PM 5 minutes plus 60 from original

Distracter Analysis: Letdown isolated on the level channel loss. When channel is selected to the 3-2 position letdown can be restored. But the procedure directs an immediate level control with manual charging and excess letdown. NV-309 would be unaffected by this and remain in automatic.

A. **Incorrect**: This was the initial lineup. But after the channel swap, an operator may think that all systems can be restored.

B. **Incorrect**: This could not work due to the low flow of excess letdown, but this is the letdown option until the channel of vital is restored.

C. **Correct**:

D. **Incorrect**: Normal letdown cannot be used until channel 1 is restored, but is the preferred letdown path and may think its available after swapping channels.

__ 6. **Verify all Pzr level channels - INDICATING THE SAME.**	**IF either selected channel is failed, THEN perform the following:** __ a. Place "PZR LEVEL CTRL SELECT" switch in any alternate operable channel position. __ b. Ensure "PZR LEVEL TO REC SEL" is selected to an operable channel. __ c. IF letdown is isolated, THEN control charging to stabilize Pzr level at program level while maintaining seal injection flow.
__ 9. **Verify 1ERPA - ENERGIZED.**	**Perform the following:** NOTE Automatic and manual VCT makeup is unavailable. Restoring letdown prior to VCT level of 23% eliminates need to swap VCT suction to FWST. __ • IF normal letdown isolated AND the unit is in Mode 1 OR 2, THEN establish excess letdown to the VCT. REFER TO OP/1/A/6200/001 (Chemical and Volume Control System).

Question: 05-12

1 Pt(s) Unit 1 is at 50% power with the following events:

- AC power instrument buss 1ERPA is de-energized
- Pressurizer level control system input is swapped to channel 3-2

During the time 1ERPA is de-energized, how is pressurizer level being controlled using 1NV-294, NV Pmps A&B Disch Flow Ctrl, and 1NV-309, Seal Water Injection Flow.

A. 1NV-294 and 1NV-309 in automatic with normal letdown

B. 1NV-294 and 1NV-309 in automatic with excess letdown

C. 1NV-294 in manual, 1NV-309 in automatic with excess letdown

D. 1NV-294 in manual, 1NV-309 in automatic with normal letdown

***Question*: 05-12** **Answer: C**

LEVEL:	RO/SRO

K/A	APE057	Title	Loss of Vital AC Instrument Buss
	AA1.02	Description	Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: **(CFR 41.7 / 45.5 / 45.6)** Manual control of PZR level
		Importance	3.8/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-IC-ILE
Objectives	6
REFERENCES	AP/1/A/5500/029 steps 6 and 9 Revision 13
Author	RJK
Time	7/8/2005 1:26 PM 5 minutes plus 60 from original

Distracter Analysis: Letdown isolated on the level channel loss. When channel is selected to the 3-2 position letdown can be restored. But the procedure directs an immediate level control with manual charging and excess letdown. NV-309 would be unaffected by this and remain in automatic.

A. **Incorrect**: This was the initial lineup. But after the channel swap, an operator may think that all systems can be restored.

B. **Incorrect**: This could not work due to the low flow of excess letdown, but this is the letdown option until the channel of vital is restored.

C. **Correct**:

D. **Incorrect**: Normal letdown cannot be used until channel 1 is restored, but is the preferred letdown path and may think its available after swapping channels.

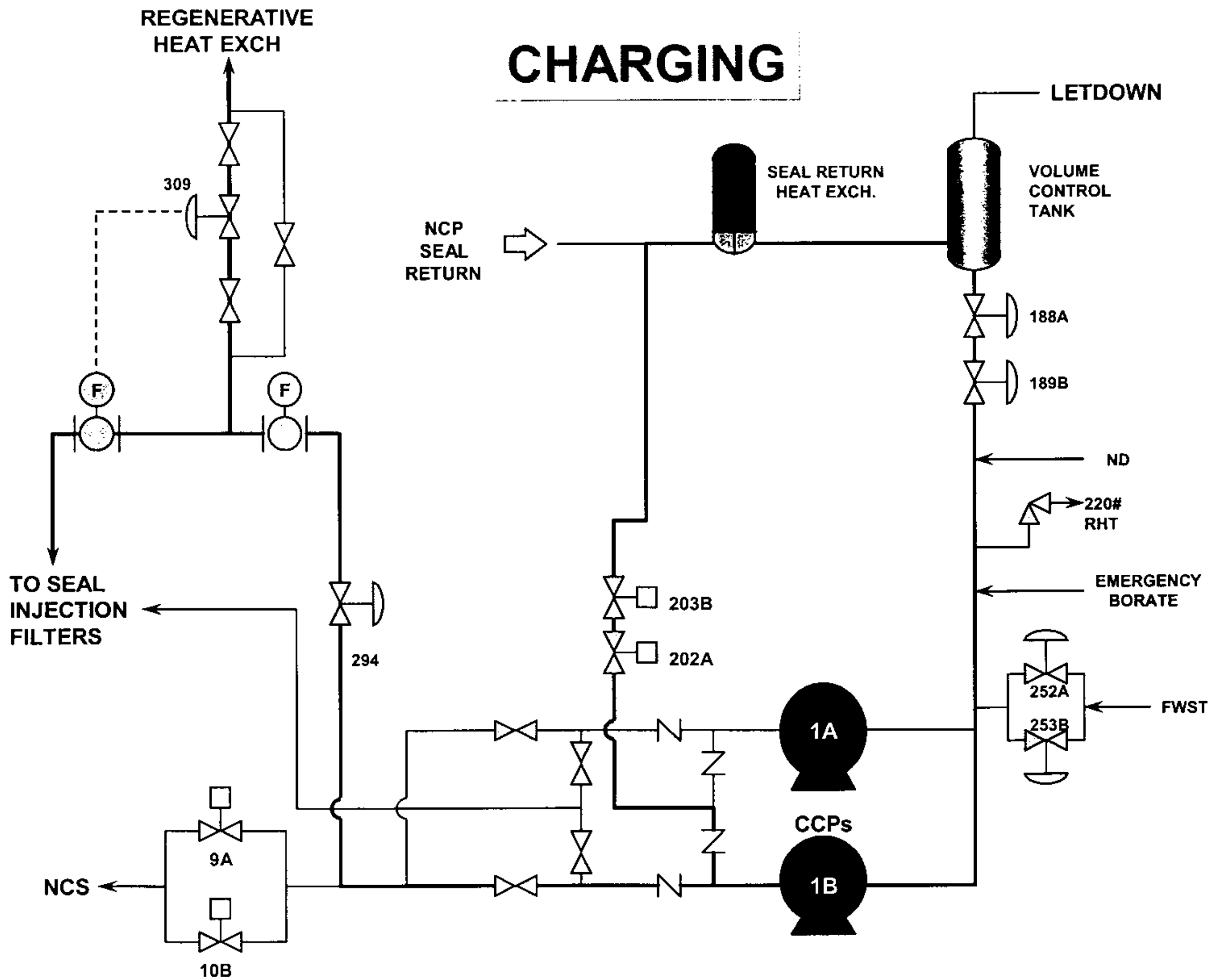
__ 6. **Verify all Pzr level channels - INDICATING THE SAME.**	**IF either selected channel is failed, THEN perform the following:** __ a. Place "PZR LEVEL CTRL SELECT" switch in any alternate operable channel position. __ b. Ensure "PZR LEVEL TO REC SEL" is selected to an operable channel. __ c. IF letdown is isolated, THEN control charging to stabilize Pzr level at program level while maintaining seal injection flow.
__ 9. **Verify 1ERPA - ENERGIZED.**	**Perform the following:** **NOTE** Automatic and manual VCT makeup is unavailable. Restoring letdown prior to VCT level of 23% eliminates need to swap VCT suction to FWST. __ • IF normal letdown isolated AND the unit is in Mode 1 OR 2, THEN establish excess letdown to the VCT. REFER TO OP/1/A/6200/001 (Chemical and Volume Control System)

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Pressurizer Level Control (ILE) System.			X	X	
2	Describe the pressurizer level control program including values and signal sources for program development.			X	X	X
3	Describe why a cold calibrated channel is required.			X	X	
4	Describe the response of ILE system to a deviation of pressurizer level from program value.			X	X	X
5	Discuss control room controls and indications associated with ILE.			X	X	X
6	Describe all automatic functions, alarm and control, that occur when pressurizer level deviates from program level, including setpoint changes and level channel failures.			X	X	X
7	Describe protection signals, trips, interlocks and permissives associated with ILE including setpoints.			X	X	X
8	Describe the actions which must be taken to restore pressurizer heater operation following a pressurizer low level heater cutoff.			X	X	X
9	Explain ILE system operation during startup, shutdown and normal operation.			X	X	
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X

TIME: 2.0 HOURS

CHARGING


REGENERATIVE
HEAT EXCH
309
F
F
TO SEAL
INJECTION
FILTERS
294
NCP
SEAL
RETURN
SEAL RETURN
HEAT EXCH.
LETDOWN
VOLUME
CONTROL
TANK
188A
189B
ND
220#
RHT
EMERGENCY
BORATE
203B
202A
252A
253B
FWST
1A
CCPs
1B
9A
NCS
10B

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 5. **Verify all Pzr pressure channels - INDICATING THE SAME.**	**IF either selected channel is failed, THEN perform the following:** a. **IF** the "PZR PRESS MASTER" is in "AUTO", **THEN** perform the following: __ 1) Place "PZR PRESS MASTER" - IN MANUAL. __ 2) Adjust "PZR PRESS MASTER" output demand TO 70%. __ 3) Place "PZR PRESS CTRL SELECT" switch in any alternate operable channel position. __ 4) Place "PZR PRESS MASTER" - IN AUTO. __ 5) Ensure "PZR PRESS TO REC SEL" is selected to an operable channel. __ 6) **GO TO** Step 6. b. Perform the following: __ 1) Place "PZR PRESS CTRL SELECT" switch in any alternate operable channel position. __ 2) Ensure "PZR PRESS TO REC SEL" is selected to an operable channel.
__ 6. **Verify all Pzr level channels - INDICATING THE SAME.**	**IF either selected channel is failed, THEN perform the following:** __ a. Place "PZR LEVEL CTRL SELECT" switch in any alternate operable channel position. __ b. Ensure "PZR LEVEL TO REC SEL" is selected to an operable channel. __ c. **IF** letdown is isolated, **THEN** control charging to stabilize Pzr level at program level while maintaining seal injection flow.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 9. **Verify 1ERPA - ENERGIZED.**	**Perform the following:**

NOTE Automatic and manual VCT makeup is unavailable. Restoring letdown prior to VCT level of 23% eliminates need to swap VCT suction to FWST.

- __ **IF** normal letdown isolated **AND** the unit is in Mode 1 **OR** 2, **THEN** establish excess letdown to the VCT. **REFER TO** OP/1/A/6200/001 (Chemical and Volume Control System).
- __ **IF** time and manpower are available without detracting from efforts to restore 1ERPA, **THEN** perform PT/1/A/4350/002C (Available Power Source Operability Check) for Diesel Generator 1A.
- __ Dispatch operator to open 1FD-23 (1A D/G Eng Fuel Oil Day Tank 1A Fill Valve Bypass) (DB-1A, 561, EE-39).
- __ Verify RN aligned to the SNSWP. **REFER TO** Enclosure 14 (1ERPA Load List), Step 18.
- __ **IF** RN alignment to SNSWP is not complete, **THEN** align RN to the SNSWP. **REFER TO** OP/0/A/6400/006C (Nuclear Service Water System).

Question: 05-13

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1 Pt(s) Unit 2 battery charger 2ECD has failed and buss 2EDD is being supplied by battery 2EBD. Which of the following statements indicates the minimum voltage at which the battery must be removed from service and the reason for removal?

A. 120 volts; to prevent damage to fed equipment

B. 115 volts; to prevent damage to fed equipment

C. 110 volts; to prevent cell reversal

D. 105 volts; to prevent cell reversal

Question: 05-13 ***Answer: D***

LEVEL:	RO/SRO

K/A	APE058	**Title**	Loss of DC Power
	AA2.02	**Description**	Ability to determine and interpret the following as they apply to the Loss of DC Power: **(CFR: 43.5 / 45.13)** 125V dc bus voltage, low/critical low, alarm
		Importance	3.3/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPL
Objectives	21
REFERENCES	Lesson plan information
Author	RJK
Time	7/8/2005 2:22 PM 28 minutes

Distracter Analysis:

A. **Incorrect**: This would be acceptable until voltage decreases to 105 volts.

B. **Incorrect**: This would be acceptable until voltage decreases to 105 volts.

C. **Incorrect**: This is above the required voltage, but is the reason to remove the cell from service.

D. **Correct**: At 105 volts the battery must be removed to prevent damaging other cells.

DC battery operation under loaded conditions (Obj. # 21) *(SER 3-99, PIP C-00-1223)*

1. When batteries consisting of more than one cell are discharged for an extended period of time, the potential exists for individual cells to drop below the voltage of the battery bank. Under loaded conditions the most accurate indication of a battery's condition (voltage) is taken at each individual cell and not at the distribution center or any meter which measures voltage across the entire bank of batteries.
2. When a battery is under a heavily loaded condition for a long period of time a phenomena known as cell reversal may occur. Cell reversal is a condition where an individual battery cell reverses polarity. The positive lead becomes the negative lead and the negative lead becomes the positive lead. When this happens, the cell becomes a load on the battery and causes the battery's voltage to decrease rapidly. This phenomena occurs at approximately 80-85% of normal battery voltage. Once a cell has undergone cell reversal, it cannot be recovered.
3. Low battery voltage can cause damage to the remaining cells in a battery bank and damage the equipment being supplied from the battery.
4. To prevent cell reversal and damage to equipment being supplied by a battery we have to minimize the drain on the battery. Actions taken to minimize the drain on a battery include removing non-vital loads from the DC bus, placing AC portions of these systems on alternate power sources, and consulting station management for recommended loads to remove from a DC bus.
5. Anytime battery voltage drops below 105 VDC, the battery is removed from the bus.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
19	Using the Annunciator Alarm Response Procedure for 1AD-11, correctly describe the annunciator alarms associated with the Vital I & C System			X	X	X
20	Given a set of specific plant conditions and access to reference material, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
21	Summarize DC battery operation under loaded conditions • State where to obtain accurate indication of a battery's condition • State actions to be taken to minimize the drain on a battery • Describe the operational characteristics when subjected to heavy loads for long periods of time	X	X	X	X	X
22	State from memory all Technical Specification actions for the applicable Systems, subsystems and components which require remedial action to be taken in less than 1 hour.			X	X	

a) its own vital buss

b) and the loads of another battery.

The two-hour period is the conservative estimate of the time required to restore power to the battery chargers under the most adverse conditions.

3. Each battery is also capable of supplying the anticipated momentary loads during this two-hour period.

   a) The battery terminal voltage shall be greater than or equal to 110.4 volts DC during Design Basis Events.

4. DC battery operation under loaded conditions (Obj. # 21) (SER 3-99, PIP C-00-1223)

   a) When batteries consisting of more than one cell are discharged for an extended period of time, the potential exists for individual cells to drop below the voltage of the battery bank. Under loaded conditions the most accurate indication of a battery's condition (voltage) is taken at each individual cell and not at the distribution center or any meter which measures voltage across the entire bank of batteries.

   b) When a battery is under a heavily loaded condition for a long period of time a phenomena known as cell reversal may occur. Cell reversal is a condition where an individual battery cell reverses polarity. The positive lead becomes the negative lead and the negative lead becomes the positive lead. When this happens, the cell becomes a load on the battery and causes the battery's voltage to decrease rapidly. This phenomena occurs at approximately 80-85% of normal battery voltage. Once a cell has undergone cell reversal, it cannot be recovered.

   c) Low battery voltage can cause damage to the remaining cells in a battery bank and damage the equipment being supplied from the battery.

   d) To prevent cell reversal and damage to equipment being supplied by a battery we have to minimize the drain on the battery. Actions taken to minimize the drain on a battery include removing non-vital loads from the DC bus, placing AC portions of these systems on alternate power sources, and consulting station management for recommended loads to remove from a DC bus.

   e) Anytime battery voltage drops below 105 VDC, the battery is removed from the bus.

Question*: *05-14

1 Pt(s) Initial Conditions:

- Unit 1 and Unit 2 are operating at 100% power.
- 1A RN pump in service.
- B train KC is in service.

Current Conditions:

- 1A RN pump tripped.
- 1B RN pump was started by the crew per AP/0/A/5500/020 (Loss of Nuclear Service Water).
- The OSM has directed that Unit 2 be removed from the RN System technical specification LCO due to upcoming scheduled work.
- Alignments are being made per OP/1/A/6400/006C, Enclosure 4.12B (Alignment for Single Pump Flow Balance Due to One Train B RN Pump and/or Its Associated D/G Inoperable).

Once alignments are made per OP/1/A/6400/006C, and the RN technical specification LCO no longer applies to Unit 2, which one of the following is still aligned to RN on Unit 1?

A. 1A NS heat exchanger

B. 1A train CA

C. 1A KC heat exchanger

D. The RN non-essential header

Question*: 05-14** ***Answer: C

LEVEL:	RO/SRO

K/A	APE062	**Title**	Loss of Nuclear Service Water
	G2.1.27	**Description**	Knowledge of system purpose and or function. (CFR: 41.7)
		Importance	2.8/2.9

SOURCE	
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-RN rev 54
Objectives	14
REFERENCES	RN OP 4.12A page 2&3
Author	JKS
Time	7/8/2005 3:24 PM 57 minutes+ 91 minutes

Distracter Analysis:

A. Incorrect: This is isolated by the enclosure.
B. Incorrect: This is isolated by the enclosure.
C. Correct:
D. Incorrect This is isolated by the enclosure.

Alignment For Single Pump Flow Balance Due To One Train B RN Pump and/or Its Associated D/G Inoperable

1. Initial Conditions

____ 1.1 Review the Limits and Precautions.

____ 1.2 Verify the RN System is in operation per one of the following:

- Enclosure 4.1 (RN System Startup)
  OR
- Enclosure 4.11 (Operability Actions With One RN Pump And/Or Its Associated D/G Inoperable With Both Units Entering An Action Statement)
  OR
- Enclosure 4.13 (Alignment For Single Pump Flow Balance Due To Two RN Pumps And/Or Their Associated D/Gs Inoperable, One On Each Train on Opposite Units).
  OR
- Enclosure 4.15B (Operability Actions With Both RN Pumps and/or Their Associated D/Gs On Train B Inoperable).

2. Procedure

NOTE:
1. This enclosure will align the RN System to supply the loads required by one pump flow balance (two D/Gs, two KC Hxs, one NS Hx, one CA assured makeup and the other essential header loads) or the essential header loads for the unit in Modes 1-4 and only the D/G and KC Hx on the unit in Mode 5, Mode 6 or No Mode.
2. Until the Single Pump Flow Balance alignment is completed, LCO 3.7.8, Action A will be applicable for any unit in Modes 1-4.
3. Alignments performed by this enclosure will result in B Train CA unavailability.
4. If performing this enclosure by direction from Enclosure 4.15B, the following step is non-applicable.

____ 2.1 Verify three RN pumps and their associated D/Gs are operable:

- ☐ RN Pump 1A and D/G 1A
- ☐ RN Pump 1B and D/G 1B
- ☐ RN Pump 2A and D/G 2A
- ☐ RN Pump 2B and D/G 2B

NOTE:	Continue on with the procedure while performing Step 2.2.

____ 2.2 **IF** a D/G is inoperable, ensure appropriate actions have been taken per OP/1(2)/A/6350/002 (Diesel Generator Operation) to meet Tech Spec requirements for removing a D/G from service.

NOTE:	Isolations to align for the single pump flow balance shall be performed on the same unit and train as the inoperable RN Pump. If both units are in Modes 1-4, the affected unit will be in action statements for NS and CA. If the unaffected unit is shutdown, the affected unit will remain in LCO 3.7.8, Action A.

2.3 **IF** RN Pump 1B is inoperable, perform the following:

____ 2.3.1 Notify the WWM or SWM to perform a risk assessment due to the unavailability of 1B NS and 1B RN to CA.
Person notified ______________________________

2.3.2 Ensure one of the following valves is closed:

____ ____ • 1RN-47A (RN Supply X-Over Isol)
____ ____ • 1RN-48B (RN Supply X-Over Isol)

2.3.3 Ensure the valve closed in the previous step is tagged on the control board only:

____ ____ • 1RN-47A (RN Supply X-Over Isol)
____ ____ • 1RN-48B (RN Supply X-Over Isol)

2.3.4 Isolate the Unit 1 RN Non Essential Header by closing one of the following valves:

____ ____ • 1RN-49A (Non-Ess Supply Hdr Isol)
____ ____ • 1RN-50B (Non-Ess Supply Hdr Isol)

2.3.5 Ensure the valve closed in the previous step is tagged on the control board only:

____ ____ • 1RN-49A (Non-Ess Supply Hdr Isol)
____ ____ • 1RN-50B (Non-Ess Supply Hdr Isol)

2.3.6 Ensure one of the following NS Hx 1B isolations is closed:

____ ____ • 1RN-229B (NS Hx 1B Outlet Isol)
____ ____ • 1RN-225B (NS Hx 1B Inlet Isol)

2.3.7 Tag on the control board only the switches for the valves closed in the above step:

_____ _____ • 1RN-229B (NS Hx 1B Outlet Isol)
_____ _____ • 1RN-225B (NS Hx 1B Inlet Isol)

_____ _____ 2.3.8 Ensure 1RN-310B (RN Hdr B To CA Pmp Suct Isol) is closed.

_____ _____ 2.3.9 Open 1EMXD-F04B (RN Header B To CA Pump Suction Isol Motor (1RN310B)).

_____ _____ 2.3.10 Tag 1EMXD-F04B (RN Header B To CA Pump Suction Isol Motor (1RN310B)).

2.3.11 The units are now in one of the following:

- If both Units are in Modes 1-4, Unit 1 is in the Actions for NS and CA. Unit 2 exits LCO 3.7.8, Action A.
- If Unit 1 is in Modes 1-4 and Unit 2 is shutdown, Unit 1 is in the Actions for RN, NS and CA. Unit 2 is **NOT** in an applicable mode and is tracking RN inoperability.
- If Unit 1 is shutdown, Unit 1 is **NOT** in an applicable mode and is therefore tracking the RN, NS and CA inoperability. If Unit 2 is in Modes 1-4, Unit 2 exits LCO 3.7.8, Action A.

2.4 **IF** RN Pump 2B is inoperable, perform the following:

_____ 2.4.1 Notify the WWM or SWM to perform a risk assessment due to the unavailability of 2B NS and 2B RN to CA.
Person notified ____

2.4.2 Ensure one of the following valves is closed:

_____ _____ • 2RN-47A (RN Supply X-Over Isol)
_____ _____ • 2RN-48B (RN Supply X-Over Isol)

2.4.3 Ensure the valve closed in the previous step is tagged on the control board only:

_____ _____ • 2RN-47A (RN Supply X-Over Isol)
_____ _____ • 2RN-48B (RN Supply X-Over Isol)

***Question*: 05-14**

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1 Pt(s) What is the effect of selecting "RN" on the "YV/RN COOL WATER MODE" switch with the "YV/RN COOL WATER CTRL" switch in the "CTRL RM" position?

A. Prevents isolating RN from the containment header on a Sp signal.

B. Enables a 5 minute time delay before RN aligns to the containment header.

C. Enables automatic alignment of RN to the containment header on a loss of power to MXE and MXI.

D. Immediately aligns RN to the containment header.

Question: 05-14 **_Answer: D_**

LEVEL:	RO/SRO

K/A	APE062	**Title**	Loss of Nuclear Service Water
	G2.1.27	**Description**	Knowledge of system purpose and or function. (CFR: 41.7)
		Importance	2.8/2.9

SOURCE	MODIFIED (CNS BANK RN-012-D)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-RN rev 54
Objectives	14
REFERENCES	Lesson plan information page 26
Author	RJK
Time	7/8/2005 3:24 PM 91 minutes

Distracter Analysis:

A. **Incorrect**: If an operator thinks that the RN position overrides the containment isolation of the RN header.

B. **Incorrect**: there is no delay with this method but a 5minute delay does exist under different conditions.

C. **Incorrect**: This occurs anyway on a power loss if in auto, this would be redundant, but it does in fact transfer. This is the function of another switch.

D. **Correct**

<u>Lesson plan information page 26</u>

A 3 Position switch "YV/RN Cool Water Mode", in the Control Room controls the above 4 valves (The "YV/RN Cool Water Ctrl" switch must be selected to "CTRL-RM").

In the "YV" position, chilled water will be supplied to the YV loads with no time delay.

In "RN" position, the RN supply and return valves open and the YV supply and return valves close with no time delay to allow RN to containment.

In "Auto", if an undervoltage is actuated on MXI OR MXE, the RN supply and return valves to containment will open, and YV valves close (1(2) RNA83,CO4 open; 1(2) RNCO2, CO3 close) (This will occur after a 5 minute time delay).

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
12	Describe the reason for <u>not</u> isolating the Auxiliary Building non-essential header supply valve on a blackout signal.	X	X	X	X	X
13	Draw a block diagram of the RN System per the ISS REQUIRED training drawing.	X				
14	Explain the purpose of the YV system and basic operation of the system. • Purpose • Normal Alignment • Flow Path • Control switch alignments & parameters required for auto swap. • Parameters required for YV operable status.	X	X	X	X	X
15	Explain the purpose of the VZ system and basic operation of the system. • Purpose • Normal Alignment • Describe how temperature is controlled.	X	X	X	X	
16	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
17	Be able to perform the following associated with a Loss of RN per AP/0/A/5500/020. • State the basic actions required of an NLO • Explain the symptoms. • Discuss the supplementary actions.	 X	 X	 X X X	 X X X	 X X X
18	Explain what indications for the RN system are available in the control room and what the operator should expect to see on these indications during normal operation.			X	X	

c) Valves RNCO2, RNCO3, RNA83, RNC04 are used to isolate the chilled water system from RN.

1) A 3 Position switch "YV/RN Cool Water Mode", in the Control Room controls the above 4 valves (The "YV/RN Cool Water Ctrl" switch must be selected to "CTRL-RM").

(a) In the "YV" position, chilled water will be supplied to the YV loads with no time delay.

(b) In "RN" position, the RN supply and return valves open and the YV supply and return valves close with no time delay to allow RN to containment.

(c) In "Auto", if an undervoltage is actuated on MXI OR MXE, the RN supply and return valves to containment will open, and YV valves close (1(2) RNA83,CO4 open; 1(2) RNCO2, CO3 close) (This will occur after a 5 minute time delay).

(d) The "YV operable" light will be lit if the following exists.

- YV supply and return valves open
- YV supply temperature less than 50°F
- YV supply pressure greater than 40 psig

(e) The "RN operable" light will be lit if the RN supply and return valve are open.

(f) The RN and YV isolated lights will light if their respective supply and return valves are closed.

d) A two-position "YV/RN Cool Water Ctrl", switch in the control room allows selection of where the supply and return valves are controlled.

1) CTRL-RM - Control Room Control (Must be in this position for Auto Swap to RN on loss of MXE OR MXI to occur).

2) Local - Containment Mechanical Equipment Building Control (Will block Auto Swap to RN if in this position).

e) A bleed line to WC is provided for system cleanup.

1) This would be necessary if swap to RN is made.

f) Auto makeup is supplied by YM.

g) Auto Swap reset.

1) The swap in auto may be prevented if prior to 5 minute timer completion:

(a) Power is restored to MCC's and Auto swap reset PB is depressed.

(b) or, the "YV/RN Cool Water Mode" switch can be taken to the "YV" position.

(c) or, the "YV/RN Cool Water Ctrl" switch can be taken to "local".

2) To return to YV following an auto swap to RN, a procedure enclosure directs the return.

(a) The only control manipulations needed are to depress the Auto Swap reset PB to realign the valves to YV.

h) Startup

1) The Chiller Pumps and Chillers are controlled from the Containment Mechanical Equipment Building.

2) Normally 2 chillers and two pumps will be placed in "Auto" then, the master stop/start; "start" pushbutton is depressed.

3) YV Supplies

(a) Lower Containment Vent Units (4) per Unit

(b) Incore Instrument Vent Units (2) per Unit

(c) NCP motor air coolers (4) per Unit

(d) Upper Containment Vent Units (4) per unit

(e) VF Supply Units (Only aligned during fuel handling operations in the fuel building)

i) YV System Trips and Isolates on S_p Signal. (due to system low flow when the Containment isolation valves shut)

Question: 05-15

1 Pt(s) Given the following events and conditions:

- Unit 1 has tripped during a loss of instrument air (VI).
- Unit 1 being stabilized in hot standby.
- Efforts to restore pressure are continuing.
- VI pressure is 55 psig.
- OAC alarms for low nitrogen bottle pressure are in alarm.

Which of the following systems use nitrogen bottles for valve operation?

A. Auxiliary Feedwater (CA)

B. Main Steam Vent To Atmosphere (SV)

C. Reactor Coolant (NC)

D. Chemical and Volume Control (NV)

Question: 05-15 ***Answer: B***

LEVEL:	RO/SRO

K/A	APE065	**Title**	Loss of Instrument Air
	AA2.07	**Description**	Ability to determine and interpret the following as they apply to the Loss of Instrument Air: **(CFR: 41.10 / 43.5 / 45.13)** Whether backup nitrogen supply is controlling valve position
		Importance	2.8/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-STM-SM
Objectives	6
REFERENCES	AP/0/A/5500/022 rev 23
Author	RJK
Time	7/12/2005 9:55 AM 35 minutes

Distracter Analysis: Of the four systems listed, the S/G PORVs have a backup N2 bottle system. When the VI pressure decreases below 80 psig the N2 bottles take over. This knowledge is stated in the Loss of VI AP/0/A/5500/022. The lesson plan states that OAC alarms come in decreasing pressure. As an operator is directed to control plant temperature with PORVs, eventually low N2 pressure alarms will be received.

A. **Incorrect**: This system does use a backup air tank system but it is from VI.

B. **Correct**:

C. **Incorrect**: The NC system does employ nitrogen for the PZR PORVs when they are in the LTOP mode of operation from the Cold Leg Accumulators.

D. **Incorrect**: There are numerous VI controlled valves; the operator may think one of them is controlling a valve.

Loss of VI AP/022 page 3 rev 23

NOTE • At 80 PSIG N2 becomes the primary motive force for the S/G PORVs.

	SM System Objectives	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the SM system	X	X	X	X	
2	Explain the purpose of the Flow Restrictor in each S/G outlet	X	X	X	X	
3	Describe the purpose of the S/G PORV's	X	X	X	X	
4	Describe the operation of the S/G PORV's	X	X			
5	Describe the location of the S/G PORV's	X	X	X	X	
6	Describe the controls and indications for the S/G PORV's			X	X	X
7	Discuss the procedure for locally operating the S/G PORV's	X	X	X	X	X
8	List the opening and closing setpoints for the S/G PORV's	X	X	X	X	X
9	List the requirements of entry into a space that has a high pressure steam relief device per Site Directive 3.1.2	X	X	X	X	X
10	Discuss the purpose of the S/G safety valves	X	X	X	X	
11	List the setpoints for the S/G safety valves	X	X	X	X	X
12	List the controls associated with the MSIV's			X	X	X
13	List the loads supplied by the SM system	X	X	X	X	X
14	List the signals that cause a SM Isolation	X	X			
15	List the signals and setpoints and coincidence that cause a SM Isolation			X	X	X
16	Describe the response of the SM system to a SM Isolation Signal	X	X	X	X	X
17	Draw the Main Steam System per Figure 1	X	X			
18	Describe the flowpath for a SM system valve lineup for unit heatup			X	X	
19	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
20	Describe the procedure for warming, pressurizing and securing the SM system			X	X	X
21	List the parameters used to monitor the SM system during operation			X	X	
22	Describe how the MSIV's operate			X	X	
23	List the safety signals that go to ESF from SM			X	X	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 4. **Dispatch operators to ensure proper VI compressor operation. <u>REFER TO</u> OP/0/A/6450/005 (Instrument Air System).**	
__ 5. **<u>IF</u> VI pressure is greater than 85 PSIG, <u>THEN</u> <u>GO TO</u> Step 11.**	

<u>NOTE</u>

- At 80 PSIG N2 becomes the primary motive force for the S/G PORVs.
- At 80 PSIG the CA valve accumulators will begin to discharge.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Verify VI pressure - GREATER THAN 80 PSIG.**	**Perform the following:** __ a. <u>IF</u> 1AD-8, F/3 "VI DRYER BYPASS VLV OPEN" is dark, **<u>THEN</u>** dispatch operator to open 1VI-671 (VI Dryer Manual Bypass Valve) (SB-564, T-35). __ b. Dispatch operator to ensure 1VI-499 (VI Comp D To VS Hdr Isol) (SB-582, T-32) is closed. __ c. <u>GO TO</u> Step 9.
__ 7. **<u>IF AT ANY TIME</u> VI pressure is less than 80 PSIG, <u>THEN</u> <u>RETURN TO</u> Step 6.**	
__ 8. **<u>GO TO</u> Step 11.**	

Question*: *05-16

1 Pt(s) A loss of coolant accident outside containment has occurred on the residual heat removal system injection header.

The crew is performing Step 3 of EP/1/A/5000/ECA-1.2, LOCA Outside Containment, which states:

"Verify leak path is isolated as follows:"

Which ONE of the following indications is used to identify that the leak has been successfully isolated?

A. ND Pump discharge pressure decreasing

B. Pressurizer level increasing

C. ND/NS room sump levels decreasing

D. Reactor coolant pressure increasing

Question*: *05-16 ***Answer: D***

LEVEL:	RO/SRO

K/A	W04	**Title**	LOCA Outside Containment
	EK2.2	**Description**	Knowledge of the interrelations between the (LOCA Outside Containment) and the following: **(CFR: 41.7 / 45.7)** Facilities 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	3.8/4.0

SOURCE	BANK (South Texas Initial Exam Bank)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-EP2
Objectives	20
REFERENCES	EP/1/A/5000/ECA-1.2 rev 2
Author	RJK
Time	7/12/2005 10:48 AM 61 minutes

Distracter Analysis: ECA-1.1 looks for the pressure increase as the crews isolate each train of ND.

A. **Incorrect**: If the leak is in ND, then decreasing pressure may equate to leak isolation because the relief valve would close on the system and the pressure would decrease.

B. **Incorrect**: Pressurizer level increasing is a later issue for SI termination. It is not reasonable to assume that level would already be on scale.

C. **Incorrect**: This might be true of the leak is contained and the sumps are pumped down but is not the indication that the procedure keys off of.

D. **Correct**:

ECA-1.2 step 3

3. **Verify leak path is isolated as follows:**

__ a. NC pressure - INCREASING.	__ a. <u>GO TO</u> EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).
__ b. Initiate actions as required to complete leak isolation.	

Question: 05-16

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1 Pt(s) A loss of coolant accident outside containment has occurred on the residual heat removal system injection header.

With the crew performing in EP/1/A/5000/ECA-1.2, LOCA Outside Containment which ONE of the following indications, per the procedure, will alert the crew that the leak has been successfully isolated?

A. ND Pump discharge pressure decreasing.

B. Pressurizer level increasing.

C. ND/NS room sump levels decreasing.

D. Reactor coolant pressure increasing.

***Question*: 05-16** ***Answer:* D**

LEVEL:	RO/SRO

K/A	W04	Title	LOCA Outside Containment
	EK2.2	Description	Knowledge of the interrelations between the (LOCA Outside Containment) and the following: **(CFR: 41.7 / 45.7)** Facilities 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	3.8/4.0

SOURCE	BANK (South Texas Initial Exam Bank)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-EP2
Objectives	20
REFERENCES	EP/1/A/5000/ECA-1.2 rev 2
Author	RJK
Time	7/12/2005 10:48 AM 61 minutes

Distracter Analysis: ECA-1.1 looks for the pressure increase as the crews isolate each train of ND.

A. **Incorrect**: If the leak is in ND, then decreasing pressure may equate to leak isolation.
B. **Incorrect**: Pressurizer level increasing is a later issue for SI termination. It is not reasonable to assume that level would already be on scale.
C. **Incorrect**: This might be true of the leak is contained and the sumps are pumped down but is not the indication that the procedure keys off of.
D. **Correct**:

ECA-1.2 step 3

3. **Verify leak path is isolated as follows:**

__ a. NC pressure - INCREASING. __ a. GO TO EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).

__ b. Initiate actions as required to complete leak isolation.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
16	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.1 (SI Termination)			X	X	X
17	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.2 (Post LOCA Cooldown and Depressurization)			X	X	X
18	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation)			X	X	X
19	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.4 (Transfer to Hot Leg Recirculation)			X	X	X
20	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation)			X	X	X
21	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ECA-1.2 (LOCA Outside Containment)			X	X	X
22	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			X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
NOTE NC system re-pressurization may be delayed following leak isolation if NC system is saturated or a cooldown is in progress.	
3. **Verify leak path is isolated as follows:**	
__ a. NC pressure - INCREASING.	__ a. **GO TO** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).
__ b. Initiate actions as required to complete leak isolation.	
__ c. **GO TO** EP/1/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).	

END

Question: 05-17

1 Pt(s) EP/1/A/5000/ECA-1.1, Loss of Emergency Coolant Recirculation is in progress. Which of the following procedure actions is performed first while attempting to restore recirculation?

A. Start one reactor coolant pump.

B. Initiate makeup to the refueling water storage tank (FWST)

C. Start a cooldown at less than 100 ºF/hr using the steam generators.

D. Reduce the number of core cooling pumps aligned from the FWST.

Question*: 05-17** ***Answer: B

LEVEL:	RO/SRO

K/A	WE11	Title	Loss of Emergency Coolant Recirculation
	EA2.2	Description	Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation) **(CFR: 41.7 / 43.5 / 45.13)** Adherence to appropriate procedures and operation within the limitations in the facilitys license and amendments.
		Importance	3.4/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-EP2
Objectives	20
REFERENCES	EP/1/A/5000/ECA-1.1
Author	RJK
Time	7/12/2005 12:39 PM 59 minutes

Distracter Analysis:

A. Incorrect: This is an action but not the first sequentially.
B. Correct:
C. Incorrect: A cooldown is done but is not the first action.
D. Incorrect: The number of pumps are reduced but that is not the first action.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
16	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.1 (SI Termination)			X	X	X
17	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.2 (Post LOCA Cooldown and Depressurization)			X	X	X
18	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation)			X	X	X
19	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ES-1.4 (Transfer to Hot Leg Recirculation)			X	X	X
20	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation)			X	X	X
21	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/ECA-1.2 (LOCA Outside Containment)			X	X	X
22	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			X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Align NS spray valves as follows:**	
__ a. Verify NS Pump 1A - ON.	a. Perform the following: __ 1) Ensure NS Train A - RESET. 2) Close the following valves: __ • 1NS-29A (NS Spray Hdr 1A Cont Isol) __ • 1NS-32A (NS Spray Hdr 1A Cont Isol).
__ b. Verify NS Pump 1B - ON.	b. Perform the following: __ 1) Ensure NS Train B - RESET. 2) Close the following valves: __ • 1NS-15B (NS Spray Hdr 1B Cont Isol) __ • 1NS-12B (NS Spray Hdr 1B Cont Isol).
c. <u>**IF AT ANY TIME**</u> NS pumps are stopped or started, <u>**THEN**</u>: __ • Ensure associated NS Train - RESET. __ • Close associated spray valves after securing a pump. __ • Open associated spray valves prior to starting a pump.	
__ 10. **Initiate makeup to FWST. <u>REFER TO</u> OP/1/A/6200/014 (Refueling Water System).**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

13. **WHEN "P-11 PZR S/I BLOCK PERMISSIVE" status light (1SI-18) is lit, THEN:**

__ a. Depress ECCS steam pressure "BLOCK" pushbuttons.

__ b. Verify main steam isolation blocked status lights (1SI-13) - LIT.

NOTE After the low steamline pressure main steam isolation signal is blocked Main Steam Isolation will occur if the high steam pressure rate setpoint is exceeded.

14. **Initiate NC System cooldown to Cold Shutdown as follows:**

__ a. Verify "C-9 COND AVAILABLE FOR STM DUMP" status light (1SI-18) - LIT.

a. Perform the following:

__ 1) Maintain cooldown rate based on NC T-Colds as close as possible without exceeding 100°F in an hour while dumping steam in the following steps.

__ 2) Dump steam from intact S/G(s) PORV.

3) **IF** any intact S/G PORV cannot be opened from the control room, **THEN**:

__ a) Dispatch operator(s) to operate affected S/G(s) PORV. **REFER TO** Enclosure 2 (Local Operation of S/G PORVs).

__ b) Obtain sound powered phone from storage box on rear wall of control room.

__ c) Connect sound powered phone to jack on 1MC-11.

__ d) Monitor sound powered phone for communication from the Doghouse(s).

(RNO continued on next page)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. **Verify S/I aligned by one of the following:**	__ **<u>GO</u> <u>TO</u> Step 26.**
__ • 1NI-9A (NV Pmp C/L Inj Isol) - OPEN	
OR	
__ • 1NI-10B (NV Pmp C/L Inj Isol) - OPEN	
OR	
• At least one ND pump on with suction aligned to either of the following:	
__ • FWST	
OR	
__ • Containment sump.	
OR	
__ • At least one NI pump - ON.	
16. **Establish one train of S/I flow as follows:**	
__ a. Verify only one NV pump - ON.	a. Perform the following:
	__ 1) **<u>IF</u>** both NV pumps are on, **<u>THEN</u>** stop one NV pump.
	(RNO continued on next page)

***Question*: 05-18**

1 Pt(s) Given the following:

- Containment pressure is 4 psig
- All steam generator pressures are 150 psig
- The OATC has been instructed to begin dumping steam using S/G PORVs to stabilize Thots.

Which of the following lists the minimum actions required to allow the S/G PORVs to be manually positioned?

A. Depress the "S/G PORV CTRL MODE" "MANUAL" pushbutton

B. Depress the "SM PORV TRN A(B) RESET" pushbuttons
Depress the "S/G PORV CTRL MODE" "MANUAL" pushbutton

C. Depress the "SM ISOL TRN A(B) RESET" pushbuttons
Depress the "SM PORV TRN A(B) RESET" pushbuttons
Depress the "S/G PORV CTRL MODE" "MANUAL" pushbutton

D. Depress the "ECCS TRN A" "RESET" pushbutton
Depress the "SM ISOL TRN A(B) RESET" pushbuttons
Depress the "SM PORV TRN A(B) RESET" pushbuttons
Depress the "S/G PORV CTRL MODE" "MANUAL" pushbutton

Question*: 05-18** ***Answer: A

LEVEL:	RO/SRO

K/A	WE12	**Title**	Uncontrolled Depressurization of all Steam Generators
	EA1.1	**Description**	Ability to operate and / or monitor the following as they apply to the (Uncontrolled Depressurization of all Steam Generators) **(CFR: 41.7 / 45.5 / 45.6)** Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features
		Importance	3.8/3.8

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-STM-SM
Objectives	6
REFERENCES	Lesson plan information (See Below)
Author	RJK
Time	7/12/2005 1:30 PM 63 minutes

Distracter Analysis:

A. Correct

B. Incorrect: The additional reset is not required for the potentiometers to work

C. Incorrect: Other steps are required if PORVs are to be allowed to operate in AUTO

D. Incorrect: ECCS has not connection to the SM PORVs, Additional actions are only required if PORVs are to be allowed to operate in AUTO.

SM lesson plan page 11/20

4. S/G PORV Response to a "MAIN STEAM ISOLATION SIGNAL".
   a. In "Auto": (Control Room)
      PORV's close and remain closed until the SM Isolation is "RESET" and PORV "RESET" is depressed for Train A & B.
   b. If PORV's in "MANUAL": (Control Room)
      1) Control for PORV'S will revert back to "AUTO" and close the PORV
      2) If PORV Operation is desired under this condition:
         (a) Auto - The SM and PORV RESETS Train A (B) must be depressed,
         (b) "MANUAL" - can be selected again and the PORV repositioned by using the "0" to "10" pot. (SM isolation signal does not have to be RESET to select "MANUAL"). "MANUAL" will allow reopening the PORV with an SM Isol Signal present.

	SM System Objectives	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the SM system	X	X	X	X	
2	Explain the purpose of the Flow Restrictor in each S/G outlet	X	X	X	X	
3	Describe the purpose of the S/G PORV's	X	X	X	X	
4	Describe the operation of the S/G PORV's	X	X			
5	Describe the location of the S/G PORV's	X	X	X	X	
6	Describe the controls and indications for the S/G PORV's			X	X	X
7	Discuss the procedure for locally operating the S/G PORV's	X	X	X	X	X
8	List the opening and closing setpoints for the S/G PORV's	X	X	X	X	X
9	List the requirements of entry into a space that has a high pressure steam relief device per Site Directive 3.1.2	X	X	X	X	X
10	Discuss the purpose of the S/G safety valves	X	X	X	X	
11	List the setpoints for the S/G safety valves	X	X	X	X	X
12	List the controls associated with the MSIV's			X	X	X
13	List the loads supplied by the SM system	X	X	X	X	X
14	List the signals that cause a SM Isolation	X	X			
15	List the signals and setpoints and coincidence that cause a SM Isolation			X	X	X
16	Describe the response of the SM system to a SM Isolation Signal	X	X	X	X	X
17	Draw the Main Steam System per Figure 1	X	X			
18	Describe the flowpath for a SM system valve lineup for unit heatup			X	X	
19	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
20	Describe the procedure for warming, pressurizing and securing the SM system			X	X	X
21	List the parameters used to monitor the SM system during operation			X	X	
22	Describe how the MSIV's operate			X	X	
23	List the safety signals that go to ESF from SM			X	X	

2) Manual Operation

   (a) Review SD 3.1.2 (Access To Reactor Building And Areas Having High Pressure Steam Relief Devices) (Obj. #9)

   (b) Unscrew clevis from manual override shaft, be aware that a Set Screw holds the Clevis in place.

   (c) Turn hand wheel to expose actuator shaft.

   (d) Slide clevis onto actuator shaft and tighten set screw.

   (e) Place bypass valve to "EQUALIZE" position

   (f) Turn handwheel to position valve as observed on local position indicator scale.

3. S/G PORV Indications and Controls

   a) Auto/Manual lights to indicate mode of operation (Control Room)

   b) Open/Closed lights to indicate position of PORV (Control Room)

   c) Percent (%) open demand signal indication for each PORV at CAPT Control Panel. (When operating in "LOCAL" at CAPT Control Panel).

4. S/G PORV Response to a "MAIN STEAM ISOLATION SIGNAL".

   a) In "Auto": (Control Room)

      PORV's close and remain closed until the SM Isolation is "RESET" and PORV "RESET" is depressed for Train A & B.

   b) If PORV's in "MANUAL": (Control Room)

      1) Control for PORV'S will revert back to "AUTO" and close the PORV

      2) If PORV Operation is desired under this condition:

         (a) Auto - The SM and PORV RESETS Train A (B) must be depressed,

         (b) "MANUAL" - can be selected again and the PORV repositioned by using the "0" to "10" pot. (SM isolation signal does not have to be RESET to select "MANUAL"). "MANUAL" will allow reopening the PORV with an SM Isol Signal present.

   c) If a "MANUAL" SM Isolation Signal is initiated and the S/G PORV's are selected to "MANUAL", the PORV's will stay in manual and will not close on the SM Isolation signal.

5. S/G PORV Isolation Valves

   a) Safety Related and powered from 600 volt ESS MCC's.

   b) S/G PORV Isolation valves receive an "OPEN" signal when ASP "LOCAL" control of PORV's is selected.

***Question*: 05-19**

1 Pt(s) Given the following conditions and sequence of events:

- The crew is responding to a continuous rod withdrawal per AP/1/A/5500/015 Case 2 Continuous Rod Motion.
- Control rods have been placed in manual and rod motion has stopped.
- Boron is being added with 1A boric acid pump to return Tavg to Tref.
- 1ETA experiences a loss of power.
- The blackout sequencer re-energized 1ETA.

Which choice states the minimum action(s), if any, required to be completed before the operator can secure the 1A boric acid pump using its control switch?

A. Reset the 1A diesel generator sequencer and reset the 1A boric acid pump.

B. Reset the 1A diesel generator sequencer.

C. Reset the 1A boric acid pump.

D. No additional actions are required.

Question*: 05-19** ***Answer: A

LEVEL:	RO/SRO

K/A	APE001	Title	Continuous Rod Withdrawal
	AA1.03	Description	Ability to operate and / or monitor the following as they apply to the Continuous Rod Withdrawal: **(CFR 41.7 / 45.5 / 45.6)** Boric acid pump control switch
		Importance	3.4/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-NV
Objectives	17, 19
REFERENCES	Lesson plan information (see below)
Author	RJK
Time	7/12/2005 2:34 PM 34 minutes

Distracter Analysis:

A. Correct:
B. Incorrect: This is correct for any sequencer load to establish control board switch control by the operator. BA pump has additional reset.
C. Incorrect: This is correct to regain control of the pump if the sequencer is reset.
D. Incorrect: Two resets are required.

NV lesson plan page 37 rev 044

Boric Acid Transfer Pumps
Both pumps Start on $S_{S.}$
Load group 1.
Must be reset separately following sequencer actuation (reset Ss, Reset sequencer, Reset BA XFER Pumps).

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
17	List the power supplies for the following pumps associated with NV: charging pumps, boric acid transfer pumps, and reactor makeup water pumps.			X	X	
18	For an automatic makeup to the VCT, discuss conditions necessary for it to start, flowpaths, and conditions which will cause the makeup to stop.			X	X	X
19	Discuss the sequence of events and flowpaths for performing dilution, alternate dilution and boration of the VCT.			X	X	X
20	Locate major components in the plant.	X	X			
21	Describe the consequences of placing a demineralizer in service that has not been properly boron saturated.			X	X	X
22	State all interlocks associated with the NV system.			X	X	
23	List the fail position of NV valves on loss of power or air.			X	X	
24	Describe the controls and indications for NV that are available at the Auxiliary Shutdown Panels and the valves that are automatically aligned when ASP is aligned for local operation.			X	X	
25	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
26	Using the Reactor Operating Data Book as a reference, determine how to maintain a given NCS boron concentration.			X	X	X
27	Using the Reactor Operating Data Book as a reference, determine how much water or boron must be added to the NCS to change boron concentration a given amount.			X	X	X
28	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X
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.			X	X	X
30	Identify configurations and operating evolutions that can potentially lead to gas intrusion.	X	X	X	X	X

i) Boron Acid Batching Tank Temperature
   1) Local temperature indication.
   2) High/Low temperature alarms.

6. Boric Acid Transfer Pumps
   a) Operated from MCB or Auxiliary Shutdown Panel.
   b) Both pumps
      1) Start on S_S.
      2) Load group 1.
   c) Must be reset separately following sequencer actuation (reset S_s, Reset sequencer, Reset BA XFER Pumps).
   d) Alarms on loss of suction.
   e) Two (2) per unit, Normally one pump in auto to start on demand from Rx M/U control system.
   f) Mini-flow recirc back to BAT to maintain thermal equilibrium via orifice in recirc line.
   g) Manual selection of pumps to provide boric acid during Emergency Borate mode.
   h) Capacity - 75 gpm each (Nor. L/D. flow).
   i) Discharge pressure capable of overcoming charging pump suction header pressure.
   j) Mini-flow design can lead to strong/weak pump interaction if running both pumps in parallel.
   k) Pump Control
      1) Auto via MU Control System.
      2) Manual at MCB.
      3) Locally at ASP.
   l) Boric Acid Transfer Pump Discharge Flow
      1) Deviation Alarm (Boric Acid) - Automatically closes NV181&186 on $\pm$ 1.2 gpm deviation between BA flow to blender and selected flow for greater than 10 secs.
      2) Recorder in C.R.

Question: 05-20

1 Pt(s) Given the following conditions:

- Unit 1 at 45% power
- Loop "A" Thot fails high

Assuming no operator action, which one of the following statements correctly explains the initial effect of this Thot failure?

A. Loop "A" OTDT setpoint increases

B. Control rods step in at 48 steps per minute

C. Charging flow increases

D. Pressurizer level increases to the Hi level alarm setpoint

Question: 05-20 *Answer: C*

LEVEL:	RO/SRO

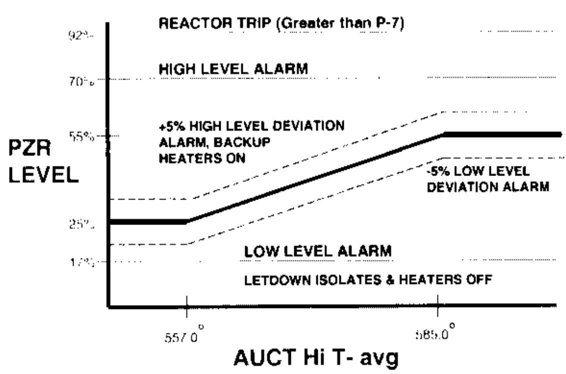
K/A	APE028	**Title**	Pressurizer (PZR) Level Control Malfunction
	AA1.02	**Description**	Ability to operate and / or monitor the following as they apply to the Pressurizer Level Control Malfunctions: **(CFR 41.7 / 45.5 / 45.6)** CVCS
		Importance	3.4/3.4

SOURCE	CNS exam bank
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-ILE
Objectives	6
REFERENCES	Lesson plan information, page 6 and 17
Author	RJK
Time	7/13/2005 12:51 PM 43 minutes

Distracter Analysis:
At 50 % power level will be about 40% per the chart below. Thot failing hot (650 F.) will cause Tavg to read approximately 604 degrees at this power level ((650-557)/2+557). If T-AVE fails to high, the Auctioneered T-AVE becomes that loop: PZR level would then just bring level to its 100% programmed level and stabilize (55%).

A. **Incorrect**: OTDT is not affected by this failure.
B. **Incorrect**: Control banks insert but at 72 step per minute. The mismatch is greater than 5 degrees where rod speed peaks at 72 SPM.
C. **Correct**:
D. **Incorrect**: If an operator assumes that pressurizer level setpoint is linear and disregards the normal 100% value of 55% being the maximum level allows by program, he may think that the trend line will continue linearly. This would equate to a PZR level of ~75% at 604 F (~1% level setpoint per degree F but only in the normal band)n This exceeds the high level setpoint (70%)

PZR LEVEL PROGRAM AND SETPOINTS (U1)



Question: 05-20

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1 Pt(s) Given the following conditions:

- Unit 1 at 45% power
- Loop "A" T-Avg fails high

Assuming no operator action, which one of the following statements correctly explains the effect on charging flow and pressurizer level?

A. Charging flow is reduced; letdown isolates on low pressurizer level.

B. Charging flow is reduced; pressurizer level reaches 25% then stabilizes.

C. Charging flow is increased; pressurizer level reaches 55% then stabilizes.

D. Charging flow is increased; pressurizer level reaches the reactor trip setpoint.

Question*: 05-20** ***Answer: C

LEVEL:	RO/SRO

K/A	APE028	**Title**	Pressurizer (PZR) Level Control Malfunction
	AA1.02	**Description**	Ability to operate and / or monitor the following as they apply to the Pressurizer Level Control Malfunctions: **(CFR 41.7 / 45.5 / 45.6)** CVCS
		Importance	3.4/3.4

SOURCE	CNS exam bank
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-ILE
Objectives	6
REFERENCES	Lesson plan information, page 6 and 17
Author	RJK
Time	7/13/2005 12:51 PM 43 minutes

Distracter Analysis:

A. **Incorrect**: Increase not decrease NV flow. Might think there would be some feedback to reduce flow back to 40%

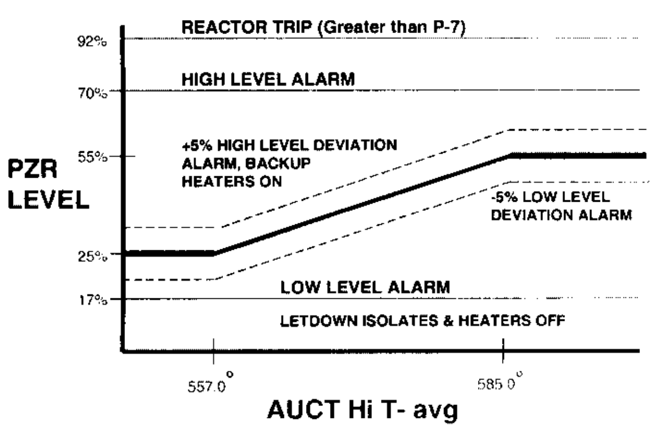
B. **Incorrect**: Increase not decrease NV flow. Might think of the no-load setpoint.

C. **Correct**:

D. **Incorrect**: Flow would only track setpoint which is limited to 55%. Might think that a high level trip situation would be created on the failure above 585 degrees.

At 50 % power level will be about 40% per the chart below. If T-AVE fails to high, the Auctioneered T-AVE becomes that loop: T-AVE would calculate to 55%. PZR level would then just bring level to its 100% programmed level and stabilize.

PZR LEVEL PROGRAM AND SETPOINTS (U1)



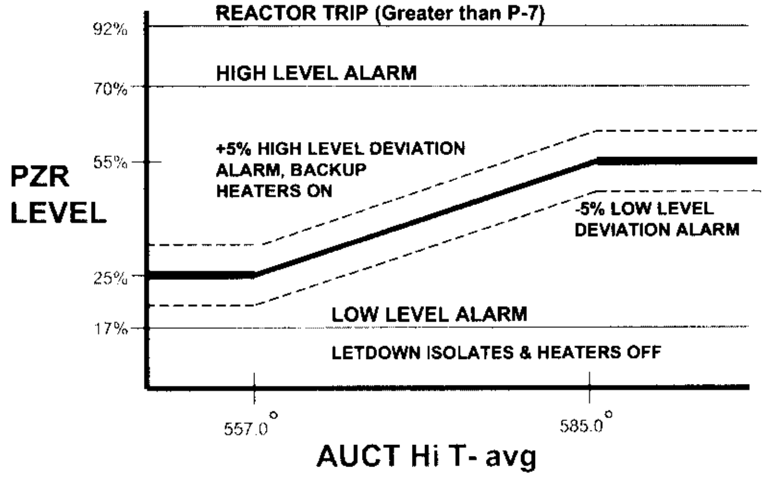
OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Pressurizer Level Control (ILE) System.			X	X	
2	Describe the pressurizer level control program including values and signal sources for program development.			X	X	X
3	Describe why a cold calibrated channel is required.			X	X	
4	Describe the response of ILE system to a deviation of pressurizer level from program value.			X	X	X
5	Discuss control room controls and indications associated with ILE.			X	X	X
6	Describe all automatic functions, alarm and control, that occur when pressurizer level deviates from program level, including setpoint changes and level channel failures.			X	X	X
7	Describe protection signals, trips, interlocks and permissives associated with ILE including setpoints.			X	X	X
8	Describe the actions which must be taken to restore pressurizer heater operation following a pressurizer low level heater cutoff.			X	X	X
9	Explain ILE system operation during startup, shutdown and normal operation.			X	X	
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X

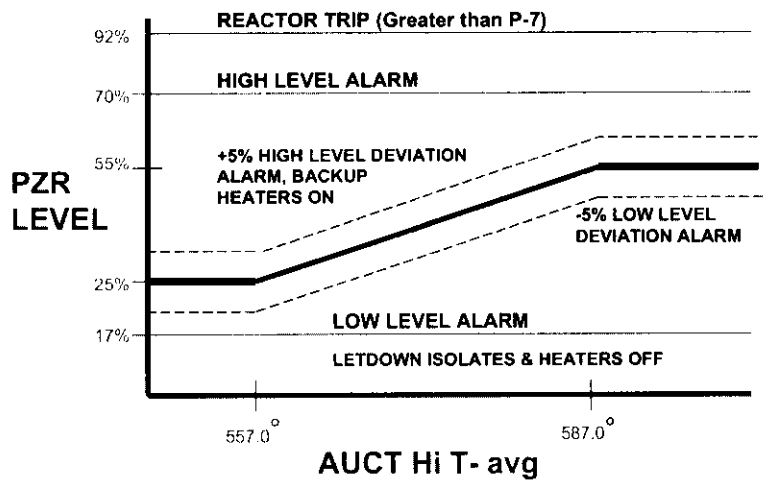
TIME: 2.0 HOURS

4. Programmed Pressurizer Level

PZR LEVEL PROGRAM AND SETPOINTS (U1)



PZR LEVEL PROGRAM AND SETPOINTS (U2)



a) Programmed as a function of Auct Hi T-Avg. (**OBJ. #2**)
   1) Level increase as T-Avg increases
   2) Level decreases as T-Avg decreases

g) T_{avg} fail high

1) No effect at 100% power

2) Less than 100% power, level will rise steadily to 55% Pzr lvl. Depending on severity may receive PZR Low Level Deviation Ann (-5%)

3) Operator action - Defeat defective T_{avg} channel

h) T_{avg} fail low

1) No effect (auctioneered Hi is used by the circuitry)

2) Operator action - Defeat defective T_{avg} channel

2. Mechanical Faults

a) Break in reference Leg

1) Removes high pressure reference side of transmitter.

2) Results in indicated level to read high.

b) Low level in reference leg.

1) Decreases high pressure reference side of transmitter.

2) Results in indicated level increase.

3) Caused by insufficient steam condensing in reference pot or small leak.

c) Adverse Containment Conditions (greater than 3 PSIG in Containment)

1) Can result in reference leg temp. increase.

2) Causes the transmitter high pressure side to be at a lower pressure due to reduced water density.

3) Results in the indicated level being higher than actual level.

d) Break on PZR line to transmitter [low pressure (impulse) side]

1) Allows actual level pressure to be removed from diaphragm.

2) Reference leg pressure to be removed from diaphragm. (delta P Maximum)

3) Results in indicated level to decrease to zero.

***Question*: 05-21**

1 Pt(s) Fuel handing activities are in progress in the Spent Fuel building when the following two (2) alarms are received simultaneously:

- 1RAD-2 A/2, 1EMF36 UNIT VENT GAS HI RAD is LIT
- 1RAD-2 F/5, CABINET 3-4 TROUBLE is LIT

The operator notes the following:

- 1EMF36 Operate and Trip 2 lights are LIT, the Trip 1 light is DARK
- The Trip 1 light on 1EMF36 is DARK
- All lights and displays for 1EMF42, FUEL BLDG VENT HI RAD are DARK
- 1RAD-2 B/1, 1EMF42 FUEL BLDG VENT HI RAD is DARK
- ABUXF-1A and ABUXF-1B have tripped

Based on the EMF indications of panel 1RAD-2, which one of the following is the FIRST response procedure action to take?

A. Review and then verify automatic actions of 1RAD-2 A/2 for the 1EMF36 Trip 2 alarm even though spent fuel building ventilation is already in the required condition to allow fuel handling activities.

B. Review automatic actions of 1RAD-2 B/1 for a 1EMF42 Trip 2. Take no action since spent fuel building ventilation would already be in the required condition to allow fuel handling activities.

C. Review the probable cause guidance of 1RAD-2 F/5 for the failure of 1EMF42.

D. Review the probable cause guidance of 1RAD-2 F/5 because both EMFs have malfunctions and no automatic actions have occurred.

Question: 05-21 **_Answer: A_**

LEVEL:	RO/SRO

K/A	APE037	**Title**	Fuel Handling Accident
	G2.4.31	**Description**	Knowledge of annunciators alarms and indications, and use of the response instructions **(CFR: 41.10 /45.3)**
		Importance	3.3/3.4

SOURCE	NEW
LEVEL of KNOWLEDGE	**Analysis**
Lesson	OP-CN-FH-VF
Objectives	12
REFERENCES	OP/1/B/6100/010Y rev 038 and lesson plan information
Author	RJK
Time	7/13/2005 1:33 PM 6 minutes

Distracter Analysis:

A. **Correct**: The EMF indications would display all three lights LIT in a Trip 2 condition. The display should be checked then the annunciator response used to verify any automatic action has occurred. This would be required even though the VF system is already in filtered exhaust mode to allow the movement of spent fuel. 1EMF36 trip 2 causes ABUXFs to trip (unit related)

B. **Incorrect**: Both EMF were checked to verify their conditions. To review and then do nothing for the automatic action of a failed EMF would not be the FIRST action an operator would take.

C. **Incorrect**: While this may be a follow-up at some point, there exists a valid alarm condition on EMF36 and choice "A" should be performed first.

D. **Incorrect**: The indications provided only verify that EMF42 has a malfunction. The operator should not assume the indication of EMF36 is also associated with a failure. WHEN EMF reaches a Trip 2 condition, all 3 lights would be LIT.

VF lesson plan page 14

4. EMF-35, 36 or 37 or EMF-42 (Hi Rad) Alarm (Obj. # 12)
   a) Verify automatic features function properly
      1) Exhaust is aligned to the filtered mode.
      2) When alarm clears, system realigns to bypass the filters.

Question*: *05-21

1 Pt(s) At which sample location would the associated EMF in Trip 2 require verification that fuel building ventilation (VF) exhaust has automatically transferred to filter mode?

A. Unit vent

B. New fuel storage areas

C. Spent fuel building bridge

D. Any of the 12 auxiliary building monitoring points

Question*: *05-21 ***Answer: A***

LEVEL:	RO/SRO

K/A	APE037	**Title**	Fuel Handling Accident
	G2.4.31	**Description**	Knowledge of annunciators alarms and indications, and use of the response instructions **(CFR: 41.10 /45.3)**
		Importance	3.3/3.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-FH-VF
Objectives	12
REFERENCES	OP/1/B/6100/010Y rev 038 and lesson plan information
Author	RJK
Time	7/13/2005 1:33 PM 23 minutes

Distracter Analysis: For these locations, only the Unit Vent EMFs generate a VF transfer to filter mode.

A. Correct:

B. Incorrect: New fuel area is outside the pool and conditions with VF airflow

C. Incorrect: Only a radiation detector for the bridge which stops the elevator

D. Incorrect: VA system covers 12 detection systems for the entire building. Operators may think that all exhaust systems may receive a transfer to "filter" signal.

VF lesson plan page 14

4. EMF-35, 36 or 37 or EMF-42 (Hi Rad) Alarm (Obj. # 12)
   a) Verify automatic features function properly
      1) Exhaust is aligned to the filtered mode.
      2) When alarm clears, system realigns to bypass the filters.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose(s) of the VF System	X	X	X	X	
2	Given a drawing of the VF System, describe the major components and their functions and trace system flow paths for different modes of operation	X	X	X	X	
3	Describe the function and operation of VF System controls and indications	X	X	X	X	X
4	List the trips and interlocks associated with the VF System	X	X	X	X	X
5	List the conditions when VF filters are required to be in operation	X	X	X	X	X
6	State cooling and heating water sources and when they are aligned	X	X	X	X	X
7	Given appropriate plant conditions, apply limits and precautions associated with related station procedures	X	X	X	X	X
8	Describe system/operator action during abnormal operations	X	X	X	X	X
9	Describe VF System response to sequencer actuation following an Ss or Blackout	X	X	X	X	X
10	Describe actions due to a fire alarm on VF filters	X	X	X	X	X
11	Describe actions due to tornado protection initiation	X	X	X	X	X
12	Describe actions due to alarms on EMF-35, 36 or 37 and EMF-42	X	X	X	X	X
13	Describe actions due to a VF supply fan trip on freeze protection	X	X	X	X	X
14	Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Spec/SLC's.			X	X	X
15	State from memory all Tech Spec actions for the applicable systems, subsystems and components that require remedial action to be taken in less than one (1) hour.			X	X	

B. Responding to abnormal conditions (Obj. # 8)

1. Sequencer actuation following an Ss or Blackout (Obj. # 9)

a) Exhaust fans are automatically stopped by LOCA sequencer signal. (Must reset sequencer to allow fans to be manually started).

b) Exhaust fans are automatically restarted by a blackout sequencer signal. The train, which receives the start signal first, will start regardless of which train was previously running. Only one train will start due to interlock.

c) Verify automatic features function properly.

2. HI or HI-Hi temperature alarm on VF filter (Obj. # 10)

a) Locally check for fire, if no fire then shutdown and establish mini-flow recirc. cooling.

b) If fire exists, manually open the deluge valve at the filter train to align RF system to filter bed.

3. Tornado protection initiation (Obj. # 11)

a) Ensure VF systems on both units are shutdown per procedure.

b) Depress the "INITIATE" pushbuttons on "TORNADO ISOL TRN A (B)" on 1MC-5 and 2MC-5.

c) To clear the signal, push "RESET" for the selected trains.

4. EMF-35, 36 or 37 or EMF-42 (Hi Rad) Alarm (Obj. # 12)

a) Verify automatic features function properly

1) Exhaust is aligned to the filtered mode.

2) When alarm clears, system realigns to bypass the filters.

5. Resetting supply fan freeze protection relay after trip (Obj. # 13)

a) Manually reset freeze protection thermostat (in spent fuel building)

b) Verify supply fan in "Auto"

c) Ensure exhaust fans in operation

2.3 Operating Experience

A. Review associated operating experience events as applicable.

3. SUMMARY

3.1 Review Objectives

3.2 Re-emphasis of Important Areas

A/2

1EMF 36 UNIT VENT GAS HI RAD

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-36 beta scintillation detector (low range).

PROBABLE CAUSE:

1. High gaseous activity from one of the combined ventilation system discharges to the unit vent.
2. PZR degas to the Sample Hood during shutdown.

NOTE:	
1.	When VC/YC is taken to "LOCAL", this trip of the unfiltered exhaust fans is bypassed.
2.	Various other VA equipment receiving run permissives from the unfiltered fans also stop.
3.	EMF-41 is inoperable when the VA System is shutdown.

AUTOMATIC ACTIONS:

1. The following Auxiliary Building Ventilation System components stop:
   - ABUXF-1A and ABUXF-1B which shutdown their respective supply units ABSU-1A and ABSU-1B.
2. The Fuel Pool Ventilation (VF) System aligns to the "FILTER" mode.
3. 1VQ-10 (VQ Fans Disch To Unit Vent) closes.
4. 1WG-160 (WG Decay Tank Outlet To Unit Vent Control) closes.

IMMEDIATE ACTIONS:

1. Verify automatic actions occur.
2. IF PZR degas is in progress during shutdown, perform the following:
   2.1 Ensure the following valves are closed:
   - 1NM-6A (Pzr Stm Smpl Line Cont Isol)
   - 1NM-7B (Pzr Smpl Hdr Cont Isol)

   2.2 Notify Chemistry to secure the PZR degas.
3. IF in Mode 5, 6 or No Mode, ensure Containment and Incore Room Purge is shutdown per OP/1/A/6450/015 (Containment Purge System).

CONTINUED ON THE NEXT PAGE

Question: 05-22

1 Pt(s) Initial Conditions:

- Unit 1 at 100% power
- EMF 71 (Steam Generator A Leakage) indicates 18 gpd
- Secondary system samples on 1A S/G by chemistry indicates 20 gpd
- EMF 33 (Condenser Air Ejector Exhaust) reads 210 CPM
- Charging system mismatch reads 12 gpm

Current Conditions:

- Mode 2
- Steam generator leakage has increased to 4 gpm

Which one detection method provided accurate indications of leak size while at 100% power and will be the PREFERRED monitoring method per NSD 513 (Primary to Secondary Leak Monitoring Program) while operating in Mode 2?

A. Secondary system samples

B. EMF 71

C. Charging system mismatch

D. EMF 33

Question: 05-22 ***Answer: A***

LEVEL:	RO/SRO

K/A	APE037	**Title**	Steam Generator Tube Leak
	AA2.05	**Description**	Ability to determine and interpret the following as they apply to the Steam Generator Tube Leak: **(CFR: 41.10 / 43.5 / 45.13)** Past history of leakage with current problem
		Importance	2.8/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	comprehension
Lesson	OP-CN-STM-SG
Objectives	24
REFERENCES	Lesson plan information (see attached)
Author	RJK
Time	7/13/2005 3:13 PM 12 minutes plus 34 minutes.

Distracter Analysis:

A. Correct:

B. Incorrect: : N-16 monitors are not accurate below 40% power, though an operator knows that 1A N-16 had been used at 100% power.

C. Incorrect: While this indication is used on the S/G leak abnormal procedure. It is not the PREFERRED method per the referenced NSD 513.

D. Incorrect Only to be used above 5% power. Operator may think that since air ejectors continue to operate, they can monitor there.

SG lesson plan page 32-34

Information taken from NSD 513 (Primary to Secondary Leak Monitoring Program)
Modes 2, 3, 4 - Leak rate monitoring is based on the tritium concentration from secondary system grab samples.

Mode 1 at ≥ 5% ≤ 40% Reactor Power - Leak rate monitoring should be based on condenser off-gas radiation monitor readings. The N-16 monitors are inaccurate below 40% power.

Mode 1 at > 40% < 95% Reactor Power - Leak rate monitoring using main steam line N-16 monitors or condenser off-gas radiation monitor.

Mode 1 at ≥ 95% to 100% Reactor Power, or stable operation at any power level > 40% Reactor Power - Leak rate monitoring using condenser off-gas radiation monitor, main steam line N-16 monitors, or condenser off-gas grab sampling (listed in order of preference).

***Question*: 05-22**

1 Pt(s) Given the following initial conditions:

- Unit 1 at 100% power
- EMF 71 (S/G A Leakage) read 18 gpd
- Secondary system samples by chemistry indicated 20 gpd

Current Conditions:

- Mode 2
- Steam generator leakage has increased to 4 gpm.

Which of the following detection methods is the preferred monitoring for the current leakage?

A. Secondary system samples

B. EMF 71 (Steam Generator A Leakage)

C. Steam generator 1A level

D. EMF 33 (Condenser Air Ejector Exhaust)

Question: 05-22 ***Answer: A***

LEVEL:	RO/SRO

K/A	APE037	**Title**	Steam Generator Tube Leak
	AA2.05	**Description**	Ability to determine and interpret the following as they apply to the Steam Generator Tube Leak: **(CFR: 41.10 / 43.5 / 45.13)** Past history of leakage with current problem
		Importance	2.8/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	comprehension
Lesson	OP-CN-STM-SG
Objectives	24
REFERENCES	Lesson plan information (see attached)
Author	RJK
Time	7/13/2005 3:13 PM 12 minutes plus 34 minutes.

Distracter Analysis:

A. **Correct**:

B. **Incorrect**: Only to be used above 5% power. Operator may think that since air ejectors continue to operate, they can monitor there.

C. **Incorrect**: N-16 monitors are not accurate below 40% power, though an operator knows that 1A N-16 had been used at 100% power

D. **Incorrect**: N-16 monitors are not accurate below 40% power, though an operator knows that 1A N-16 had been used at 100% power.

SG lesson plan page 32-34

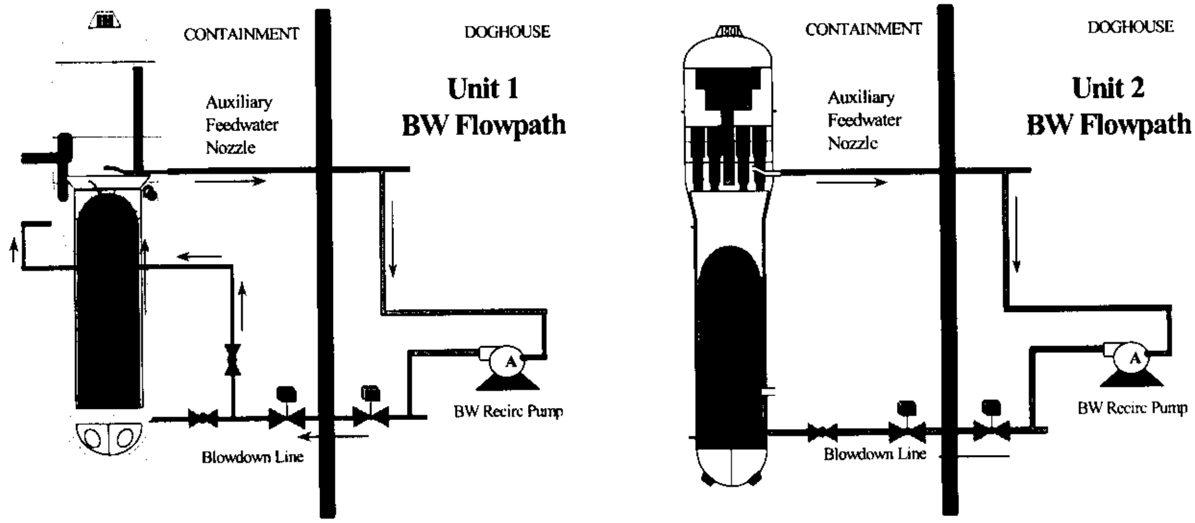
Modes 2, 3, 4 - Leak rate monitoring is based on the tritium concentration from secondary system grab samples.

Mode 1 at ≥ 5% ≤ 40% Reactor Power - Leak rate monitoring should be based on condenser off-gas radiation monitor readings. The N-16 monitors are inaccurate below 40% power.

Mode 1 at > 40% < 95% Reactor Power - Leak rate monitoring using main steam line N-16 monitors or condenser off-gas radiation monitor.

Mode 1 at ≥ 95% to 100% Reactor Power, or stable operation at any power level > 40% Reactor Power - Leak rate monitoring using condenser off-gas radiation monitor, main steam line N-16 monitors, or condenser off-gas grab sampling (listed in order of preference).

	Objectives *Note:* ***Although Catawba Unit 1 and Unit 2 Steam generators are of a significantly different design, all lesson objectives are applicable to both units unless otherwise indicated.***	I S S	N L O	L P R O	L P S O	P T R Q
	associated with related station procedures.					
24	Understand what indicators are available to determine SG tube leak rate and the limitations of the steam line N-16 monitors.			X	X	X
25	Given a copy of references and a set of plant conditions, determine compliance with the following Technical Specifications, Nuclear System Directives, and Selected License Commitments: • T.S. 3.4.13 (Reactor Coolant System Leakage) with respect to steam generator tube leakage. • T.S. 3.7.17 (Secondary Specific Activity) • T.S. 3.4.18 (Steam Generator Tube Integrity) • SLC 16.5-7 (Steam Generator Pressure/Temperature Limitation) • SLC 16.11-7 (Radioactive Gaseous Effluent Monitoring Instrumentation)			X	X	X
26	State the purpose for Auxiliary Feedwater Nozzle Tempering Flow.	X				
27	State the purpose for Main Feedwater Reverse Purge Flow.	X				



7. To provide adequate isolation between parts of the Steam Generator Wet Layup (BW) System that contain high design pressures (1200 and 1400 psia) and a low design pressure (150 psia and 50 psia), spectacle flanges are installed. The "open" portion of the spectacle flange will be installed when the BW system is required operational (at cold shutdown). The blind flange portion of the spectacle flange will be installed during normal plant operation.

C. S/G Drain **(Obj. #21)**

1. Refer to OP/1(2)/A/6250/003B (S/G Fill and Drain)
2. The BB system is usually used to drain a S/G to the turbine building sump.
3. S/G drain pumps located in lower containment are used to drain the S/G to the S/G Drain Tank. These will typically be used when the S/G inventory is contaminated.
4. At 5% WR level, the S/G Drain Pump is shutdown. The remaining water is routed to the containment floor and equipment sump via a local drain.

2.9 NSD513 (Primary-to-Secondary Leak Monitoring Program) **(Obj. #25)**

A. There are six action levels associated with the primary-to-secondary leak monitoring program. The limits shown here match those in appendix A not the limits shown in the text of the NSD. CNS uses values that have been corrected for measurements made at 557 °F.

1. No Available Continuous Radiation Monitor which is EMF-33 OOS and any N-16 monitor OOS. This action level requires the following to be performed:

a) If samples show leak rate is > 100 gpd, then shutdown to mode 3 in 6 hours.

2. Normal Operation is defined as the plant condition where no significant primary-to-secondary leakage is detected by routine surveillance.
3. Increased Monitoring is ≥5 gpd but less than 40 gpd in any steam generator.
4. Action Level 1 is ≥ 40 gpd but less than 100 gpd in any steam generator. This action level requires the following to be performed:
    - Monitor EMF-33 and N-16 monitors every 15 minutes.
    - Minimize secondary system contamination.
5. Action Level 2 is ≥ 100 gpd but less than 125 gpd in any one steam generator for more than one hour. This action level requires the following to be performed:
    - Shutdown to mode 3 in 24 hours
    - Minimize secondary system contamination.
    - Monitor EMF-33 and N-16 monitors every 15 minutes.
6. Action Level 3 is ≥ 125 gpd in any steam generator. This action level requires the following to be performed:
    - Shutdown to < 50% in 1 hour and to mode 3 in the next 2 hours.
    - Minimize secondary system contamination.
    - Monitor EMF-33 and N-16 monitors every 15 minutes.

B. In the event of an oscillating leak action levels shall be established based on the peak value of the spike.

C. During startup and shutdown the accuracy of various leak rate monitors varies with power level. The OAC calculation of leak rate is affected by air ejector off gas flow rate and Xe-135 equivalent which must be manually inputted into the calculation. If any leak rate monitors alarms while power level is changing, then the power level should be stabilized and the alarm validated.

1. Modes 2, 3, 4 - Leak rate monitoring is based on tritium concentration from secondary system grab samples.
2. Mode 1 at ≥ 5% ≤ 40% Reactor Power - Leak rate monitoring should be based on condenser off-gas radiation monitor readings. The N-16 monitors are inaccurate below 40% power.
3. Mode 1 at > 40% < 95% Reactor Power - Leak rate monitoring using main steam line N-16 monitors or condenser off-gas radiation monitor.
4. Mode 1 at ≥ 95% to 100% Reactor Power, or stable operation at any power level > 40% Reactor Power - Leak rate monitoring using condenser off-gas radiation monitor, main steam line N-16 monitors, or condenser off-gas grab sampling (listed in order of preference).

D. If there is significant disagreement in the trend of online monitors such that the monitor results are called into question, then condenser off-gas grab sampling shall be used for operational decision-making

E. During Modes 2, 3, and 4, tritium analysis shall be used to determine the primary-to-secondary leak rate. If a leak rate is approaching an administrative leak rate limit (CNS doesn't have one.) or 80 gallons per day, the plant shall cease start up activities until the leak status can be validated.

F. If a radiation monitor used to monitor primary-to-secondary leak rate becomes inoperable, it should be assigned the highest priority for repair.

2.10 Simplified version of the OAC leak rate calculation performed in PT/1/B/4600/028 (Determination of Steam Generator Tube Leak Rate for Unit 1). While various correction factors are applied by Chemistry, the following formula illustrates the relationship between significant variables in the calculation. **(Obj. #24).**

$$Pri\ to\ Sec\ Leak\ Rate \propto \frac{Total\ Off\ Gas\ Flow * EMF33\ Gain\ Factor * (EMF33\ Running\ Avg - EMF33\ Bkgrnd)}{Xe^{133}\ Equivalent\ Activity}$$

Where :

Total Off Gas Flow = Manual update

EMF 33 Gain Factor = Manual update

EMF33 Running Avg = OAC feed from EMF33 (E0111)

EMF33 Bkgrnd = Manual update

Xe^{133} Equivalent Activity = Manual update

A. The result of this calculation is displayed on OAC point C1/2P0187 (Estimated Total Pri to Sec Leakrate).

1. This point is used by point C1/2P0189 (Pri to Sec Leakrate 15 Min Running Ave) to calculate a 15 minute average leak rate.

B. AP/10 Case 1 refers the operator to OAC points C1/2P0187, C1/2P0189 and display group EROSLEAK for determining SG leak rate.

1. EROSLEAK displays both points in addition to points associated with the calculated leak rate from EMFs 71, 72, 73 & 74.

2. Operational decision making should be based upon the peak value displayed by OAC point C1/2P0187 and/or the N-16 monitors.

C. Steam Line N16 monitors (EMFs 71, 72, 73, & 74):

1. Provide estimated leak rate in GPD.

2. Inaccurate at power levels below 40%

3. Have a range of 1-100,000 gpd.

Question*: *05-23

1 Pt(s) Area radiation monitors functions are limited to detecting which of the following type events?

A. High radiation detected during a normal waste gas release, seal water heat exchanger tube leak, waste gas storage tank rupture

B. High radiation detected during a normal waste gas release, waste gas storage tank rupture, fuel handling accident

C. Seal water heat exchanger tube leak, high radiation at solid waste processing, radiation in reactor coolant filters

D. Fuel handling accident, high radiation at solid waste processing, radiation in reactor coolant filters

Question*: 05-23** ***Answer: D

LEVEL:	RO/SRO

K/A	APE061	**Title**	Area Radiation Monitoring (ARM) System Alarms
	AK1.01	**Description**	Knowledge of the operational implications of the following concepts as they apply to Area Radiation Monitoring (ARM) System Alarms: **CFR (41.8 / 41.10 / 45.3)** Detector limitations
		Importance	2.5/2.9

SOURCE	Modified (South Texas HLP bank)
LEVEL of KNOWLEDGE	Memory
Lesson	BNT - CP02R rev 6 pg 23/30 and EMF annunciator responses
Objectives	10
REFERENCES	Lesson plan information
Author	RJK
Time	7/13/2005 3:38 PM 4 minutes plus 23 minutes

Distracter Analysis:

- Hi rad during a waste release is EMF50 which is process.
- Sealwater HX leak is EMF46 A/B which is process
- WG storage tank rupture is EMF 41 and/or EMF 35,36,37 which are process
- Waste process area is EMF23 which is an area
- Fuel handling accidents are EMF 38, 39,40 or EMF 17 in containment which are process and area respectively AND EMF 42 (VF) and EMF15 in the SFP which are process and area respectively
- NC filter monitoring is with EMF18 or 19 which are area monitors

A. All process monitors
B. Mix of process and area
C. Mix of process and area
D. Correct:

SEQ	SENSORS AND DETECTORS ENABLING OBJECTIVES	BOT	GFES
1	Draw, label, and explain the Gas-Filled Detector characteristic curve. CP02086	X	X
2	State the basic theory of operation of an ion chamber radiation detector. CP02085	X	X
3	State the basic principles of operation of a Geiger-Mueller tube radiation detector. CP02087	X	X
4	Describe the two major subsystems that make up the Neutron Monitoring System. CP02093	X	X
5	Describe the construction and operation of a fission chamber used to detect neutrons. CP02094	X	X
6	Describe the construction and operation of a proportional counter. CP02095	X	X
7	Explain the effects of core voiding on neutron detection. CP02096		X
8	State the basic theory of operation of a scintillation radiation detector. CP02084	X	
9	State the purpose of process and area monitoring systems. CP02110	X	
10	Describe the basic operation of process and area monitors. CP02111	X	
11	List the four instrument checks required prior to the use of portable radiation monitoring instruments CP02088		X
12	Explain construction and basic theory of operation of the following dosimetry devices:		
	A. Thermoluminescent Dosimeter (TLD) CP02089		X
	B. Direct Reading Dosimeter (DRD) CP02090		X
	C. Electronic Dosimeter CP02091		X

PANEL: 1RAD-3

1EMF23 599 WW, 57A WS EQUIP AREA

E/3

SETPOINT:	Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).
ORIGIN:	1EMF-23 low range G-M Detector (Trip 2 Contacts).
PROBABLE CAUSE:	Radioactive spill or leak in the area.
AUTOMATIC ACTIONS:	None
IMMEDIATE ACTIONS:	1. Monitor activity level of 1EMF-23. 2. Evacuate personnel from the area if necessary.
SUPPLEMENTARY ACTIONS:	1. Monitor 1EMF-41 (Aux. Bldg.) activity levels. 2. Notify Radiation Protection personnel of this alarm. 3. Refer to RP/0/A/5000/010 (Conducting a Site Assembly or Evacuation) to determine the need of a site assembly.
REFERENCES:	CNM-1346.05-33

D/2

1EMF17 REACTOR BLDG REFUEL BRIDGE

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-17 low range G-M detector (trip 2 contacts).

PROBABLE CAUSE:

1. Radioactive spill or leak in containment.
2. Fuel element damage (refueling in progress).

AUTOMATIC ACTIONS: IF below P-6, containment evacuation alarm actuated.

IMMEDIATE ACTIONS:

1. Verify automatic action occurs.
2. IF valid alarm, ensure all personnel are evacuated from containment.
3. IF below P-6, contact upper and lower RP Hatch Watches and report the validity of the alarm.
4. Monitor 1EMF-17 activity levels.
5. IF 1EMF-39 is inoperable, secure any VQ in progress per OP/1/A/6450/017 (Containment Air Release And Addition System).

SUPPLEMENTARY ACTIONS:

1. IF operable, monitor 1EMF-38, 39, 40 (Containment Atmosphere) activity levels.
2. Notify Radiation Protection personnel of this alarm.
3. Refer to RP/0/A/5000/010 (Conducting a Site Assembly or Evacuation) to determine the need of a site assembly.
4. Refer to the appropriate coolant leak procedure for the condition of the plant:
   - AP/1/A/5500/10 (Reactor Coolant Leak)
   - AP/1/A/5500/27 (Shutdown LOCA)
   - AP/1/A/5500/19 (Loss of Residual Heat Removal System) Case II
5. Refer to AP/1/A/5500/25 (Damaged Spent Fuel).

REFERENCES:

1. CNM-1346.05-33
2. NSM CN-00001

PANEL: 1RAD-3

1EMF15 SPENT FUEL BLDG REFUEL BRIDGE

C/5

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-15 low range G-M detector (trip 2 contacts).

PROBABLE CAUSE:
1. Fuel element damage.
2. Radioactive spill or leak in area.

AUTOMATIC ACTIONS: Stops new fuel elevator from rising up.

IMMEDIATE ACTIONS:
1. Verify automatic action occurs.
2. Monitor 1EMF-15 activity level and evacuate spent fuel pool area if such action is warranted.

SUPPLEMENTARY ACTIONS:
1. Notify Radiation Protection personnel of this alarm.
2. Monitor activity level for 1EMF-42 (Fuel Hdlg Hi Gas Rad) and ensure Spent Fuel Pool Ventilation System filters in filter mode per OP/1/A/6450/004 (Fuel Pool Ventilation System), if required.
3. Monitor 1EMF-35, 36, 37 (Unit Vent) activity levels.
4. Refer to RP/0/A/5000/010 (Conducting a Site Assembly or Evacuation) to determine the need of a site assembly.
5. Attempt to identify source of activity.
6. Refer to AP/1/A/5500/25 (Damaged Spent Fuel).

REFERENCES: CNM-1346.05-33

PANEL: 1RAD-3

1EMF18 568 KK, 56 NC FILTER 1A

D/3

SETPOINT:	Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).
ORIGIN:	1EMF-18 high range ionization chambers (trip 2 contacts).
PROBABLE CAUSE:	1. Large radioactive crud deposit in filter. 2. Radioactive spill or leak in room.
AUTOMATIC ACTIONS:	None
IMMEDIATE ACTIONS:	Monitor 1EMF-18 activity level and evacuate personnel from the affected area if such action is warranted.
SUPPLEMENTARY ACTIONS:	1. Monitor EMF-41 (Aux. Bldg.) and 1EMF-35, 36, 37 (Unit Vent) activity levels. 2. Notify Radiation Protection and Maintenance personnel of apparent need to change filter cartridge. 3. Refer to RP/0/A/5000/010 (Conducting a Site Assembly or Evacuation) to determine the need of a site assembly.
REFERENCES:	CNM-1346.05-33

1EMF19 568 KK-LL, 56 NC FILTER 1B

D/4

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-19 high range ionization chambers (trip 2 contacts).

PROBABLE CAUSE:
1. Large radioactive crud deposit in filter.
2. Radioactive spill or leak in room.

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS: Monitor 1EMF-19 activity level and evacuate personnel from the affected area if such action is warranted.

SUPPLEMENTARY ACTIONS:
1. Monitor EMF-41 (Aux. Bldg.) and 1EMF-35, 36, 37 (Unit Vent) activity levels.
2. Notify Radiation Protection and Maintenance personnel of apparent need to change filter cartridge.
3. Refer to RP/0/A/5000/010 (Conducting a Site Assembly or Evacuation) to determine the need of a site assembly.

REFERENCES: CNM-1346.05-33

E/3

1EMF 42 FUEL BLDG VENT LOSS OF FLOW

SETPOINT: 1 scfm

ORIGIN: 1EMF-42 sample flow switch.

PROBABLE CAUSE:

1. Line blockage upstream or downstream.
2. Pump/motor fault.
3. Pipe leak upstream of the flow switch.

AUTOMATIC ACTIONS: The gas sample pump trips.

IMMEDIATE ACTIONS: Verify the automatic action occurs.

SUPPLEMENTARY ACTIONS:

1. Verify 1MXX-F05G (Fuel Bldg Vent Rad Mon 1EMF-42 Sample Pump Motor) (TB-594, 1L-34) closed.
2. **IF** the cause of the alarm **CANNOT** be determined **AND** corrected, perform the following:
   - 2.1 Notify Radiation Protection personnel of this alarm.
   - 2.2 Issue a work request to initiate corrective action.
3. **WHEN** condition causing alarm has been corrected, restart the gas sample pump motor.
4. Refer to SLC 16.7-10.
5. During accident conditions, have the Operations TSC representative notify the RP Dose Assessment Coordinator of this alarm.

REFERENCES:

1. CNM-1346.05-33
2. NSM CN-60056

1EMF-46A TRAIN A KC HI RAD

A/4

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-46A gamma scintillation detector.

PROBABLE CAUSE: Tube leak on one or more heat exchangers interfacing with primary coolant.

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS: None

SUPPLEMENTARY ACTIONS:

1. Notify Radiation Protection and Chemistry personnel of this alarm.

NOTE: Potential sources of inleakage might be:

- NV Letdown Hx
- NV Excess Letdown Hx
- KF Hxs
- NC Pump Thermal Barriers
- ND Hx

2. Attempt to locate source of leakage into the KC System.
3. Monitor the KC surge tank levels to prevent a contaminated spill at the KC surge tank vent valves, 1KC-122 and 1KC-128, since these valves are open.
4. Refer to AP/1/A/5500/10 (Reactor Coolant Leak).
5. Refer to Tech Spec 3.4.13.

REFERENCES: CNM-1346.05-33

1EMF 46B TRAIN B KC HI RAD

A/4

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-46B gamma scintillation detector.

PROBABLE CAUSE: A tube leak on one or more heat exchangers interfacing with the primary coolant.

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS: None

SUPPLEMENTARY ACTIONS:

1. Notify Radiation Protection and Chemistry personnel of this alarm.

NOTE: Potential sources of inleakage might be:

- NV Letdown Hx
- NV Excess Letdown Hx
- KF Hxs
- NC Pump Thermal Barriers
- ND Hxs

2. Attempt to locate the source of leakage into the KC System.
3. Monitor the KC surge tank levels to prevent a contaminated spill at the KC surge tank vent valves, 1KC-122 and 1KC-128, since these valves are open.
4. Refer to the appropriate coolant leak procedure for the condition of the plant:
   - AP/1/A/5500/10 (Reactor Coolant Leak)
   - AP/1/A/5500/27 (Shutdown LOCA)
   - AP/1/A/5500/19.(Loss of Residual Heat Removal System) Case II
5. Refer to Tech Spec 3.4.13

REFERENCES: CNM-1346.05-33

1EMF 35 UNIT VENT PART HI RAD

A/1

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-35 beta scintillation detector (low range).

PROBABLE CAUSE: High particulate activity from one of the combined ventilation system discharges to the unit vent.

NOTE:
1. When VC/YC is taken to "LOCAL", this trip of the unfiltered exhaust fans is bypassed.
2. Various other VA equipment receiving run permissives from the unfiltered fans also stop.
3. EMF-41 is inoperable when the VA System is shutdown.

AUTOMATIC ACTIONS:

1. The following Auxiliary Building Ventilation System components stop:
   - ABUXF-1A and ABUXF-1B which shutdown their respective supply units ABSU-1A and ABSU-1B.
2. The Fuel Pool Ventilation (VF) System aligns to the "FILTER" mode.
3. 1VQ-10 (VQ Fans Disch to Unit Vent) closes.
4. 1WG-160 (WG Decay Tank Outlet to Unit Vent Control) closes.

IMMEDIATE ACTIONS: Verify automatic actions occur.

CONTINUED ON THE NEXT PAGE

1EMF 35 UNIT VENT PART HI RAD (Cont'd)

A/1

SUPPLEMENTARY ACTIONS

1. Monitor activity levels for the following:
   - 1EMF-38 (Containment Part Hi Rad)
   - 1EMF-35 (Unit Vent Hi Part Rad)
   - 1EMF-33 (CSAE)
   - 2EMF-33 (CSAE)
   - EMF-41 (Auxiliary Building)
   - 1EMF-42 (Fuel Building)
2. Notify Radiation Protection personnel of this alarm.
3. During accident conditions, have the Operations TSC representative notify the RP Dose Assessment Coordinator of this alarm.
4. After alarm clears, restore VA System to normal per OP/0/A/6450/003 (Auxiliary Building Ventilation System) and VF System per OP/1/A/6450/004 (Fuel Pool Ventilation System).
5. Refer to SLC 16.11-7.

REFERENCES:

1. CNM-1346.05-33
2. CNEE-0166-01.46-01
3. NSM CE-60308
4. MM CE-61117
5. MM CE-61118

A/2

1EMF 36 UNIT VENT GAS HI RAD

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-36 beta scintillation detector (low range).

PROBABLE CAUSE:

1. High gaseous activity from one of the combined ventilation system discharges to the unit vent.
2. PZR degas to the Sample Hood during shutdown.

NOTE:	
1.	When VC/YC is taken to "LOCAL", this trip of the unfiltered exhaust fans is bypassed.
2.	Various other VA equipment receiving run permissives from the unfiltered fans also stop.
3.	EMF-41 is inoperable when the VA System is shutdown.

AUTOMATIC ACTIONS:

1. The following Auxiliary Building Ventilation System components stop:
   - ABUXF-1A and ABUXF-1B which shutdown their respective supply units ABSU-1A and ABSU-1B.
2. The Fuel Pool Ventilation (VF) System aligns to the "FILTER" mode.
3. 1VQ-10 (VQ Fans Disch To Unit Vent) closes.
4. 1WG-160 (WG Decay Tank Outlet To Unit Vent Control) closes.

IMMEDIATE ACTIONS:

1. Verify automatic actions occur.
2. **IF** PZR degas is in progress during shutdown, perform the following:
   - 2.1 Ensure the following valves are closed:
     - 1NM-6A (Pzr Stm Smpl Line Cont Isol)
     - 1NM-7B (Pzr Smpl Hdr Cont Isol)
   - 2.2 Notify Chemistry to secure the PZR degas.
3. **IF** in Mode 5, 6 or No Mode, ensure Containment and Incore Room Purge is shutdown per OP/1/A/6450/015 (Containment Purge System).

CONTINUED ON THE NEXT PAGE

A/2

1EMF 36 UNIT VENT GAS HI RAD (Cont'd)

SUPPLEMENTARY ACTIONS:

1. Monitor activity levels for the following:
   - 1EMF-39 (Containment Gas Hi Rad)
   - 1EMF-36 (Unit Vent Hi Gas Rad)
   - 1EMF-33 (CSAE)
   - 2EMF-33 (CSAE)
   - EMF-41 (Auxiliary Building)
   - 1EMF-42 (Fuel Building)
   - EMF-50 (Waste Gas)
2 Notify Radiation Protection and Radwaste Chemistry personnel of this alarm.
3. During accident conditions, have the Operations TSC representative notify the RP Dose Assessment Coordinator of this alarm.
4. After alarm clears, restore VA System to normal per OP/0/A/6450/003 (Auxiliary Building Ventilation System), and VF System per OP/1/A/6450/004 (Fuel Pool Ventilation System).
5. Refer to SLC 16.11-7.

REFERENCES:

1. CNM-1346.05-33
2. CNEE-0166-01.46-01
3. NSM CE-60308
4. MM CE-61117
5. MM CE-61118

A/3

1EMF 37 UNIT VENT IODINE HI RAD

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-37 gamma scintillation detector.

PROBABLE CAUSE: High iodine activity from one of the combined ventilation system discharges to the unit vent.

NOTE:
1. When VC/YC is taken to "LOCAL", this trip of the unfiltered exhaust fans is bypassed.
2. Various other VA equipment receiving run permissives from the unfiltered fans also stop.
3. EMF-41 is inoperable when the VA System is shutdown.

AUTOMATIC ACTIONS:
1. The following Auxiliary Building Ventilation components stop:
    - ABUXF-1A and ABUXF-1B which shutdown their respective supply units ABSU-1A and ABSU-1B.
2. The Fuel Pool Ventilation (VF) System aligns to the "FILTER" mode.
3. 1VQ-10 (VQ Fans Disch To Unit Vent) closes.
4. 1WG-160 (WG Decay Tank Outlet To Unit Vent Control) closes.

IMMEDIATE ACTIONS: Verify automatic actions occur.

CONTINUED ON THE NEXT PAGE

A/3

1EMF 37 UNIT VENT IODINE HI RAD (Cont'd)

SUPPLEMENTARY ACTIONS:

1. Monitor activity levels for the following:
   - 1EMF-40 (Containment Iodine Hi Rad)
   - 1EMF-37 (Unit Vent Hi Iod Rad)
   - 1EMF-33 (CSAE)
   - 2EMF-33 (CSAE)
   - EMF-41 (Auxiliary Building)
   - 1EMF-42 (Fuel Building)
2. Notify Radiation Protection personnel of this alarm.
3. During accident conditions, have the Operations TSC representative notify the RP Dose Assessment Coordinator of this alarm.
4. After alarm clears, restore VA System to normal per OP/0/A/6450/003 (Auxiliary Building Ventilation System) and VF System per OP/1/A/6450/004 (Fuel Pool Ventilation System).
5. Refer to SLC 16.11-7.

REFERENCES:

1. CNM-1346.05-33
2. CNEE-0166-01.46-01
3. NSM CE-60308
4. MM CE-61117
5. MM CE-61118

1EMF 42 FUEL BLDG VENT HI RAD

B/1

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: 1EMF-42 beta scintillation detector.

PROBABLE CAUSE: Spent fuel damage resulting in high gaseous activity in the fuel handling area.

AUTOMATIC ACTIONS: The VF System aligns in the filter mode.

IMMEDIATE ACTIONS:

1. Verify the automatic action occurs.
2. Evacuate personnel from the fuel building.

SUPPLEMENTARY ACTIONS:

1. Monitor activity levels for the following:
   - 1EMF-42 (Fuel Hdlg Hi Gas Rad)
   - 1EMF-36 (Unit Vent Gas Monitor)
   - 1EMF-35 (Unit Vent Hi Part Rad)
   - 1EMF-37 (Unit Vent Hi Iod Rad)
2. Notify Radiation Protection personnel of this alarm.
3. Refer to AP/1/A/5500/25 (Damaged Spent Fuel).
4. During accident conditions, have the Operations TSC representative notify the RP Dose Assessment Coordinator of this alarm.

REFERENCES: CNM-1346.05-33

C/4

EMF-50 WASTE GAS DISCH HI RAD

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: EMF-50 beta scintillation detector (low range).

PROBABLE CAUSE:
1. Inadvertent opening of 1WG-160 (WG Decay Tank Outlet to Unit Vent Control).
2. Error in release rate calculations.

AUTOMATIC ACTIONS: 1WG-160 (WG Decay Tank Outlet to Unit Vent Control) closes.

IMMEDIATE ACTIONS:
1. Notify personnel making release at the Waste Gas Panel of this alarm.
2. Verify that 1WG-160 (WG Decay Tank Outlet to Unit Vent Control) closes, per computer points C1D3042 and C1D3043.
3. Monitor activity levels for EMF-35, 36 and 37.

SUPPLEMENTARY ACTIONS:
1. Notify Radiation Protection personnel of this alarm.
2. Monitor Unit Vent EMFs 35, 36 and 37 for high activity levels.

NOTE: Prior to opening 1WG-160, its controller must be reset by running it back to zero.

REFERENCES: CNM-1346.05-33

B/3

EMF-41 AUX BLDG VENT HI RAD

SETPOINT: Per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).

ORIGIN: EMF-41 beta scintillation detector.

PROBABLE CAUSE:
1. Radioactive spill/leak in the auxiliary building.
2. PZR degas to the Sample Hood during shutdown.

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS:
1. **IF** EMF-41 > $1x10^6$CPM, conduct a site assembly per RP/0/A/5000/010 (Conducting A Site Assembly or Evacuation).
2. Verify filter trains on both units are in service.
3. Ensure that all Control Room doors are closed and that a positive pressure is being maintained.
4. **IF** PZR degas is in progress during shutdown on either unit, perform the following:
   - 4.1 Ensure the applicable valves are closed:
     Unit 1
     - 1NM-6A (Pzr Stm Smpl Line Cont Isol)
     - 1NM-7B (Pzr Smpl Hdr Cont Isol)

     Unit 2
     - 2NM-6A (Pzr Stm Smpl Line Cont Isol)
     - 2NM-7B (Pzr Smpl Hdr Cont Isol)
   - 4.2 Notify Chemistry to secure the PZR degas.
5. Monitor 12-points via VA graphic to determine location of activity.
   - 5.1 Reference next page for EMF point inputs.
6. Monitor activity levels for EMF-35, 36 and 37.
7. Refer to AP/1/A/5500/10 (Reactor Coolant Leak).

SUPPLEMENTARY ACTIONS:
1. Notify Radiation Protection personnel of this alarm.
2. Attempt to isolate leak if one exists.
3. Refer to SLC 16.7-10.
4. Refer to RP/0/A/5000/01 (Classification of Emergency).

REFERENCES:
1. CNM-1346.05-33
2. CN-1577 Series
3. CN-1211.00-358
4. MM CE-61117
5. MM CE-61118
6. NSM CN11352

NOTE: Inputs to EMF-41 are listed on the following page.

CONTINUED ON THE NEXT PAGE

EMF-41 AUX BLDG VENT HI RAD (Cont'd)

EMF 41 INPUTS

Points 1 & 2

U1 NS Pump Rm (102, 103)
U1 ND Pump Rm (104, 105)
U1 Pipe Chase (113)
U1 NV Pump Rm (230, 231)
U1 NI Pump Rm (234, 235)

Point 5

All Point 6 Areas

Stairwell (212A, 310A, 400A, 500C)
Pipe Chase Open Area (217)
Decon Sink (310)
Valve Gallery (311, 312, 313)

Point 7 & 8

U2 NS Pump Rm (107, 108)
U2 ND Pump Rm (109, 110)
Pipe Chase (113)
U2 NV Pump Rm (240, 241)
U2 NI Pump Rm (244, 245)

Point 11

All Point 12 Areas

Pipe Chase Open Area (227)
Boric Acid Pump Rm (301, 302)
Decon Sink (303)
Valve Gallery (304)
BAT Rm (305, 307)

Point 3

Decon Sink (500)
U1 ZJ System
Count Rm (510)
S/R Sample Hood (511)
Corridor (501, 513F, 517, 551A, 604, 605)
Men Change Room (513)
Hot Machine Shop (515)
Stairs (517A, 619A)
Emergency Kit Rm - Inst. Cal. Rm (517)
Resp. Comp. Rm (518)

Point 6

WEFT
Stairwell (200A, 300A, 401A, 501A, 605A)
Open Area (200B)
Ground Water Sump Rm (200C)
Decon Sinks (200, 300, 400)
Recycle Evap. Feed Pump Room (210A)
Room (210B)
Boron Recycle Evaporator Room (211)
WCDT Drain Pump Rm (213)
CDT Pump Room (214)
WGT Pump Room (215A)
WL Evap. Feed Pump Rm (215B)

Point 9

U2 ZJ System
Decon Sink (500)
Women Change Rm (502)
Laundry Facility (506, 507, 508)
Waste Shipping (509)
Hot Labs (611)
AA Room (612)
Compactor Area (619)
Container Storage Rm (620)

First Aid Rm (666)
Corridor (671, 675)

Point 12

Decon Sinks (200, 300, 400)
Stairwell (200D, 322A, 400B, 561A)
Valve Gallery (202, 306)
WGDT Rm (203)
WG Analyzer Rack Room (204B, 205A)
WG H_2 Recombiner Room (205, 206A)
WG Comp. Pack Room (206B, 207)
Stairwell (209A, 303A, 400E, 500A
MST Sludge Pump Rm (220)
MST Room (221)

CONTINUED ON THE NEXT PAGE

PANEL: 1RAD-1

EMF-41 AUX BLDG VENT HI RAD (Cont'd)

EMF 41 INPUTS

Vestibule (519A)
Decon Rm & Hoods (520, 521, 522)
Hot Inst. Shop (523)
Cont. Tool Cal. Rm (525)
Inst. Cal. Rm (551)

Women Toilet (606)
Men Toilet (607)
Cold Lab (613)
Chem. Office (619, 620, 622)

WDT Room (215C)
WEFT Room (215C)
Decon Sink (215)
WL Evap. Room (216)
543 Mech. Pen Rm (217)
Pipe Chase (217)
U1 PD Pump (233)
Open Area (236)

Valve Gallery (315)
Seal Water H/E Room (331)
Filter/Demineralizer Rooms: (Pits)

410	416B	452	459
411	430	453	470
412	431	454	471
413	432	455	472
414	433	456	473
415	450	457	
416A	451	458	

Point 10
Boron Inj. Recirc. Tank Room (308A)
U2 VCT Room (309)
U2 KF Demin Room (408)
U2 KF H/E Room (409)

U2 NS/ND H/E Room (425)
U2 NS/ND H/E Room (426)
Mech. Pen. Room (427)
U2 Letdown Reheat H/E Room (465)
U2 Letdown Chiller H/E Room (466)
U2 Letdown H/E Rm (467)
U2 Moderating H/E Rm (468)

SRST - B (222A)
SRST Rm (222A, 222B)
Spent Resin Valve Gallery Rm (222)
Spent Resin Sluicing Pump Rm (223)
LHST Pump Room (224)
LHST & FDT Room (225)
FDT Pump Room (226)
Mech. Pen. Rm & Pipe Chase (227)
U2 PD Pump Room (243)
Open Area (246)
U2 Seal Water H/E Rm (321)
U2 Boronometer Rm (324)

Point 4
Valve Gallery (317)
Boron Inj. Recirc. Pump Rm (318A)
VCT (319)
KF Demin Rm (417)
KF H/E Rm (418)
Mech. Pen Rm (419)
NS/ND H/E Rm (434)
NS/ND H/E Rm (435)
Letdown Reheat H/E Room (474)
Letdown Chiller H/E Room (475)
Letdown H/E Rm (476)
Moderating H/E Rm (477)

Filter/Demineralization Room: (Pits)

420	442	449
421	443	460
422	444	461
423	445	462
424	446	463
428	447	464
441	448	

Objective 9

The purpose of the Process Radiation Monitoring System is to:

- Monitor primary and secondary systems within the station during normal operation to provide early warning of equipment, component or system malfunction or potential radiological hazards.
- Provide continuous monitoring of radioactive liquid and gas discharges to the environment.
- Provide interlocks to automatically terminate discharges from waste systems at preset activity levels.
- Provide monitoring of airborne and liquid activity in selected locations and effluent paths during postulated loss of coolant accidents.
- Detect and assess high-level activity passing through the Main Steam Lines.

The purpose of the Area Radiation Monitoring System is to:

- Indicate radiation levels at various locations throughout the station where personnel exposure is likely.
- Sound local alarms when the radiation level exceeds the alarm setpoint.
- Indicate activity buildup in the reactor coolant filters.
- Provide interlocks for containment evacuation alarms.

Objective 10

7.1 PROCESS MONITORING

Radiation detectors for each process are chosen to measure the isotopes most indicative of the status of the unit. Detector selection is based upon:

- Parameter to be measured (gross gamma, gross beta, specific isotope).
- Required sensitivity
- Required range

Overall range of the instrumentation covers the full range of radiation concentrations expected during normal operations and postulated accidents. In many cases, dual ranges are required. Signals from each detector are sent to readout modules in the control cabinet. The Modules provide analog and digital (in some cases) display of channel activity while Multipoint recorders provide records of activity. Each channel provides a high level alarm with a setpoint adjustable over the full range of the instrument. The high levels are annunciated at the control cabinet. In some cases, high radiation alarms result in automatic control actions.

For some monitors that sample air, a vacuum pump is provided with a flow switch which will alarm if sample flow is lost. To verify the operability of the channel, a check source is provided.

7.2 AREA MONITORING

Gamma sensitive detectors are used for area monitors. The detector range is sufficient to indicate when personnel access is not permitted to a given area. Audible alarms are sounded at detector locations in most cases. Indications and alarms are also provided at the control console. Check sources are provided to verify channel operation.

***Question*: 05-24**

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1 Pt(s) Select the statement that represents a loss of containment integrity?

A. Both lower PAL doors closed with all seals deflated.

B. Annulus doors blocked open for maintenance work.

C. Submarine hatch closed with the tamper seal removed.

D. Engineering discovery of major divider barrier seal degradation.

Question*: 05-24** ***Answer: A

LEVEL:	RO/SRO

K/A	APE069	Title	Loss of Containment Integrity
	AK2.03	Description	Knowledge of the interrelations between the Loss of Containment Integrity and the following: **(CFR 41.7 / 45.7)** Personnel access hatch and emergency access hatch
		Importance	2.8/2.9

SOURCE	New
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CNT-CNT
Objectives	26
REFERENCES	T.S. 3.6.2 and bases Lesson plan information
Author	RJK
Time	7/18/2005 9:39 AM 89 minutes

Distracter Analysis: One door and one seal is the minimum required for CONTAINMENT INTEGRITY as far as acting a barrier to the release of radioactivity.

A. Correct.

B. Incorrect: Doors may be inoperable, but two doors closed with seal inflated is integrity. The operator may think that the interlocks are required since they are a LCO.

C. Incorrect: One door is sufficient for integrity of the containment. But again the operator may confuse operability per Tech Spec with integrity.

D. Incorrect: Per T.S. and the Containment DBD, one door and one seal is integrity. But the minimum number of doors and seals may confuse the operator to think there is no integrity.

Lesson plan: D.3.d) It should be noted that only one of the four seals is required to maintain containment integrity.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
26	When given plant conditions and a copy of Tech. Specs. Or Selected License Conditions and associated bases, **DETERMINE** compliance with LCO's and apply Action statements: T.S. 3.3.3 T.S. 3.6.1 T.S. 3.6.2 T.S. 3.6.3 T.S. 3.6.4 T.S. 3.6.5 T.S. 3.6.14 T.S. 3.6.15 T.S. 3.6.16 T.S. 3.6.17 SLC 16.6-1 SLC 16.8-1 SLC 16.7-10 SLC 16.11-7			X	X	X
27	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.			X	X	

4. Refer to Tech. Spec. 3.6.14 (Divider Barrier Integrity).

D. Personnel Air Locks (PALs) (Penetration Nos. C100 (Lower) and C300 (Upper))

1. Purpose

   a) The purpose of the PALs is to provide double barrier protection for containment isolation as well as to provide access into containment.

   b) The "reactor side" bulkhead serves as the first barrier and the "auxiliary side" bulkhead serves as the redundant barrier.

2. Door Interlocks (Obj. #12)

   a) Each bulkhead has a door using two inflatable seals. An interlocking system is used to prevent these doors from opening simultaneously.

   b) These interlocks are sometimes bypassed during outages or when an equipment malfunction occurs.

3. Door Seal Operation

   a) The inflatable seals on each door are supplied with air by the Instrument Air System (VI).

   b) In the event of a loss of Instrument Air, air tanks mounted on the air lock doors provide a backup air supply.

   c) To ensure the integrity of the air lock system, the three-way solenoid valves supplying air to the airlock seals are safety related. The power supply for these valves is non-safety grade power. If power to the valves is interrupted, these solenoid valves fail to the open position.

   d) It should be noted that only one of the four seals is required to maintain containment integrity

4. Instrumentation

   a) Status lights are provided to indicate the position of each door locally and in the Control Room.

5. Bypass Leakage Enclosures (CAD doors)

   a) The Bypass Leakage Enclosures function as extensions of the Reactor Building's Annulus and are designed to enclose the Upper and Lower PALs.

   b) The Upper/Lower PAL penetrates both a fire barrier and the Annulus pressure boundary. To maintain the integrity of the Annulus, the Upper/Lower Bypass Leakage Enclosures function both as a fire barrier and as part of the Reactor Building Annulus pressure barrier for the purposes of tornado depressurization protection.

   c) These doors are sometimes propped open during outages to facilitate personnel material transit into and out containment. A fire impairment and tornado depressurization compensatory action is required.

6. Site Administrative Requirements for Containment or Annulus Entry (Obj. #10)

   a) Refer to SD 3.1.2 (Access to Containment or Annulus and Areas Having High Pressure Steam Relief Devices):

BASES

ACTIONS (continued)

B.1, B.2, and B.3

With an air lock interlock mechanism inoperable in one or more air locks, the Required Actions and associated Completion Times are consistent with those specified in Condition A.

The Required Actions have been modified by two Notes. Note 1 ensures that only the Required Actions and associated Completion Times of Condition C are required if both doors in the same air lock are inoperable. With both doors in the same air lock inoperable, an OPERABLE door is not available to be closed. Required Actions C.1 and C.2 are the appropriate remedial actions. Note 2 allows entry into and exit from containment under the control of a dedicated individual stationed at the air lock to ensure that only one door is opened at a time (i.e., the individual performs the function of the interlock).

Required Action B.3 is modified by a Note that applies to air lock doors located in high radiation areas and allows these doors to be verified locked closed by use of administrative means. Allowing verification by administrative means is considered acceptable, since access to these areas is typically restricted. Therefore, the probability of misalignment of the door, once it has been verified to be in the proper position, is small.

C.1, C.2, and C.3

With one or more air locks inoperable for reasons other than those described in Condition A or B, Required Action C.1 requires action to be initiated immediately to evaluate previous combined leakage rates using current air lock test results. An evaluation is acceptable, since it is overly conservative to immediately declare the containment inoperable if both doors in an air lock have failed a seal test or if the overall air lock leakage is not within limits. In many instances (e.g., only one seal per door has failed), containment remains OPERABLE, yet only 1 hour (per LCO 3.6.1) would be provided to restore the air lock door to OPERABLE status prior to requiring a plant shutdown. In addition, even with both doors failing the seal test, the overall containment leakage rate can still be within limits.

Required Action C.2 requires that one door in the affected containment air lock must be verified to be closed within the 1 hour Completion Time. This specified time period is consistent with the ACTIONS of LCO 3.6.1, which requires that containment be restored to OPERABLE status within 1 hour.

***Question*: 05-25**

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1 Pt(s) Given the following events and conditions:

- Unit 1 LOCA in progress
- Core Exit Thermocouple (CET) temperatures are 712 ºF
- Reactor Coolant (NC) pressure is 400 psig
- Steam generators (S/G) pressures are 1000 psig

Which of the following statements explains the relationship between primary system temperature and steam generator pressure, and what affect does depressurizing S/Gs have on Thot temperatures?

A. Reactor coolant temperatures in the S/G hot leg sides are at approximately the same as CET temperatures.
Depressurizing the S/G's would not decrease the Thot temperatures.

B. Reactor coolant temperatures in the S/G hot leg sides are at approximately the same as CET temperatures.
Depressurizing the S/Gs would decrease Thot temperatures.

C. Reactor coolant temperatures in the S/G hot leg sides are approximately at the saturation temperature for S/G pressure.
Depressurizing the S/Gs would not decrease the Thot temperatures.

D. Reactor coolant temperatures in the S/G hot leg sides are approximately at the saturation temperature for S/G pressure.
Depressurizing the S/Gs would decrease Thot temperatures.

Question*: 05-25** ***Answer: D

LEVEL:	RO/SRO

K/A	EPE074	**Title**	Inadequate Core Cooling
	EA2.04	**Description**	Ability to determine or interpret the following as they apply to a Inadequate Core Cooling: **(CFR 41.10 / 43.5 / 45.13)** Relationship between RCS temperature and main steam pressure
		Importance	3.7/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-EP-FRC
Objectives	3
REFERENCES	EP/FR-C.1
Author	RJK
Time	November 10, 2005

Distracter Analysis:

A. **Incorrect**: First part is false even during inadequate core cooling, there exists a small amount of reflux cooling. To assume that CETS and T-HOTS inside the S/G would not be correct. Second part is false: Dumping steam is the FIRST choice per FR-C.1 and WOULD benefit to the primary when the S/G pressure is decrease.

B. **Incorrect**: First part is false, even during inadequate core cooling, there exists a small amount of reflux cooling. To assume that CETS and T-HOTS inside the S/G would not be correct. Second part is True. Dumping steam is the FIRST choice per FR-C.1 and would benefit to the primary when the S/G pressure is decrease.

C. **Incorrect**: First part is true, even during inadequate core cooling, there exists a small amount of reflux cooling. Second part is True . Dumping steam is the FIRST choice per FR-C.1 and WOULD benefit to the primary when the S/G pressure is decrease

D. **Correct**:

Question: 05-25

1 Pt(s) Given the following events and conditions:

- Unit 1 LOCA in progress.
- EP1/A/5000/FR-C.1, Response to Inadequate Core Cooling in effect.
- Reactor coolant system temperatures are 570 °F and slowly increasing.
- Reactor coolant wide range pressure is 1269 psig and stable.
- Vessel level is on the low range and slowly decreasing.
- Steam generator pressures are 1100 psig then depressurized to approximately 100 psig.

What is the expected reactor coolant system temperatures following the depressurization?

Reference Provided

A. 570 °F

B. 557 °F

C. 328 °F.

D. 212 °F.

Question*: 05-25** ***Answer: C

LEVEL:	RO/SRO

K/A	EPE074	**Title**	Inadequate Core Cooling
	EA2.04	**Description**	Ability to determine or interpret the following as they apply to a Inadequate Core Cooling: **(CFR 41.10 / 43.5 / 45.13)** Relationship between RCS temperature and main steam pressure
		Importance	3.7/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-EP-FRC
Objectives	3
REFERENCES	Steam tables EP/FR-C.1 Background document for step 15
Author	RJK
Time	7/18/2005 10:59 AM 40 minutes

Distracter Analysis: There are 2 depressurizations for the steam generators in an attempt to get core cooling from ECCS components. First are the CLAs and to ensure they do not inject nitrogen, a limit of 328 degree T-hot is set when S/G pressures reach 110 psig.
If the first depressurization fails, then the S/Gs are depressed to atmospheric in attempts to reduce primary pressure to less than the ND pumps.

A. **Incorrect**: Equivalent to W/R NC pressure
B. **Incorrect**: Equivalent to the initial S/G pressure
C. **Correct**:
D. **Incorrect**: Equivalent to a fully depressurized NC system.

EP Background document for step 15

To prevent accumulator nitrogen injection, the operator should stop the secondary depressurization when the S/G pressure reaches 110 PSIG and when at least two NC System hot leg temperatures fall below 328°F. A steam generator pressure limit is set to preclude significant nitrogen injection into the NC System

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of Function Restoration procedures EP/1/A/5000/FR-C Series - Core Cooling			X	X	X
2	State the Bases for all NOTES and CAUTIONS in Function Restoration procedures EP/1/A/5000/FR-C Series - Core Cooling			X	X	X
3	Explain the Bases for all steps in each of Function Restoration procedures EP/1/A/5000/FR-C Series - Core Cooling			X	X	X
4	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			X	X	X

STEP 15: Depressurize all intact S/Gs as follows:

PURPOSE:

To recover the core via CLA injection.

APPLICABLE ERG BASIS:

The rapid secondary depressurization has been shown to be the most effective way to reduce NC System pressure. NC System pressure must be reduced in order for the accumulators and ND pumps to inject.

To prevent accumulator nitrogen injection, the operator should stop the secondary depressurization when the S/G pressure reaches 110 PSIG and when at least two NC System hot leg temperatures fall below 328°F. A steam generator pressure limit is set to preclude significant nitrogen injection into the NC System.

Instrument uncertainties are not included in the determination of the steam generator pressure limit to preclude a bias toward either having more accumulator water injected into the NC System of having less nitrogen injected into the NC System.

The hot leg temperature of 328°F should be determined so that the NC System saturation pressure exceeds the accumulator pressure after the accumulator water has been discharged. This precludes nitrogen injection into the NC System. Instrument uncertainties are not included in the determination of the NC System hot leg temperature setpoint to preclude a bias toward either having more accumulator water injected into the NC System or having less nitrogen injected into the NC System. Two RTDs are used to ensure that one RTD is not giving an erroneous reading.

PLANT SPECIFIC INFORMATION:

The target S/G pressure ensures a steam supply source for the turbine driven CA pump. CNM 1201.05-0249 states that a minimum steam pressure of 125 PSIA is required which converts to approximately 110 PSIG.

KNOWLEDGE/ABILITY:

Operators asked for a clarification of the expectations on how to operate S/G PORVs or steam dumps in EP steps that require the operator to maximize a cooldown while attempting to avoid a Main Steam Isolation. When using condenser steam dumps the operator should quickly initiate steam dumping and then monitor the rate annunciators and bistables to determine if steaming is excessive. If a rate alarm actuates then the operator should adjust the steaming rate to clear the rate annunciator. (The rate alarms must be cleared prior to blocking P-11 or a Main Steam Isolation will occur when you block) If the S/G PORVs are being used then the max rate should be established and maintained. If a SM isolation occurs then reopen the S/G PORVs at max rate. With a SM Isolation signal present or condenser unavailable the S/G PORVs should be quickly opened to the full open position. (PPRB OPS-8647)

***Question*: 05-26**

1 Pt(s) The required actions for a high reactor coolant activity event to limit site boundary dose is based on a ___________.

A. Main Steam Line Break

B. Steam Generator Tube Rupture

C. Small Break LOCA

D. Loss of Containment Integrity

Question*: 05-26** ***Answer: B

LEVEL:	RO/SRO

K/A	APE076	**Title**	High Reactor Coolant Activity
	G2.2.22	**Description**	Knowledge of limiting conditions for operations and safety limits. **(CFR: 43.2 / 45.2)**
		Importance	3.4/4.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PS-NC
Objectives	10
REFERENCES	Tech Spec bases 3.4.16
Author	RJK
Time	7/18/2005 12:10 PM 36 minutes

Distracter Analysis: See bases for T.S. 3.4.16

A. **Incorrect**: since this accident dumps steam to the environment, even a small leak in one S/G would contribute to offsite dose.

B. **Correct**:

C. **Incorrect**: This accident breaches the reactor coolant boundary and pressurizes containment. There is a small allowable leakage allowed in containment that is filtered and would still contribute to some low level of off site dose.

D. **Incorrect**: While a loss of containment integrity would be an issue coincident with another accident, containment atmosphere is not necessarily contaminated and therefore would not contribute to offsite dose.

TS 3.4.16 bases:
The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Specific Activity

BASES

BACKGROUND

The maximum dose to the whole body and the thyroid that an individual at the site boundary can receive for 2 hours during an accident is specified in 10 CFR 100 (Ref. 1). The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits during analyzed transients and accidents.

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I–131 and gross specific activity. The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits. The limits in the LCO are standardized, based on parametric evaluations of offsite radioactivity dose consequences for typical site locations.

The parametric evaluations showed the potential offsite dose levels for a SGTR accident were an appropriately small fraction of the 10 CFR 100 dose guideline limits. Each evaluation assumes a broad range of site applicable atmospheric dispersion factors in a parametric evaluation.

APPLICABLE SAFETY ANALYSES

The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary will not exceed a small fraction of the 10 CFR 100 dose guideline limits following a SGTR accident. The SGTR safety analysis (Ref. 2) assumes the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 576 gpd. The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 μCi/gm DOSE EQUIVALENT I–131 from LCO 3.7.17, "Secondary Specific Activity."

The analysis for the SGTR accident establishes the acceptance limits for RCS specific activity. Reference to this analysis is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The analysis is for two cases of reactor coolant specific activity. One case assumes specific activity at 1.0 μCi/gm DOSE EQUIVALENT I–131 with a concurrent large iodine spike that increases the I–131 activity in the reactor coolant by a factor of about 50 immediately after the accident. The second case assumes the initial reactor coolant iodine activity at 60.0 μCi/gm DOSE EQUIVALENT I–131 due to a pre-accident iodine spike caused by an RCS transient. In both cases, the noble gas activity in the reactor coolant assumes 1% failed fuel, which closely equals the LCO limit of $100/\bar{E}$ μCi/gm for gross specific activity.

The analysis also assumes a loss of offsite power at the same time as the SGTR event. The SGTR causes a reduction in reactor coolant inventory. The reduction initiates a reactor trip from a low pressurizer pressure signal or an RCS overtemperature ΔT signal if the leakage continues for a long enough time, although a manual trip is also credited after a conservatively long delay.

The coincident loss of offsite power causes the steam dump valves to close to protect the condenser. The rise in pressure in the ruptured SG discharges radioactively contaminated steam to the atmosphere through the SG power operated relief valves and the main steam safety valves. The unaffected SGs remove core decay heat by venting steam to the atmosphere until the cooldown ends.

The safety analysis shows the radiological consequences of an SGTR accident are within a small fraction of the Reference 1 dose guideline limits. Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed the limits shown in Figure 3.4.16-1, in the applicable specification, for more than 48 hours. The safety analysis has concurrent and pre-accident iodine spiking levels up to 60.0 μCi/gm DOSE EQUIVALENT I–131.

The remainder of the above limit permissible iodine levels shown in Figure 3.4.16-1 are acceptable because of the low probability of a SGTR accident occurring during the established 48 hour time limit. The occurrence of an SGTR accident at these permissible levels could increase the site boundary dose levels, but still be within 10 CFR 100 dose guideline limits.

The limits on RCS specific activity are also used for establishing standardization in radiation shielding and plant personnel radiation protection practices.

RCS specific activity satisfies Criterion 2 of 10 CFR 50.36 (Ref. 3).

A DNB analysis was performed for both of these cases. It was found that both cases have a minimum DNBR greater than the limit value.

Effect of Continued Auxiliary Feedwater Addition

An analysis was performed to determine the potential for unacceptable worsening of the reactor return-to-power as a result of continued addition of auxiliary feedwater following a main steam line break. The main steam line break transient as analyzed here should be insensitive to continued auxiliary feedwater addition, since the limiting core conditions, as described above, occur within the first few minutes due to the initial high cooldown rate. During this time the primary to secondary heat transfer rate from the blowdown of the initial steam generator water inventory is several orders of magnitude greater than the rate due to the additional auxiliary feedwater, even when runout flow is assumed. The supplementary analysis, assuming auxiliary feedwater at runout flow conditions as described in Section 6.2.1.1.3.3, was evaluated in Reference 6. This evaluation found that the transient was insensitive to continued auxiliary feedwater addition, and, therefore, that the main analysis above remained bounding.

15.1.5.3 Environmental Consequences

* The Main Steam Line Break may lead to releases of radioactivity to the environment through two pathways. One pathway is release of radioactivity from the secondary side of the faulted steam generator via blowdown and from the secondary side of the other steam generators before closure of the Main Steam Isolation Valves. The other pathway is via primary to secondary leakage. Radioactivity entrained with primary to secondary leakage in the faulted steam generator may escape directly to the environment once it is dried out or when its tubes are uncovered. Radioactivity entrained with tube leakage in the intact steam generators mixes with the water in the secondary sides if their tubes are submerged. From there, the radioactivity is released to the environment with boiloff. If the tubes of an intact steam generator are uncovered for any time span, the radioactivity entrained with tube leakage may escape to the environment during that time span.

A conservative analysis of the potential offsite radition doses following a main steam line break is presented assuming primary to secondary leakage. Two cases are postulated as follows:

Case 1: There is a pre-existent iodine spike at accident initiation. The reactor coolant iodine specific activities are the maximum permitted for full power operation (60 times the equilibrium Technical Specification limit).

Case 2: There is a concurrent iodine spike at accident initiation. The initial reactor coolant iodine specific activities correspond to the equilibrium Technical Specification limit (1 μCi/gm dose equivalent I-131 – DEI). The transient iodine specific activities are found by increasing the equilibrium appearance rates by a factor of 500. A cutoff time for the appearance of iodine isotopes in the reactor coolant is assumed and set to 8 hours after the initiating event.

The following assumptions and parameters are used to calculate the activity release and offsite radiation doses for a postulated main steam line break:

1. The initial specific activities in the steam generator secondary sides are set to the limit listed in the plant Technical Specifications.
2. Releases from the secondary systems of the affected unit through the faulted steam generator end at 10 minutes.
3. The primary to secondary leakage in each steam generator is set to 150 gpd.
4. All noble gases entrained with primary to secondary leakage are released directly to the environment.

5. The faulted steam generator is assumed to dry out instantaneously and remain dried out for the duration of the accident. All fission products entrained with tube leakage in the faulted steam generator are released directly to the environment.
6. Beginning with accident initiation, tube bundle uncovery is assumed to occur in all intact steam generators. Limiting time spans of tube bundle uncovery for the intact steam generators are listed in Table 15-17. All fission products entrained with tube leakage in the intact steam generators are released directly to the environment during these time spans.
7. While their tubes are submerged, iodine entrained with tube leakage in the intact steam generators mix with the water in the secondary side and released only with steam releases. The iodine partition fraction for steam releases from the intact steam generators is set to 0.01.
8. Offsite power is assumed to be lost.
9. All releases of radioactivity to the environment (tube leakage in the faulted steam generator and tube leakage and boiloff in the intact steam generators) end when the temperatures of the primary and secondary coolant are lowered to 210°F.
10. Other assumptions are listed in Table 15-17.

15.1.6 References

1. Deleted Per 1997 Update
2. Deleted Per 1997 Update
3. Letter (NS-TMA-2182), T.M. Anderson (Westinghouse) to S.H. Hanaver (NRC) Dec. 30, 1979.
4. Moody, F. S., "Maximum Flow Rate of a Single Component, Two Phase Mixture", J. Heat Transfer, 87, 134-142, 1965.
5. "McGuire and Catawba Nuclear Stations Multidimensional Reactor Transients and Safety Analysis Physics Parameters Methodology," *DPC-NE-3001-PA*, Duke Power Company, Revision 0a, December, 1997.
6. Letter, T. M. Novak (NRC) to H. B. Tucker, October 14, 1982. Enclosure: Safety Evaluation Report of Duke Power Co. response to I. E. Bulletin 80-04.
7. "RETRAN-02: A Program for Transient Thermal-Hydraulic Analysis of Complex Fluid Flow Systems", *EPRI NP-1850-CCM*, Revision 6, EPRI, December, 1995.
8. "VIPRE-01: A Thermal-Hydraulic Code for Reactor Cores", *EPRI NP-2511-CCM-A*, Revision 3, EPRI, August, 1989.
9. Deleted Per 2000 Update.
10. "Duke Power Company Thermal-Hydraulic Statistical Core Design Methodology," *DPC-NE-2005P-A*, Revision 2, June, 1999.
11. BAW-10199-PA, "The BWU Critical Heat Flux correlations," Addendum 1, September 1996.
12. WCAP-15025-P, "Modified WRB-2 Correlation, WRB-2M, for Predicting Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids," Westinghouse, February 1998.

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3. After reactor trip, break flow reaches an equilibrium when it is balanced by incoming safety injection flow as shown in Figure 15-103. The resultant break flow continues from plant trip until pressures are equalized. Operator actions are modeled to terminate break flow.
4. The single failure identified for maximizing offsite dose is the failure of the PORV on the ruptured steam generator to close.

The above assumptions, extremely conservative for the design basis tube rupture, are made to maximize doses and do not model all expected operator actions for recovery. Plant characteristics and initial conditions are discussed in Section 15.0. Both the feedring steam generators (Unit 1) and the model D5 steam generators (Unit 2) are analyzed. Due to the similarity in the system response between the two analyses, only the feedring steam generator analysis that is representative of Unit 1 is presented.

Detailed RETRAN-02 calculations are also performed to evaluate steam generator overfill for both the Catawba Unit 1 feedring steam generators (FSG) and the Catawba Unit 2 Model D5 steam generators. The method used for both analyses is based on the methodology presented in Reference 48. The results indicate that steam generator overfill will not occur for either Catawba Unit.

The DNBR calculation for this accident is performed with the VIPRE-01 computer code described in introduction to this chapter using the Statistical Core Design procedure described in Reference 44. DNBR is a concern for this transient because the assumed loss of offsite power causes a reactor coolant pump coastdown. Because of the loss of inventory through the ruptured tube, the RCS pressure is significantly lower than the normal operating value when the coastdown occurs. Since the loss of offsite power is assumed to occur coincident with reactor and turbine trip, the amount of depressurization prior to the coastdown would be limited by the overtemperature ΔT trip function. This trip setpoint is reduced both by depressurizations and RCS heatup. Because of the relative effects on DNBR of the heatup and depressurization allowed by this trip function, the steam generator tube rupture coastdown transient from a lower RCS pressure is bounded by the complete loss of flow transient in Section 15.3.2.

Results

The results of the thermal-hydraulic calculations for dose inputs are shown in the following figures.

Loop 1 models a single RCS loop with the ruptured SG.

Loop 3 models a double RCS loop with intact SGs.

Loop 2 models the remaining single RCS loop with an intact SG.

Figure 15-103 Break Flow

Figure 15-104 Pressurizer Pressure

Figure 15-105 Reactor Coolant System Hot Leg Temperatures

Figure 15-106 Reactor Coolant System Cold Leg Temperatures

Figure 15-107 Pressurizer Water Level

Figure 15-108 Steam Generator Pressure

Figure 15-229 Steam Generator Water Levels

The sequence of events is presented in Table 15-49.

15.6.3.3 Environmental Consequences

The postulated accidents involving release of steam from the secondary system do not result in a significant release of radioactivity unless there is leakage from the RCS to the secondary system in the steam generators. A conservative analysis of the postulated steam generator tube rupture assumes the loss of offsite power. This causes the loss of main steam dump capabilities and the subsequent venting of steam from the secondary system to the atmosphere. A conservative analysis of the potential offsite doses resulting from this accident is presented assuming primary to secondary leakage. This analysis incorporates assumptions of 1 percent defective fuel and steam generator leakage of 1 gpm prior to the postulated accident for a time sufficient to establish equilibrium specific activities in the secondary system. Three postulated cases are analyzed:

Case 1: Normal equilibrium Technical Specification iodine concentrations exist at the time of the accident.

Case 2: There is a pre-existing iodine spike at the time the accident occurs. The reactor coolant concentrations are the maximum permitted for full power operation (60 times the normal equilibrium Technical Specification limit).

Case 3: There is a coincident iodine spike at the time the accident occurs. The iodine concentrations are found by increasing the equilibrium appearance rate in the coolant by a factor of 500.

The primary coolant activity prior to the accident correspond to limits set by Technical Specifications.

The following assumptions and parameters are used to calculate the activity release and offsite dose for the postulated steam generator tube rupture:

1. Prior to the accident, an equilibrium activity of fission products exists in the primary system.
2. The accident is initiated by the rupture of a steam generator tube, which results in the transfer of approximately 174,000 pounds of reactor coolant into the shell side of the defective steam generator.
3. Offsite power is lost.
4. The primary to secondary leakage is .104 gal/min in each of the nondefective steam generators.
5. The steam release from the defective steam generator terminates in 65 minutes. The release from the nondefective steam generators terminates in 8 hours.
6. All noble gases which leak to the secondary side are released.
7. The steam generator iodine partition factor is 0.01 during the accident.
8. For Case 1, the primary coolant concentration is at the equilibrium Technical Specification limit.
9. For Case 2, the primary coolant concentration is at the maximum permitted for full power operation (60 times the normal equilibrium Technical Specification limit).
10. For Case, 3, the iodine spike occurs at the onset of the accident and continues for the duration of the accident. The iodine concentrations are determined by increasing the equilibrium appearance rate by a factor of 500.
11. Other assumptions are listed in Table 15-31.

Based on the foregoing model, the thyroid and whole body doses are calculated at the exclusion area boundary and the low population zone. The results are presented in Table 15-31. The doses at these distances are below the regulatory acceptance criteria for each of the above cases analyzed.

The current controls for dose equivalent I-131 (DEI) specific activity are established by the license conditions of Facility Operating License Amendment 159/151 (Reference 83). The current limits are 0.46 μCi/gm DEI for equilibrium reactor coolant specific activity and 26 μCi/gm DEI for transient reactor coolant specific activity. These limits are based on a supplemental calculation of radiation doses for a postulated steam generator tube rupture with failure of control power to the power operated relief valves of two steam generators.

Question: 05-26

1 Pt(s) The required actions for a high reactor coolant activity event to limit site boundary dose is based on a Loss of Offsite power and ___________ occurring at the same time.

A. Main Steam Line Break

B. Steam Generator Tube Rupture

C. Small Break LOCA

D. Loss of Containment Integrity

Question: 05-26 ***Answer: B***

LEVEL:	RO/SRO

K/A	APE076	Title	High Reactor Coolant Activity
	G2.2.22	Description	Knowledge of limiting conditions for operations and safety limits. **(CFR: 43.2 / 45.2)**
		Importance	3.4/4.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PS-NC
Objectives	10
REFERENCES	Tech Spec bases 3.4.16
Author	RJK
Time	7/18/2005 12:10 PM 36 minutes

Distracter Analysis: Reactor shutdown and cooldown to less than 500 degrees ensures the Steam Line safeties do not lift coincident with a SGTR.

A. **Incorrect**:
B. **Correct**:
C. **Incorrect**:
D. **Incorrect**:

TS 3.4.16 bases:
The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
9	Examine NC system operations.					
	• Explain NC System leak testing			X	X	X
	• Given appropriate plant conditions, apply limits and precautions associated with related station procedures.			X	X	X
	• Explain controlling NC level in a drained condition.			X	X	X
	• List the symptoms for entry into AP1/A/5500/010 (Reactor Coolant Leak)			X	X	
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
11	State the system designator and nomenclature for major components.	X				
12	Describe "Critical Valves" as specified in OP/1(2)/A/6100/001 (Controlling Procedure For Unit Startup). Include in discussion which valves are designated as critical valves, how they may be identified locally, and actions taken to ensure these valves are closed prior to commencing normal power operations.	X	X			
13	Describe the EMF's associated with NC and be able to describe the automatic actions that occur when they reach the Trip 2 setpoint.			X	X	X
14	State from memory all T.S actions for the applicable systems, subsystems and components which require remedial action to be taken in less than 1 hour.			X	X	
15	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X

TIME: 2.0 HOURS

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Specific Activity

BASES

BACKGROUND

The maximum dose to the whole body and the thyroid that an individual at the site boundary can receive for 2 hours during an accident is specified in 10 CFR 100 (Ref. 1). The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits during analyzed transients and accidents.

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I–131 and gross specific activity. The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits. The limits in the LCO are standardized, based on parametric evaluations of offsite radioactivity dose consequences for typical site locations.

The parametric evaluations showed the potential offsite dose levels for a SGTR accident were an appropriately small fraction of the 10 CFR 100 dose guideline limits. Each evaluation assumes a broad range of site applicable atmospheric dispersion factors in a parametric evaluation.

APPLICABLE SAFETY ANALYSES

The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary will not exceed a small fraction of the 10 CFR 100 dose guideline limits following a SGTR accident. The SGTR safety analysis (Ref. 2) assumes the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 576 gpd. The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 μCi/gm DOSE EQUIVALENT I–131 from LCO 3.7.17, "Secondary Specific Activity."

The analysis for the SGTR accident establishes the acceptance limits for RCS specific activity. Reference to this analysis is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits.

Question*: *05-27

1 Pt(s) Conditions at 1400 hrs:

- Unit 1 safety injection occurred due to a LOCA
- Reactor coolant (NC) system pressure is 915 psig
- NC Tcold temperatures are 535 ºF
- Core Exit Thermocouples (CET) are 565 ºF
- Crew has implemented EP/1/A/5000/FR-C.2, Response to Degraded Core Cooling
- The OSM has directed a cooldown to allow ND to be placed in service

What is the maximum cooldown rate allowed per EP/1/A/5000/FR-C.2, and what is the lowest temperature that could be attained by 1600 hrs using that rate?

A. Cooldown at 80 ºF/hr to 375 ºF on NC Tcolds

B. Cooldown at 80 ºF/hr to 405 ºF on CETs

C. Cooldown at 100 ºF/hr to 335 ºF on NC Tcolds

D. Cooldown at 100 ºF/hr to 365 ºF on CETs

Question: 05-27 **Answer: C**

LEVEL:	RO/SRO

K/A	E07	Title	Saturated Core Cooling
	EK3.4	Description	Knowledge of the reasons for the following responses as they apply to the (Saturated Core Cooling) **(CFR: 41.5 / 41.10, 45.6, 45.13)** RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.
		Importance	3.3/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	EP-CN-EP-CSF rev 16
Objectives	1
REFERENCES	TS 3.4.3 EP/1/A/5000/FR-C.2
Author	RJK
Time	7/18/2005 1:45 PM 138 minutes

Distracter Analysis: 80 /hr is plausible because if the normal cooldown limit in OPs. This procedure allows 100/hr. (TS 3.4.3 limit) The reference temperature to use is the Tcold, NOT Core exit temperature.

A. **Incorrect**: Wrong rate, right reference temperature.
B. **Incorrect**: Wrong rate, wrong reference temperature.
C. **Correct**:
D. **Incorrect**: Right rate used, but wrong reference temperature.

Question: 05-27

1 Pt(s) Given the following:

- Unit 1 has inadequate ECCS flow and degrading core cooling conditions.
- EP1/A/5000/E-1, Loss of Reactor or Secondary Coolant was just completed.
- A transition brief was in progress prior to entering EP/1/A/5000/ES-1.2, Post LOCA Cooldown and Depressurization.
- The STA reported the following critical safety function (CSF) status:
    - o There is a valid yellow path condition on core cooling.
    - o Based on current trends, an orange path condition on core cooling will exist within 30 minutes.
    - o The STA recommends actions be taken using the yellow path CSF procedure to address the core cooling issues.

The OSM agrees that with the STA's recommendation.

Based on procedure rules of usage, which of the following statements explain the validity of the OSM's decision and direction to restore adequate core cooling?

A. The OSM was incorrect; the crew should have transitioned to ES-1.2 and not entered a CSF procedure unless the orange path condition actually exists.

B. The OSM was correct; the crew shall transition to ES-1.2 and may concurrently implement the yellow path procedure.

C. The OSM was correct; the crew shall transition to the yellow path procedure, complete it then transition to ES-1.2.

D. The OSM was incorrect; the crew should have transitioned to the orange path procedure, completed it then transitioned to ES-1.2.

Question: 05-27 **Answer: B**

LEVEL:	RO/SRO

K/A	E07	**Title**	Saturated Core Cooling
	EK3.4	**Description**	Knowledge of the reasons for the following responses as they apply to the (Saturated Core Cooling) **(CFR: 41.5 / 41.10, 45.6, 45.13)** RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.
		Importance	3.3/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	EP-CN-EP-CSF rev 16
Objectives	1
REFERENCES	OMP 1-7 rev 31
Author	RJK
Time	7/18/2005 1:45 PM 138 minutes

Distracter Analysis:

OMP 1-7 guidance allows concurrent use of YELLOW path FRGs, not transitions to YELLOW path FRGs.

A. **Incorrect**: This is an absolute and does not follow the guidance of OMP 1-7, you would exit based on Orange or Red path CSF conditions.

B. **Correct**:

C. **Incorrect**: If addressed, the inventory CSF is of lower priority and actually is caused by the saturated conditions in the core. This would directly violate the intent of the EP actions.

D. **Incorrect**: While this is a true condition it is an Absolute and it does not address the allowable actions of the question. The crews are expected to use yellow path procedures when the condition arises.

OMP 1-7 page 15 E (CSF rules of usage)

Yellow path procedures are to be performed concurrent with the non-critical safety function EP in effect when the yellow path is implemented. While performing the actions of the yellow path, continuous actions or foldout page items of the non-critical safety function EP in effect are still applicable and shall be monitored by the operator. (DW-95-043)

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the Rules of Usage for Critical Safety Function (CSF) status tree procedures per OMP 1-7			X	X	X
2	Explain the priority system associated with the CSF status trees as seen on the SPDS portion of the OAC			X	X	X
3	State the purpose of the ND FLOW and RADIATION SPDS blocks			X	X	X
4	Explain how the OAC is used to provide information about any CSF status tree			X	X	X
5	Explain the use of EP/1/A/5000/F-0 (Critical Safety Function Status Trees) to determine the status of all CSFs			X	X	X
6	Describe the validation process for CSF status trees per OMP 1-7 (Emergency/Abnormal Procedure Implementation Guidelines') (**NOTE**: For PTRQ this objective applies to SROs only)				X	X
7	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			X	X	X

- Yellow path procedures are to be performed concurrent with the non-critical safety function EP in effect when the yellow path is implemented. While performing the actions of the yellow path, continuous actions or foldout page items of the non-critical safety function EP in effect are still applicable and shall be monitored by the operator. (DW-95-043)

- If a red or orange condition indicates and then clears prior to implementation of the corresponding procedure, the procedure shall not be performed. The CSF procedure is considered to be "implemented" when the CRS reads the first step to the crew.

- The STA shall keep the Operations Shift Manager informed of all off normal CSFs. The Operations Shift Manager shall ensure the crew is updated as appropriate, typically by allocating time during updates for the STA. (SOER 94-1)

F. Normally, the condition of the CSF Status Trees is continuously displayed by SPDS on the OAC. Control room indications shall be used to validate any off normal alarm and to determine which procedure to implement. Once status tree monitoring is initiated, the STA should periodically monitor the status trees and compare against control board indications to ensure SPDS is functioning properly. Status tree monitoring shall be continuous if an orange or red condition exists. Otherwise, monitoring frequency shall be every 10 to 20 minutes. (SOER 94-1)

***Question*: 05-28**

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1 Pt(s) Why are the reactor coolant pumps (NCP) shutdown on a high-high containment pressure condition?

A. Cooling water flow is isolated to the upper containment air handling units.

B. Cooling water flow is isolated to the NCP seals.

C. NCP seal water return path from containment is isolated.

D. Cooling water flow is isolated to the NCP motor oil coolers.

Question*: 05-28** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS003	**Title**	Reactor Coolant Pump
	K1.01	**Description**	Knowledge of the physical connections and/or cause-effect relationships between the RCPS and the following systems: **(CFR: 41.2 to 41.9 / 45.7 to 45.8)** RCP lube oil
		Importance	2.6/2.8

SOURCE	CNS exam bank (NCP-053-D)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PS-NCP
Objectives	4 and 12
REFERENCE S	NCP lesson plan EP/1/A/5000/E-0
Author	RJK
Time	7/18/2005 2:17 PM 36 minutes

Distracter Analysis:

A. **Incorrect**: Upper containment air handling units do not cool the NCPs. But RN is isolated to containment on SP signal.

B. **Incorrect**: While true, the continued flow from the NV pumps keep the seals working correctly and cooled. Operator may think that this would cause overheating.

C. **Incorrect**: While true, this does nothing since the seal leakoff flow goes to the PRT thru a relief valve.

D. **Correct**:

E-0 backgorund step 10 bases

isolate additional potential release paths from containment. Since component cooling to the NC pump seals and motors is isolated on a Phase B signal, the NC pumps must be tripped to prevent overheating of the seals and motors.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the NC pumps.	X	X	X	X	
2	Explain the design, operation, and function of major NC pump and motor components. • Stator and Stator Cooler • Vibration Monitors • Flywheel • Anti-reverse Rotation Device • Motor Thrust and Guide Bearings • Pump Impeller • Pump turning Vane-Diffuser • Pump Diffuser Adapter • Thermal Barrier Heat Exchanger • Pump Radial Bearing	X	X	X	X	
3	Explain the operation of the NC pump seals including injection flow paths, flow rates, discharge flow paths, and pressure drops.	X	X	X	X	X
4	Explain which cooling water supplies cool the NCP components.	X	X	X	X	X
5	Explain the operation and purpose of the oil lift system.	X	X	X	X	X
6	Explain the sources of water, lineups and flowpaths needed to fill the NCP stand pipe.			X	X	
7	Identify the power supplies to the NC pumps.			X	X	
8	Explain the function and operation of the NCP Monitor System.			X	X	X
9	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.			X	X	X
10	Outline the procedures for starting/stopping NC pumps. • Explain the use of redundant breakers between the 7KV switchgear and the NC pumps. • Explain the interlocks associated with the pump breakers and the oil lift system.			X	X	X

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
11	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
12	Evaluate NCP operations including: • NCP operability verification • NCP Starting duties • NCP malfunction • When immediate trip of the NCP is required			X	X	X
13	State the Immediate Actions of AP/04 from memory.			X	X	X

STEP 10: Verify proper Phase B actuation as follows:

PURPOSE:

To ensure automatic actuation of Containment Spray and Containment Phase B Isolation if containment pressure exceeded their actuation setpoint.

APPLICABLE ERG BASIS:

The basis for the "has remained less than 3 PSIG" condition on containment pressure is that containment pressure may have exceeded the setpoint and then decreased due to spray actuation. In this case the operator should still verify system operation as per the Response Not Obtained (RNO) column.

If containment pressure exceeds 3 PSIG, containment spray is automatically initiated to mitigate the containment pressure transient. Containment Isolation Phase B valves are closed to isolate additional potential release paths from containment. Since component cooling to the NC pump seals and motors is isolated on a Phase B signal, the NC pumps must be tripped to preclude overheating of the seals and motors.

PLANT SPECIFIC INFORMATION:

Since the NC pumps are tripped when support conditions are lost due to the Phase B actuation, the standard ERG note to maintain seal injection is applicable as follows:

- To ensure that seal cooling flow is continued even if NC pumps are stopped.
- The effectiveness of the NC pump Number 1 seal is not affected by pump rotation. To ensure continued performance of the seal, cool filtered water should be continuously supplied. The operator should not isolate the seal injection lines unless directed to in the procedures.

This step is sequenced at this point in the procedure based on operator feedback, to avoid having the BOP behind the main control board verifying proper ventilation status when containment pressure is required to be checked. This placement also ensures that all crew members are in the control room when the continuous action step is read.

A note and substep were added to the RNO to document the approximate time of reactor trip. Certain events/procedure sequences eventually lead to the establishment of auxiliary spray from the residual heat removal system. IF/WHEN auxiliary spray is used, it must be initiated within a relatively close time frame based around 50 minutes from time of reactor trip.

Since there is a time delay associated with VX after 3.0 psig has been generated inside containment, it is helpful to provide guidance to monitor for VX initiation and subsequent operation. This guidance is included on an enclosure.

KNOWLEDGE/ABILITY:

The Group 5 Sp lights also includes verification of VX System operation. Equipment that have time delays or other interlocks are identified by the red tape along the sides of the window. The Monitor Light Panel Cross Reference Manual is available in the control room and can be used for further information.

This is a continuous action step while in this procedure(DW-01-026).

Question: 05-29

1 Pt(s) Given the following plant conditions:

- Unit 1 is in Mode 3 at 400 ºF
- Plant cooldown in progress to Mode 4
- Normal pressurizer spray is not available
- The crews have aligned auxiliary spray from the chemical and volume control system to cooldown the pressurizer

Which of the following is a concern expressed in OP/1/A/6100/002, Controlling Procedure for Unit Shutdown, related to this alignment?

A. Potential for flashing the letdown line

B. Isolating the charging flow path

C. Inferior pressure control compared to normal spray

D. Over cooling the pressurizer spray nozzle

Question*: 05-29** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS004	**Title**	Chemical and Volume Control
	K5.11	**Description**	Knowledge of the operational implications of the following concepts as they apply to the CVCS: **(CFR: 41.5/45.7)** Thermal stress, brittle fracture, pressurized thermal shock
		Importance	3.6/3.9

SOURCE	New
LEVEL of KNOWLEDGE	memory
Lesson	OP-CN-PS-NV
Objectives	9
REFERENCES	OP/1/A/6200/001 Enclosure 4.15 caution OP/1/A/6100/002 Enclosure 4.4 cautions
Author	RJK
Time	7/18/2005 2:46 PM 34 minutes

Distracter Analysis: there are specific cautions that the cold water from the NV system will cause thermal stresses on the spray line. It should only normally be used when less than 240 degrees.

A. **Incorrect**: When NV aux spray is aligned, the normal charging path is isolated and NV flow aligned to the spray nozzle. The operator controls the flowrate and could decrease flow to the point where letdown line flashing may become an issue. But this concern is not addressed in this procedure.

B. **Incorrect**: This is the only way to align the aux spray header.

C. **Incorrect**: This provides throttle capability similar to the spray valves.

D. **Correct**:

OP1/A/6200/001 Enclosure 4.15 caution

2. If letdown is secured, NV Auxiliary Spray should **NOT** be used. The admission of NV Spray to the pressurizer spray nozzle while letdown is secured may cause thermal shocking of the pressurizer spray nozzle.

3. To limit thermal stress on the aux spray line piping it is preferred to only use NV Auxiliary Spray when NC cold Leg temperatures are δ 240°F. However under emergency conditions, NV Auxiliary Spray may be used as needed. {PIP C-00-4752}

OP/1/A/6100/002 Enclosure 4.4 caution

Auxiliary PZR spray should **NOT** be initiated with PZR steam space temperature >240°F to limit the thermal transient on the PZR spray nozzle. {PIP C-00-4752}

***Question*: 05-29**

1 Pt(s) What is the <u>primary</u> concern when using auxiliary spray from the chemical and volume control system instead of the normal spray valves to cooldown the pressurizer?

A. Reduction in seal injection flow.

B. Isolating the charging flow path.

C. Poor pressure control compared to normal spray.

D. Over cooling the pressurizer spray nozzle.

Question: 05-29 ***Answer: D***

LEVEL:	RO/SRO

K/A	SYS004	**Title**	Chemical and Volume Control
	K5.11	**Description**	Knowledge of the operational implications of the following concepts as they apply to the CVCS: **(CFR: 41.5/45.7)** Thermal stress, brittle fracture, pressurized thermal shock
		Importance	3.6/3.9

SOURCE	New
LEVEL of KNOWLEDGE	memory
Lesson	OP-CN-PS-NV
Objectives	9
REFERENCES	OP/1/A/6200/001 Enclosure 4.15 caution OP/1/A/6100/002 Enclosure 4.4 cautions
Author	RJK
Time	7/18/2005 2:46 PM 34 minutes

Distracter Analysis: there are specific cautions that the cold water from the NV system will cause thermal stresses on the spray line. It should only normally be used when less than 240 degrees.

A. Incorrect: This has nothing to do with aux spray. Seal flow still functions. But this might be something an operator may be affected when charging is isolated.
B. Incorrect: This is the only way to align the aux spray header.
C. Incorrect: This provides throttle capability similar to the spray valves.
D. Correct:

OP1/A/6200/001 Enclosure 4.15 caution

2. If letdown is secured, NV Auxiliary Spray should **NOT** be used. The admission of NV Spray to the pressurizer spray nozzle while letdown is secured may cause thermal shocking of the pressurizer spray nozzle.
3. To limit thermal stress on the aux spray line piping it is preferred to only use NV Auxiliary Spray when NC cold Leg temperatures are δ 240°F. However under emergency conditions, NV Auxiliary Spray may be used as needed. {PIP C-00-4752}

OP/1/A/6100/002 Enclosure 4.4 caution

Auxiliary PZR spray should **NOT** be initiated with PZR steam space temperature >240°F to limit the thermal transient on the PZR spray nozzle. {PIP C-00-4752}

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Chemical and Volume Control (NV) system.	X	X	X	X	
2	State the purpose of the makeup portion of the Reactor Makeup (NB) system.	X	X	X	X	
3	Discuss the importance of maintaining a flow balance in the NV system and state nominal flow values.	X	X	X	X	X
4	Describe the operation and flowpath of NV normal letdown purification including functions of the different ion exchangers and filters.	X	X	X	X	
5	Describe the operation and flowpath of NV letdown from ND.	X	X	X	X	
6	Describe the operation and flowpath of normal charging.	X	X	X	X	
7	Describe the operation and flowpath of NV seal injection.	X	X	X	X	
8	Describe the operation and flowpath of NV excess letdown.	X	X	X	X	
9	Describe the operation and flowpath of NV auxiliary spray.			X	X	
10	Describe the ECCS alignment of the NV system.	X	X	X	X	X
11	List the source(s) of cooling water to components requiring cooling in NV.	X	X	X	X	
12	Discuss the basic operation of the NC system makeup portion of the NB system for boration, dilution and emergency boration.	X	X			
13	Given a copy of the system flow diagram or a one line symbolic diagram, label the major components and show the flow path through the major components.	X	X			
14	State the function of the cover gases used on the VCT including minimum pressure requirements and how pressure is maintained.			X	X	X
15	Discuss how fission gases are removed from the VCT.			X	X	X
16	List the control features of VCT level, including channel, setpoint and coincidence.			X	X	X

> **NOTE:** 1. Backflush of the PZR spray and spray bypass valves should **NOT** occur until the crudburst cleanup is nearing completion and PZR temperature is less than 140°F.
>
> 2. Step 2.38 should be performed after securing the NC Pumps. The Operations Outage Execution Group may provide additional detail.

2.38 **IF** desired, backflush the PZR spray and spray bypass valves as follows:

_____ 2.38.1 Notify Radiation Protection to monitor each flush to determine the needed duration.
Person notified ____________

_____ 2.38.2 Verify the temperature difference between the PZR Steam Space and the ND Pump discharge is less than 70°F.

> **CAUTION:** Auxiliary PZR spray should **NOT** be initiated with PZR steam space temperature >240°F to limit the thermal transient on the PZR spray nozzle. {PIP C-00-4752}

_____ 2.38.3 Ensure PZR spray from ND or NV is in service.

_____ 2.38.4 Record the number of turns while closing each of the following:

- ☐ 1NC-28 (PZR Spray Control From NC Loop A Byp Throttle) (CV-571, 27'-65°, LC) ____________
- ☐ 1NC-30 (PZR Spray Control From 1B NC Loop Bypass Throttle) (CV-570, 24'-121°, LC) ____________

_____ 2.38.5 Ensure 1NC-29 (PZR Spray From Loop B) is closed.

_____ 2.38.6 Manually open 1NC-27 (PZR Spray From Loop A).

_____ 2.38.7 Ensure one of the following is open:

- ☐ 1NV-857 (Pressurizer Aux Spray Ctrl)
- ☐ 1NV-37A (NV Supply To Pzr Aux Spray)

_____ 2.38.8 **WHEN** notified by RP that NC activity has been reduced to desired level, close 1NC-27 (PZR Spray From Loop A).

_____ 2.38.9 Manually open 1NC-29 (PZR Spray From Loop B).

1. Initial Conditions

_____ 1.1 Review the Limits and Precautions.

_____ 1.2 **IF** a steam bubble exists in the pressurizer, verify pressurizer spray is unavailable from the NC System or the ND System.

_____ 1.3 Verify the NV System is in operation per one of the following:

- ☐ Enclosure 4.1 (Establishing Charging Flow and Seal Injection Flow)
- ☐ Enclosure 4.26 (Establishing/Securing NV Charging With ND Letdown)

_____ 1.4 Verify the temperature difference between the pressurizer and the fluid spray is ≤ 320°F (OAC point C1P1362, or OAC graphic NCPZR).

2. Procedure

CAUTION:

1. If the temperature difference between the PZR steam space and the spray fluid is greater than 260°F (OAC point C1P1362, or OAC graphic NCPZR), spray flow should **NOT** be initiated or maintained. This is to minimize temperature transients to the PZR spray nozzle. A ΔT of 320°F shall **NOT** be exceeded.
2. If letdown is secured, NV Auxiliary Spray should **NOT** be used. The admission of NV Spray to the pressurizer spray nozzle while letdown is secured may cause thermal shocking of the pressurizer spray nozzle.
3. To limit thermal stress on the aux spray line piping it is preferred to only use NV Auxiliary Spray when NC cold Leg temperatures are ≤ 240°F. However under emergency conditions, NV Auxiliary Spray may be used as needed. {PIP C-00-4752}

_____ 2.1 Ensure the following valves are closed:

- ☐ 1NC-27 (PZR Spray Ctrl From Loop A)
- ☐ 1NC-29 (PZR Spray Ctrl From Loop B)

***Question*: 05-30**

---

1 Pt(s) Given the following conditions:

- Both trains of residual heat removal (ND) are in service
- ND heat exchanger outlet valves are full open
- ND train flows are 3300 gpm each
- Train "B" ND heat exchanger outlet valve is manually closed

.

Which one of the following would represent the final stabilized total system flow and inlet temperature for Train "A" ND heat exchanger?

	Total System Flow	Train "A" ND heat exchanger Inlet Temperature
A.	DECREASE	INCREASE
B.	REMAIN THE SAME	INCREASE
C.	REMAIN THE SAME	REMAIN THE SAME
D.	DECREASE	REMAIN THE SAME

Question: 05-30 *Answer: B*

LEVEL:	RO/SRO

K/A	SYS005	**Title**	Residual Heat Removal
	K6.03	**Description**	Knowledge of the effect of a loss or malfunction on the following will have on the RHRS: **(CFR: 41.7 / 45.7)** RHR heat exchanger
		Importance	2.5/2.6

SOURCE	BANK (South Texas HLP Bank)
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-PS-ND rev 031
Objectives	3 & 7
REFERENCES	Lesson plan page 11
Author	RJK
Time	7/18/2005 3:56 PM 55 minutes

Distracter Analysis: The outlet valve fails closed and shifts all the cooling over to "A" train. As the NC system heats up, the inlet temperature should increase. The bypass valve will compensate to maintain flow in that loop at setpoint. Total flow is basically unaffected.

A. **Incorrect**: Total flow remains constant. May think flow shifts to "A" train.
B. **Correct**:
C. **Incorrect**: Inlet temperature increases. May think that more flow through heat exchanger maintains temperature.
D. **Incorrect**: Both incorrect. But may think that these would be the result for two trains in operation.

ND lesson plan page 11
ND flow through the tube side
ND Hx Outlet valves (ND-26, 60) (Obj. #3)
Air operated butterfly valves
Control flow through the Hx to maintain desired cooldown rate.
Fail open during S_S to ensure heat removal capability is maintained.

ND Hx bypass valves (ND-27, 61) (Obj. #3)
Air operated butterfly valves
Used in conjunction with ND-26, 60 to maintain train flow at approximately 3300 gpm based on potentiometer setting.

Question: 05-30

1 Pt(s) Given the following conditions:

- Both trains of residual heat removal (ND) are in service.
- ND heat exchanger outlet valves are full open.
- ND train flows are 3300 gpm each.

If the Train "B" ND heat exchanger outlet valve is closed, once the system has stabilized, what is the final condition of these system parameters?

	Total System Flow	Train "A" ND heat exchanger Inlet Temperature
A.	DECREASE	INCREASE
B.	REMAIN THE SAME	INCREASE
C.	REMAIN THE SAME	REMAIN THE SAME
D.	DECREASE	REMAIN THE SAME

Question*: 05-30** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS005	**Title**	Residual Heat Removal
	K6.03	**Description**	Knowledge of the effect of a loss or malfunction on the following will have on the RHRS: **(CFR: 41.7 / 45.7)** RHR heat exchanger
		Importance	2.5/2.6

SOURCE	BANK (South Texas HLP Bank)
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ND lesson plan page 11
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ND Hx bypass valves (ND-27, 61) (Obj. #3)
Air operated butterfly valves
Used in conjunction with ND-26, 60 to maintain train flow at approximately 3300 gpm based on potentiometer setting.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the ND system	X	X	X	X	
2	Describe the operation and flowpaths for normal cooldown, injection and recirculation phases for the ND System. • Describe the water supplies available for use by the ND system • Describe how the ND system is cooled	X	X	X	X	X
3	Identify the ND system major components and discuss the function of each.	X	X	X	X	
4	Describe the alignment of alternate power to 1ND-1B and 1ND-37A • Describe the purpose of the alignment • Describe the basic operations performed • Describe local operation of the valves.	X	X			
5	State the system designator and nomenclature for major components	X				
6	State the power supplies to the ND pumps.			X	X	
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 system)			X	X	X
8	Given appropriate plant conditions, apply Limits and Precautions associated with related station procedures.			X	X	X
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			X	X	X
10	Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
11	State from memory all Tech Spec actions for the applicable systems, subsystems and components which require remedial action to be taken in			X	X	

3. Normally closed with power removed.

H. ND Heat Exchangers (Obj. #3)

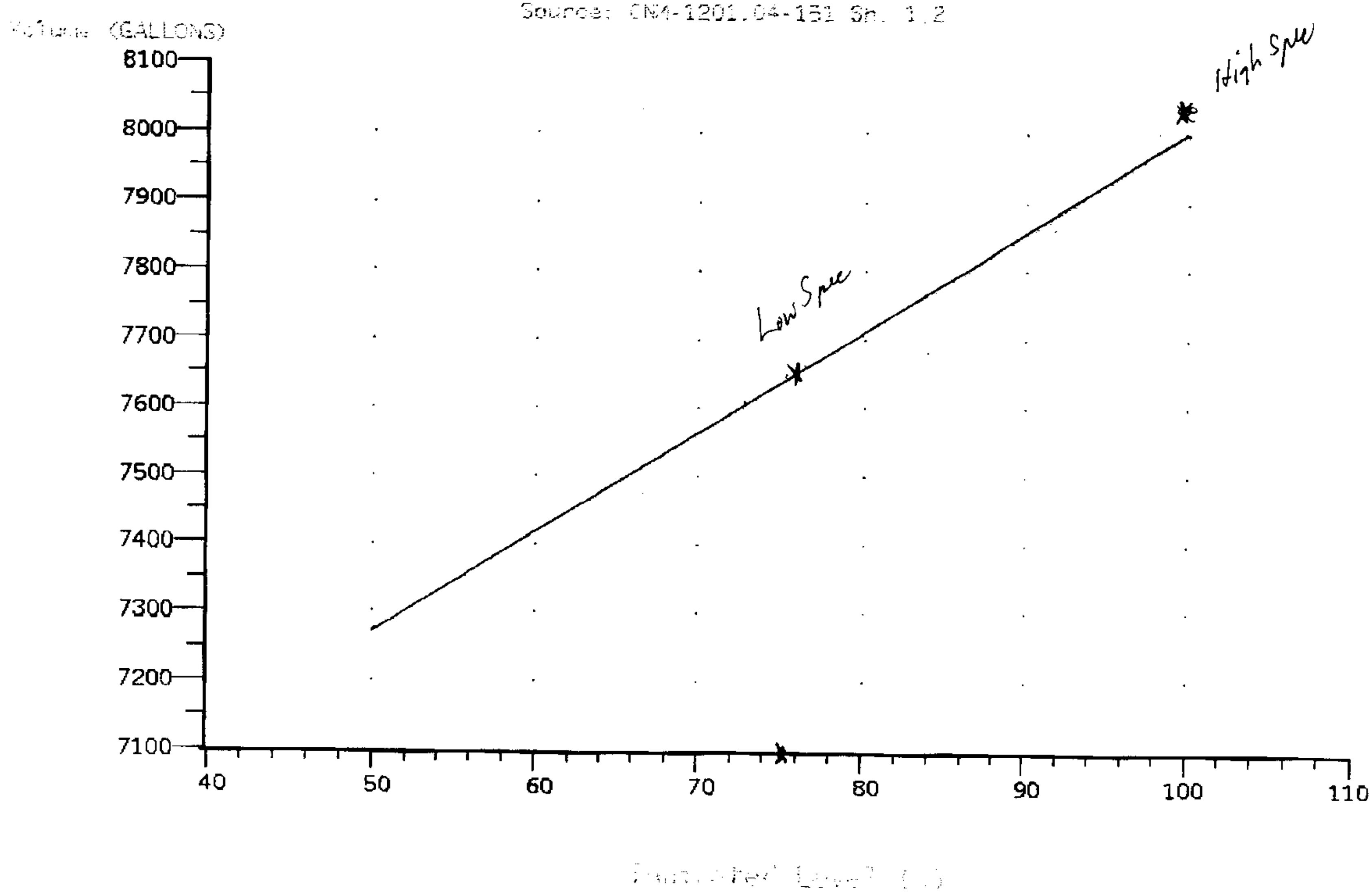
1. Shell and U-tube construction
2. KC flows through the shell side for cooling (Obj #2)
3. ND flow through the tube side
    a) ND Hx Outlet valves (ND-26, 60) (Obj. #3)
        1) Air operated butterfly valves
        2) Control flow through the Hx to maintain desired cooldown rate.
        3) Fail open during S_S to ensure heat removal capability is maintained.
        4) Controlled normally from MC-11; manual S_S reset for each valve. (Obj. #7)
        5) Local Manual loader used when operating at the ASP's. Placed in service by manually directing control air via a 3-way valve.
    b) ND Hx bypass valves (ND-27, 61) (Obj. #3)
        1) Air operated butterfly valves
        2) Used in conjunction with ND-26, 60 to maintain train flow at approximately 3300 gpm based on potentiometer setting.
        3) Fail closed on S_S.
        4) Normally operated from MC-11; manual S_S reset for each valve. (Obj. #7)
        5) Local controller is automatically placed in service when ASP's are placed in "LOCAL"
4. Temperature Indications (Obj. #7)
    a) Upstream of ND Hx A and B (NDT 5060, 5070)
        1) Supplies dual pen recorders in Control Room.
    b) Downstream of ND Hx A and B (NDT 5000, 5120)
        1) Supplies dual pen recorders in Control Room.
    c) Local Temperature indication downstream of ND Hx (NDT 5020, 5030)
5. Flow Indications (Obj. #7)
    a) Downstream of ND Hx's (NDFT 5180, 5190)
        1) Indication in C/R (MC-11) for Cold legs flow A&B (C&D)
        2) Used for auto control of ND Hx Bypass valves

21-NOV-2005 08:40:25

SELECT FUNC. KEY OR TURN-ON CODE DBKXY > [redacted] 1 47 A 1 47 B SPDS

Cold Leg Accumulator Indicated Volume

Source: CN4-1201.04-151 Sh. 1,2



Question: 05-31

1 Pt(s) What is the minimum number of cold leg accumulator(s) required to support emergency core cooling and partially cover the reactor core?

A. one

B. two

C. three

D. four

Question*: 05-31** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS006	Title	Emergency Core Cooling
	K6.02	**Description**	Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: **(CFR: 41.7 / 45.7)** Core flood tanks (accumulators)
		Importance	3.4/3.9

SOURCE	New
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-ECCS-CLA rev 021
Objectives	1 & 2
REFERENCE S	Lesson plan information statement see below
Author	RJK
Time	7/19/2005 12:17 PM 15 minutes

Distracter Analysis: According to the design of this system, 3 CLAs are needed with one CLAs being wasted out the break and it will still function in conjunction with the ECCS systems to partially cover the core.

A. Incorrect:
B. Incorrect:
C. Correct:
D. Incorrect:

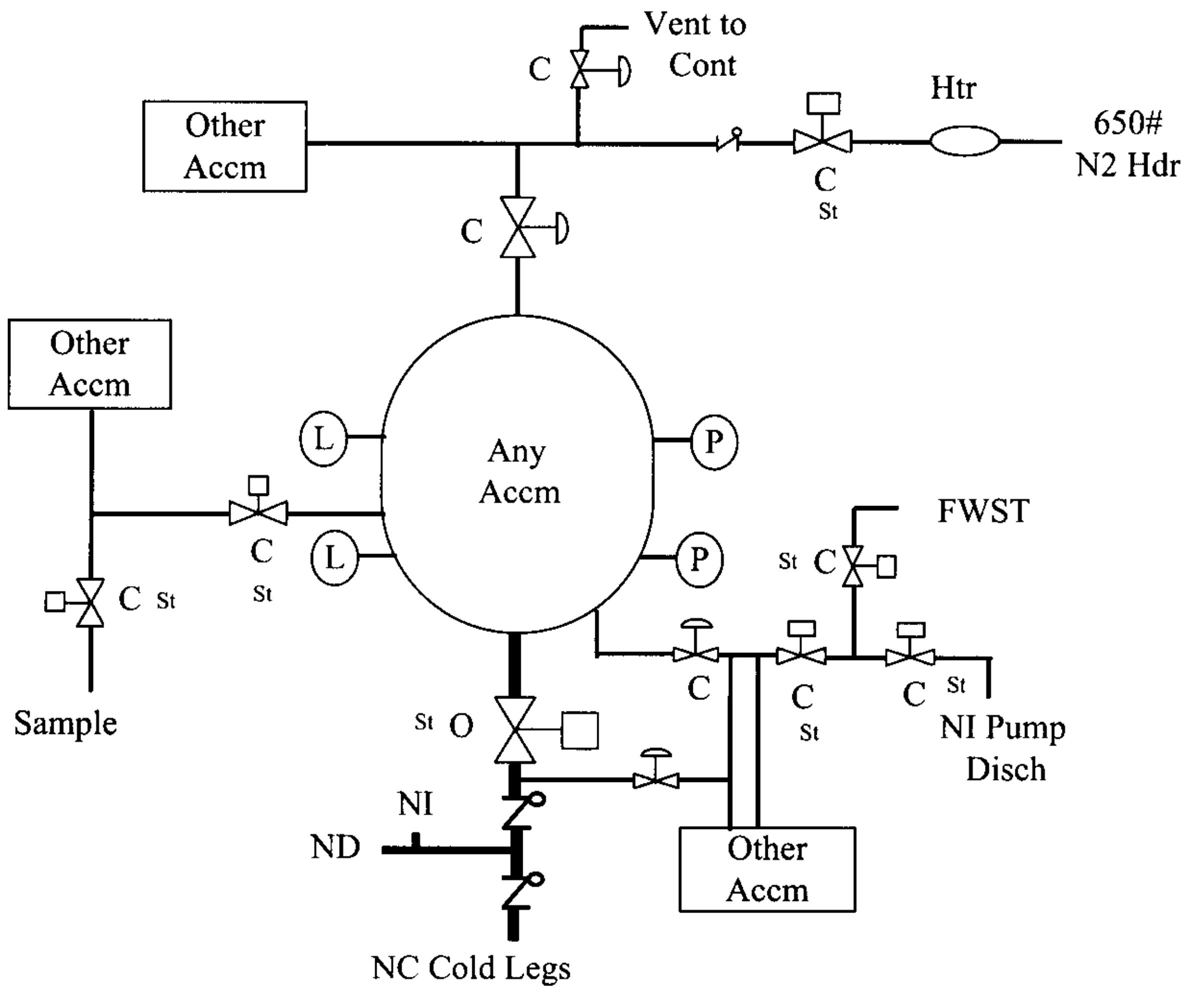
Lesson plan page 6/14

2.1 A. 5. The contents of only 3 accumulators need be injected in order to partially cover the core. The 4th CLA is assumed to dump out through the Cold Leg break and bypass the core.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Cold Leg Accumulators.	X	X	X	X	
2	Describe the injection flow path of the Cold Leg Accumulators.	X	X	X	X	
3	Explain the operation of the CLA isolation valves during startup, normal operations and shutdown.	X	X	X	X	X
4	Describe the flow path for pressurizing the CLA's with N2 and the flow path for depressurizing the CLA's.	X	X	X	X	
5	Describe the flow path for filling or draining the Cold Leg Accumulators and list the source of water to the CLA's.	X	X	X	X	X
6	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X
7	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.			X	X	X
8	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.			X	X	

2.2 System Description (Obj. #2)

A. 4 Cold Leg Accumulators; A,B,C and D.



1. CLA is connected to its Cold Leg by a 10" discharge line.
2. Each CLA must contain a borated water volume range of (See Technical Specification 3.5.1).
3. The boron concentration is cycle-specific (Refer to Core Operating Limits Report 2.10).
4. Each CLA must have a N_2 cover gas of between 585 and 678 psig. (Refer to Tech Spec 3.5.1).
5. The contents of only **3** accumulators need be injected in order to partially cover the core. The 4th CLA is assumed to dump out through the Cold Leg break and bypass the core.
6. Two pressure transmitters on each accumulator readout on MC-11 and Alarm at 602 PSIG (LO) and 661 PSIG (HI) (AD-9).

Question: 05-32

---

1 Pt(s) Given the following Pressure Relief Tank (PRT) parameters:

	0800 hrs	0810 hrs
Temperature	71.8 °F	72.1 °F
Pressure	3.0 psig	3.9 psig
Level	72.5 %	72.9 %

Which one of the following valves passing full flow for 10 minutes would account for the 0810 values in the PRT?

A. Letdown orifice line relief valve

B. Pressurizer PORV

C. Reactor coolant pump seal return line relief valve

D. Residual heat removal pump suction line relief valve

Question: 05-32 ***Answer: C***

LEVEL:	RO/SRO

K/A	SYS007	Title	Pressurizer Relief Tank
	A3.01	Description	Ability to monitor automatic operation of the PRTS, including: **(CFR: 41.7 / 45.5)** Components which discharge to the PRT
		Importance	2.7/2.9

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-PS-NC	OP-CN-PS-NV
Objectives	9	7
REFERENCES	Simulator parameters 10 minute test. AP/1/A/5500/010 Enclosure 13	
Author	RJK	
Time		

Distracter Analysis: Based on the contents of the system providing input to the PRT:

A. **Incorrect**: Due to the temperatures at this point, causes excessive pressure and temperatures increases: 14.9 psig and 87.8°F.
B. **Incorrect**: The PORV showed the largest increase after only 5 minutes.
C. **Correct**: Since these lines carry a small amount of water (~1-3 gpm per pump).
D. **Incorrect**: This source is a massive amount of water and causes a large pressure and level increase: 28.3 psig and 86.4%

IC set #1 for 10 minutes:	Temperature	Level	Pressure
0800 Initial conditions	71.8°F	72.5%	3.0 psig
ND suction relief	73.7°F	86.4%	28.3 psig
L/D relief	87.8°F	78.7%	14.5 psig
Seal return relief	72.1°F	72.9%	3.9 psig
PORV	212 °F	84 %	55 psig (after only 5 minutes)

Clearly a small increase from only one source.

Question: 05-32

1 Pt(s) A single relief valve lifted and passed full flow for 10 minutes causing the Pressure Relief Tank (PRT) parameters to change as follows:

	Initial value	Final value
Temperature	71.8 °F	72.1 °F
Pressure	3.0 psig	3.9 psig
Level	72.5 %	72.9 %

Which of the following system relief valves would most likely cause these final PRT conditions?

A. Letdown orifice line

B. Letdown heat exchanger line

C. Reactor coolant pump seal return line

D. Residual heat removal pump suction line

Question*: 05-32** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS007	Title	Pressurizer Relief Tank
	A3.01	Description	Ability to monitor automatic operation of the PRTS, including: **(CFR: 41.7 / 45.5)** Components which discharge to the PRT
		Importance	2.7/2.9

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-PS-NC	OP-CN-PS-NV
Objectives	9	7
REFERENCES	Simulator parameters 10 minute test. AP/1/A/5500/010 Enclosure 13 NV system drawing	
Author	RJK	
Time	7/19/2005 2:05 PM	54 minutes

Distracter Analysis: Based on the contents of the system providing input to the PRT:

A. **Incorrect**: Due to the temperatures at this point, causes excessive pressure and temperatures increases: 14.9 psig and 87.8°F.

B. **Incorrect**: This line relief to the VCT, but the operator may become confused with which valves relieves where.

C. **Correct**: Since these lines carry a small amount of water (~1-3 gpm per pump)

D. **Incorrect**: This source is a massive amount of water and causes a large pressure and level increase: 28.3 psig and 86.4%

IC set #1 for 10 minutes:	Temperature	Level	Pressure
Initial conditions	71.8°F	72.5%	3.0 psig
ND suction relief	73.7°F	86.4%	28.3 psig
L/D relief	87.8°F	78.7%	14.5 psig
Seal return relief	72.1°F	72.9%	3.9 psig

Clearly a small increase from only one source.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
9	Examine NC system operations.					
	• Explain NC System leak testing			X	X	X
	• Given appropriate plant conditions, apply limits and precautions associated with related station procedures.			X	X	X
	• Explain controlling NC level in a drained condition.			X	X	X
	• List the symptoms for entry into AP1/A/5500/010 (Reactor Coolant Leak)			X	X	
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
11	State the system designator and nomenclature for major components.	X				
12	Describe "Critical Valves" as specified in OP/1(2)/A/6100/001 (Controlling Procedure For Unit Startup). Include in discussion which valves are designated as critical valves, how they may be identified locally, and actions taken to ensure these valves are closed prior to commencing normal power operations.	X	X			
13	Describe the EMF's associated with NC and be able to describe the automatic actions that occur when they reach the Trip 2 setpoint.			X	X	X
14	State from memory all T.S actions for the applicable systems, subsystems and components which require remedial action to be taken in less than 1 hour.			X	X	
15	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X

TIME: 2.0 HOURS

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Chemical and Volume Control (NV) system.	X	X	X	X	
2	State the purpose of the makeup portion of the Reactor Makeup (NB) system.	X	X	X	X	
3	Discuss the importance of maintaining a flow balance in the NV system and state nominal flow values.	X	X	X	X	X
4	Describe the operation and flowpath of NV normal letdown purification including functions of the different ion exchangers and filters.	X	X	X	X	
5	Describe the operation and flowpath of NV letdown from ND.	X	X	X	X	
6	Describe the operation and flowpath of normal charging.	X	X	X	X	
7	Describe the operation and flowpath of NV seal injection.	X	X	X	X	
8	Describe the operation and flowpath of NV excess letdown.	X	X	X	X	
9	Describe the operation and flowpath of NV auxiliary spray.			X	X	
10	Describe the ECCS alignment of the NV system.	X	X	X	X	X
11	List the source(s) of cooling water to components requiring cooling in NV.	X	X	X	X	
12	Discuss the basic operation of the NC system makeup portion of the NB system for boration, dilution and emergency boration.	X	X			
13	Given a copy of the system flow diagram or a one line symbolic diagram, label the major components and show the flow path through the major components.	X	X			
14	State the function of the cover gases used on the VCT including minimum pressure requirements and how pressure is maintained.			X	X	X
15	Discuss how fission gases are removed from the VCT.			X	X	X
16	List the control features of VCT level, including channel, setpoint and coincidence.			X	X	X

__ 1. **1NC-1 (Pressurizer Safety Relief).**

__ 2. **1NC-2 (Pressurizer Safety Relief).**

__ 3. **1NC-3 (Pressurizer Safety Relief).**

__ 4. **1NC-36B (PZR PORV).**

__ 5. **1NC-34A (PZR PORV).**

__ 6. **1NC-32B (PZR PORV).**

__ 7. **1NC-108 (Pzr Vent To PRT).**

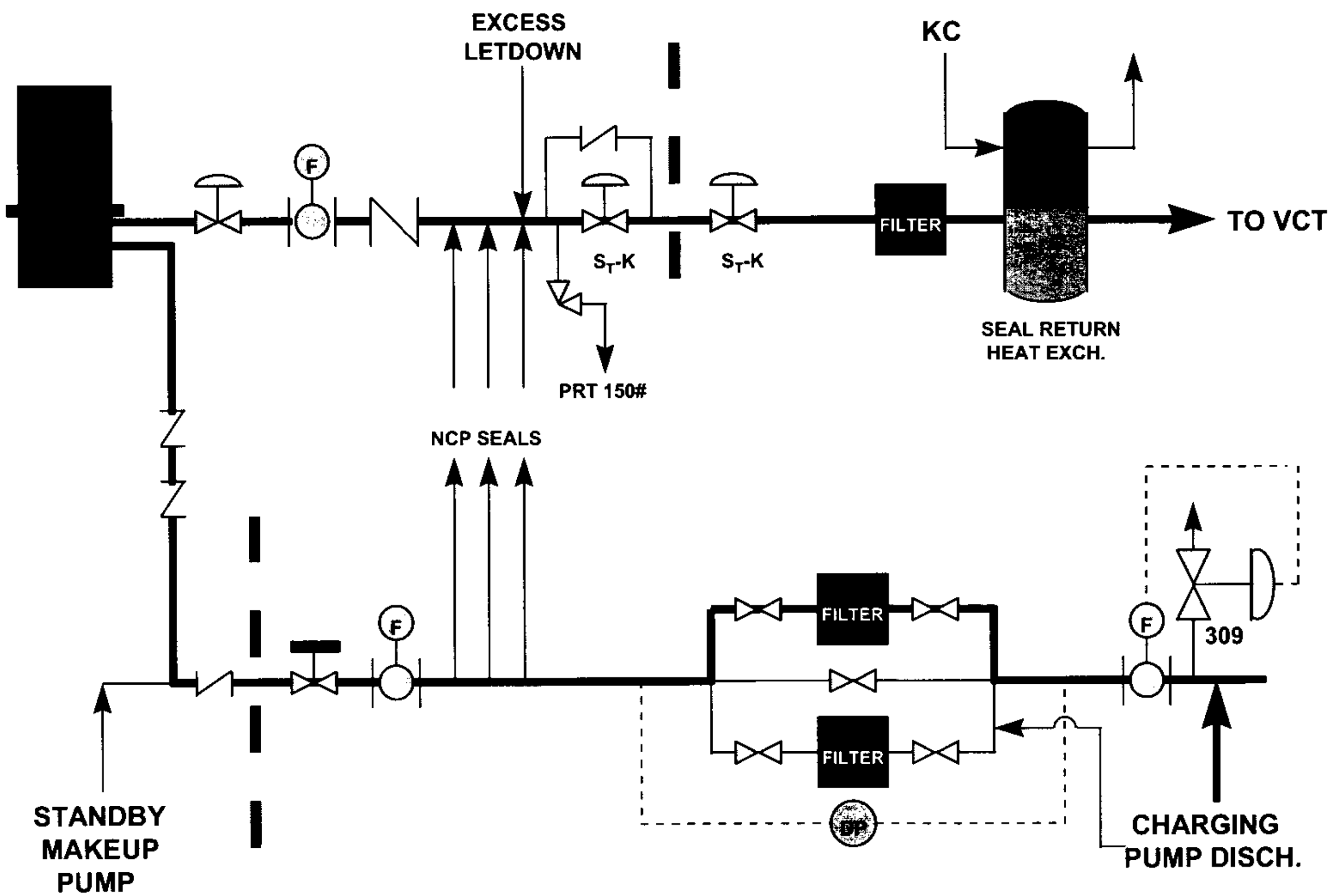
8. **Rx Head Vents:**

   __ • 1NC-250A (Rx Head Vent Block)
   __ • 1NC-251B (Rx Head Vent)
   __ • 1NC-252B (Rx Head Vent Block)
   __ • 1NC-253A (Rx Head Vent)

__ 9. **1NV-87 (NC Pumps Seal Return Hdr Inside Relief).**

__ 10. **1NV-14 (Letdn Orif Hdr Relief).**

SEAL INJECTION AND RETURN



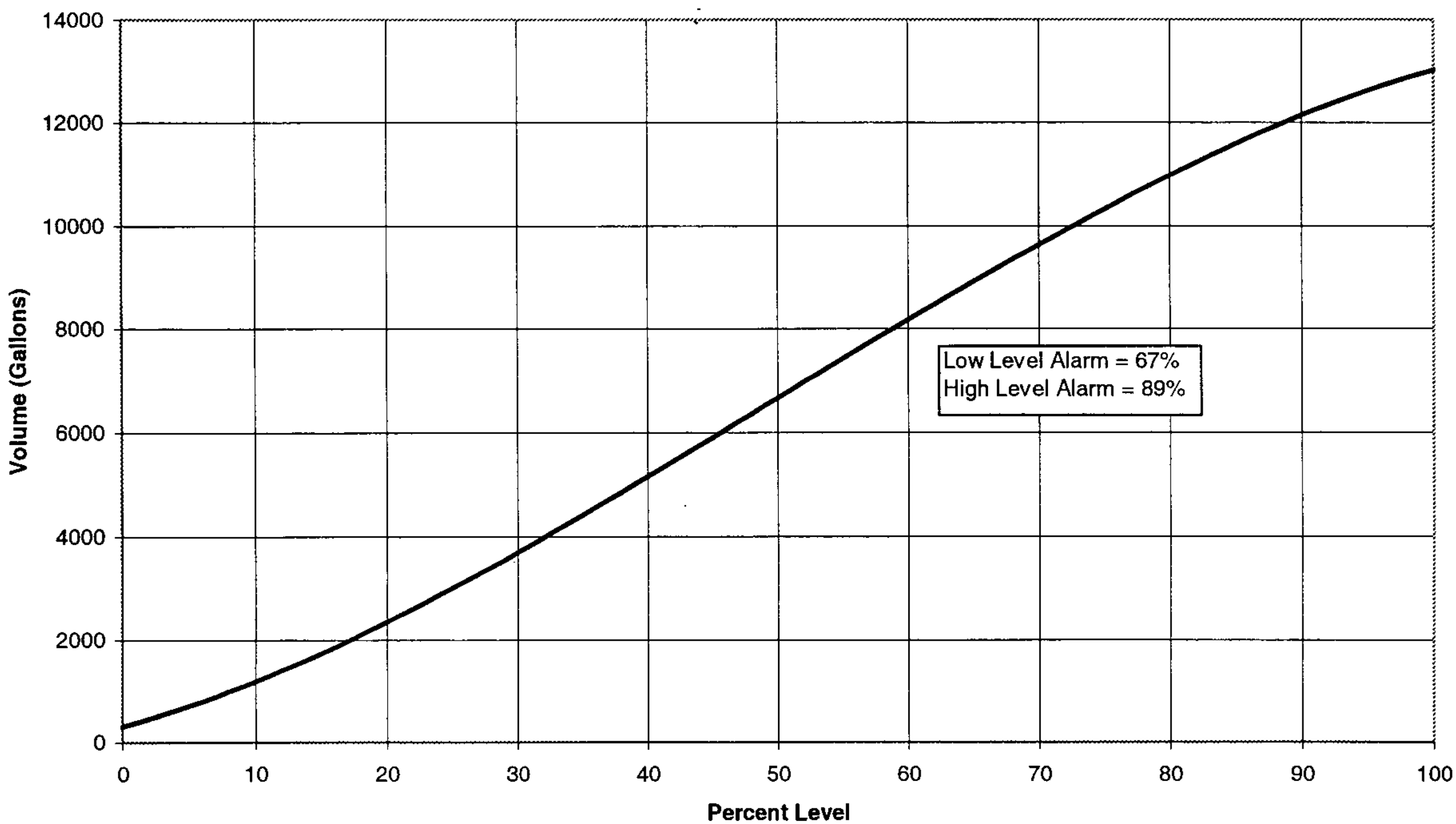


Figure 4 - Pressurizer Relief Tank Voume vs. Level

b) ND-1B Normal: EMXD; Alternate: EMXC

c) ND-37A Normal: EMXS; Alternate: EMXL

d) Alternate power supplies provide a ND suction path if one Train's power supply is lost. (i.e.: damage from a fire)

9. Area between the double isolation valves are protected against high pressure due to heatup via a spring loaded lift check valve that taps off between the valves and returns to the loops.

C. FWST Isolations (FW-27A, 55B)

1. Operated from MC-11

2. Interlocks to OPEN FW-27A (55B) (Obj #7)

a) NS-43A (38B) closed

b) NS-18A (1B) closed [NS Pump Suctions from Containment]

c) NI-185A (184B) closed

d) ND-28A (NI-136B) closed

3. Automatically close when the Containment Sump Suction Isolation valves reach their OPEN position, following S_S and 2/4 lo FWST level (37%).

D. Containment Sump Isolations (NI-185A, 184B) (Obj #7)

1. Operated from MC-11

2. Automatically OPEN following a S_S with 2/4 lo FWST level (37%).

a) "ENABLED" condition indicated by "C-Leg Recirc FWST To CONT SUMP SWAP ENABLE" light lit.

b) This Auto swap will occur even if ECCS is reset.

c) If not "ENABLED" during an S_S and the level of the FWST has decreased to the Auto Swap over setpoint, Manual action is required and <u>all</u> interlocks for opening NI-185A, 184A must be met.

d) This auto swap over can be blocked by pressing the "Defeat" pushbutton (i.e.: LOCA outside CNT, prevents ND pumps from losing suction source)

3. Interlocks to OPEN NI-185A (184B) (Obj. #7)

a) ND1B or 2A (36B or 37A) closed

b) FW-27A (55B) closed

E. ND Pump Suction Reliefs (ND-3, 38)

1. Provide overpressure protection of the ND System suction piping.

2. While the ND suction isolation valves are open to the NC System, they are able to relieve pressure transients in the NC System and provide low temperature overpressure protection (LTOP).
3. Relieve to the PRT at 450 psig
4. Capacity of each valve is a minimum of 900 gpm. This is in excess of the combined flowrate of the maximum allowed injection capability.

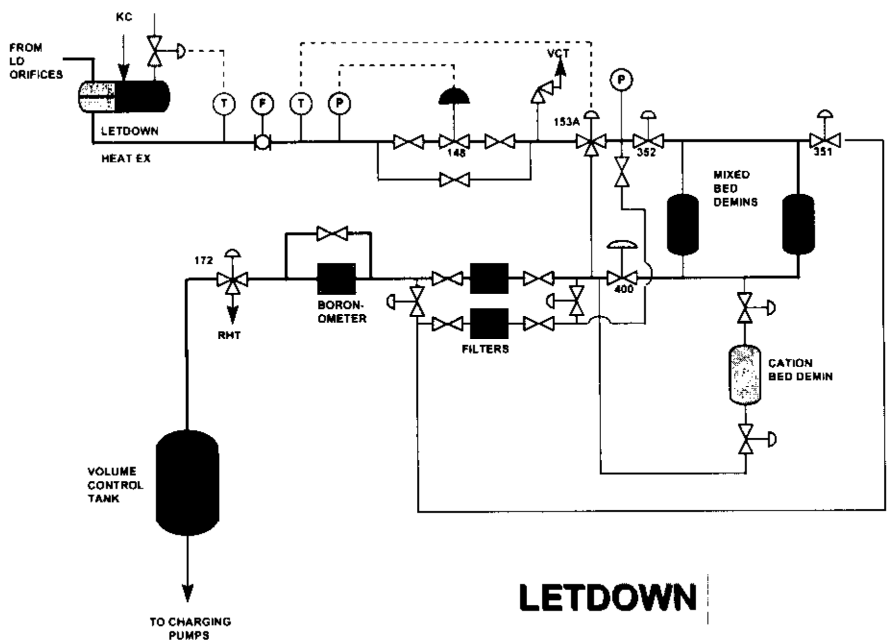
F. ND Pumps (Obj #3)

1. Vertical, centrifugal pumps.
2. KC cools Mechanical Seals and Motor. (Obj. #2)
3. Design flow of 3,000 gpm at 161 psi
4. Powered from: A-ETA, B-ETB (Obj #6)
5. Mini-flow (ND-25A, 59B)
    a) May be manually operated from MC-11
    b) Automatically operated based on flowrate downstream of ND pumps. (NDFT 5040, 5050)
        1) OPEN when flow is less than 500 gpm
        2) CLOSE when flow is greater than 1400 gpm or on pump shutdown
    c) Protects the pumps from potential low flow induced overheating and vibration.
6. ND pumps are operated from: (Obj. #7)
    a) MC-11
    b) ASP's: A-'A' ND Pump; B-'B' ND Pump
7. Receive an Auto Start signal on Ss from D/G Load Sequencer. (LOCA only load, Blackout will not start the pumps).
8. Instrumentation
    a) ND Pump Discharge Pressure (NDP5090, 5080) provides indication on MC-11 and alarm on AD-9
    b) Local ND Pump Suction Pressure (NDPG 5150, 5160) and Discharge Pressure (NDPG 5200, 5210)
    c) ND Pump Mechanical Seal HX KC outlet lo flow alarm on AD-9 set at 4 gpm

G. ND Supply to PZR Aux Spray (Obj #7)

1. ND-90 and 91
2. Motor operated from MC-11 to supply PZR spray from ND while plant is cooled down.

7. Letdown Line Relief Valve (1NV14)
   a) Overpressure protection for low press. piping and tube side of L/D heat exchanger.
   b) Relief setpoint 600 psig.
   c) Relieves to Pressurizer Relief Tank (PRT).
   d) Capacity -max flow rate through all orifices.
8. NV15B - L/D Containment Isolation Valve
   a) Operated from MCB.
   b) AUTO-CLOSE on S_t signal.
   c) AUTO-OPENS on ASP "B" to local.
9. ND Letdown Control Valve (NV135) (OBJ. #5)
   a) Open when ND system is in RHR Mode and NCS cleanup desired.
   b) Control and indication on C/B.
   c) Fails closed on loss of instrument air. (OBJ. #23)
10. Letdown heat exchanger



LETDOWN

   a) Single shell-multi pass.

3) Auto OPEN on ASPs to local.

j) NV101A - NC Pumps #1 Seal Bypass

1) Controlled from MCB. Air operated, fail closed valve.

2) Used to isolate the #1 seal bypass flows following startup of the NC pumps.

k) Seal return containment isols. NV 89A and 91B (OBJ. #22)

1) Shut on S_T signal.

2) Fail as is.

3) Controlled from MCB (or SSF for NV89A only).

4) Auto OPEN on ASPs to local.

l) Relief valve NV 87

1) Relieves to PRT @ 150 psig.

2) Capacity equal to 4 NCP seal return flows and excess L/D flow.

m) Seal return filter

1) Designed to pass excess L/D and seal return flow to VCT.

2) Maximum design DP is 75 psid.

n) Seal return heat exchanger

1) Cools seal return, excess L/D, and mini flow from CCP's.

2) Shell side flow- KC (OBJ. #11).

3) Tube side discharge to VCT.

Water cooled to normal VCT temp. (115°F)

4) SW Hx Relief Valve (NV205).

Relieves @ 150 psig to VCT.

5) NCP seal leakoff return check valves. Prevents backflow through #1 seal leakoff line prior to NCS venting when pressure is low.

C. Rx Makeup Control System (OBJ. #12) (OBJ. #18 & 19)

1. Provides manual or automatic means of supplying M/U water (pure or borated) to the NC system via the VCT and/or charging pumps.

2. Used to adjust Rx coolant boron concentration during all modes of operations.

a) Reactivity control.

b) Chemical shim control keeps control rods at optimum height in core.

Question: 05-33

---

1 Pt(s) Given the following conditions and sequence of events:

- Unit 1 is at 100 %
- Alternate cooling is aligned to 1A charging pump (NV)
- A safety injection occurs

Which system provided cooling to the 1A NV pump before the safety injection and what action is required (if any) after the safety injection to maintain cooling to 1A NV pump?

A. Drinking water (YD)
Maintain cooling from drinking water

B. Drinking water
Realign cooling from component cooling (KC)

C. Nuclear service water (RN)
Realign cooling from component cooling

D. Nuclear service water
Maintain cooling from nuclear service water

Question*: 05-33** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS008	**Title**	Component Cooling Water
	G2.1.27	**Description**	Knowledge of system purpose and or function. **(CFR: 41.7)**
		Importance	2.8/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-KC rev 50
Objectives	7 and 14
REFERENCES	Lesson plan information see below
Author	RJK
Time	8/15/2005 12:03 PM 64 minutes

Distracter Analysis:

A. **Incorrect**: While the drinking water is used as alternate, when the safety injection occurs, operator must restore KC to the charging pumps.

B. **Correct**:

C. **Incorrect**: Do not use RN as a backup source. RN is used in the KC surge tank.

D. **Incorrect**: Do not use RN for any cooling but it is a source used in the KC surge tank.

Lesson plan page 15 rev 50

4. NV Pump Alternate Cooling on a total loss of KC:

a) If Safety Injection has not actuated on either unit and both trains of KC have been lost, then alternate cooling from the YD System can be aligned to both units "A" NV Pump.

b) If a NV Pump is aligned for alternate cooling and a Safety Injection occurs on either unit, then that NV Pump must be realigned to its normal cooling source (KC).

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the KC System.	X	X	X	X	
2	Describe how the KC System is cooled.	X	X	X	X	
3	Describe the normal flowpath of the KC System, including each header and the type of loads serviced by each.	X	X	X	X	X
4	Explain what happens in the KC System during: - Safety Injection (Ss) - Phase A Containment Isolation (St) - Phase B Containment Isolation (Sp) - Blackout - Low Low KC Surge Tank Level	X	X	X	X	X
5	Given appropriate plant conditions, apply limits and precautions associated with OP/1(2)/A/6400/005 (Component Cooling Water System)	X	X	X	X	X
6	State the typical values of the KC pump discharge pressure, KC Hx outlet temperature and KC pump flow.	X	X	X	X	X
7	State the basic actions required of an NLO for a loss of Component Cooling Water and why.	X	X			
8	Describe KC system makeup.	X	X			
9	Draw a block diagram of the KC system per the KC System Simplified Drawing.	X	X			
10	Explain when the Chemistry group is to be notified concerning the KC system.	X	X	X	X	X
11	Describe the purpose of the EMF's associated with the KC System and what is indicated by a high level radiation alarm.	X	X	X	X	X
12	List the instrumentation available in the control room for the KC System.			X	X	
13	When given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Spec/SLC's.			X	X	X

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
14	Discuss the supplementary actions for the loss of KC AP.			X	X	X
15	State the function of all KC System controls, interlocks, instrumentation, and minimum flow requirements.			X	X	X
16	Recognize the effect on the KC System when going to local at either Aux. Shutdown Panel.			X	X	X
17	Recognize and apply the necessary actions applicable to all KC System Annunciators.			X	X	X
18	State the system designator and nomenclature for major components.	X				

C. Emergency Operation (OBJ. #7 &14)

1. Review AP/1/A/5500/021 actions for the following as applicable to the class being presented with this lesson material.

2. A loss of KC cooling to the NC pumps results in a gradual approach to an overheated condition prior to a possible shaft seizure. The duration of the heatup phase, estimated to be approximately ten minutes, provides a sufficient time for operator recognition and response. Additional time exists between exceeding the high bearing temperature limit and the conditions required for shaft seizure.

3. If KC and NV seal cooling are lost at the same time, seal injection from the SSF must be established within TEN minutes to prevent a LOCA through the NC pump seals. (0-C95-1697)

4. NV Pump Alternate Cooling on a total loss of KC:

   a) If Safety Injection has not actuated on either unit and both trains of KC have been lost, then alternate cooling from the YD System can be aligned to both units "A" NV Pump.

   b) If a NV Pump is aligned for alternate cooling and a Safety Injection occurs on either unit, then that NV Pump must be realigned to its normal cooling source (KC).

5. 1.47 Panel will light for KC bypass if: (OBJ. # 17)

   a) Any valve that receives a safety signal and is in a NON-Safety position with power removed.

   b) KC pump racked out

   c) RN to KC closed with power removed

   d) Loss of VI

6. ND Hx flow control valves (KC-57A, 82B) and KC Hx A&B outlet throttle valves (RN-291, 351).

   a) Fail open on a loss of air.

   b) Ss signal fails air to valves causing them to open.

   c) Manual operation

      1) Only performed in extreme emergency conditions as this could damage bushings and reset travel stops.

      2) If air is available, ensure positioner is isolated before manual operation.

      3) Handwheel must be returned to its proper throttle position to ensure the system flow balance is valid. Contact Systems Engineering for proper throttle position.

Question*: *05-34

1 Pt(s) Given the following conditions:

- Unit 1 in Mode 4 cooling down to Mode 5
- Pressurizer level is 85%
- Pressurizer heater groups 1A and 1D are in MANUAL and ON
- Reactor coolant pumps (NCP) 1A and 1B are running
- An electrical fault results in the loss of 1TA and 1ETA

Five minutes later it is reported the pressurizer outflow <u>cannot</u> be verified.

Which of the following actions will reinitiate and then maintain a continuous pressurizer outflow?

A. Energized pressurizer heater group 1B and close the spray valve for 1A NCP

B. Start NCP 1D

C. Increase the spray valve open position for NCP 1B

D. Adjust charging and letdown to decrease pressurizer level to 80%

Question: 05-34 *Answer: A*

LEVEL:	RO/SRO

K/A	SYS010	Title	Pressurizer Pressure Control
	A2.01	Description	Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Heater failures
		Importance	3.3/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-IC-IPE
Objectives	18
REFERENCES	OP/1/A/6100/002 Controlling Procedure for Unit Shutdown: limit and precautions and references in Encl. 4.1. rev 155 Lesson plan page 27
Author	RJK
Time	7/19/2005 3:14 PM

Distracter Analysis:

A. **Correct**: 1A heaters were lost on the power failure. Extra heaters capacity must be used per the operating procedures. When a NCP is shutdown its spray valve must then be closed to ensure the remaining NCP spray flow is not diverted back into the shutdown pumps spray line.

B. **Incorrect**: Neither of these pumps would be used to generate spray flow but by procedure they could be started for other reasons as long as they promote good mixing for even cooling.

C. **Incorrect:** This would only act to reduce pressurizer pressure. The outflow is more a factor of the heater capacity.

D. **Incorrect**: As level is decreased, you would see the effects in the PZR surge line, but once level reaches 80%, and NV readjusted to maintain 80%, surge line flow from the level decrease would cease. This would not create a continuous outflow required by the operating procedure.

OP/1/A/6100/002 Limits and Precaution

2.25 Maintain an outflow on the PZR to minimize PZR stratification. PZR outflow may be confirmed by the following:

- Extra heater capacity energized.
- NC, NV or ND PZR spray indicated by valve positive demand
- PZR surge line temperature and PZR water space temperatures are approximately equal.
- PZR spray valve for idle NC Pumps closed.

Enclosure 4.1

NOTE: PZR outflow shall be maintained until the PZR bubble is collapsed.

____ 2.17 Energize PZR heaters as necessary to achieve an outflow from the PZR

____ 2.18 Ensure PZR outflow as follows:

- ☐ Extra PZR heater capacity is energized.
- ☐ NC, NV or ND PZR spray is indicated by valve positive demand.
- ☐ PZR surge line temperatures and PZR water space temperatures are approximately equal
- ☐ PZR spray valve for idle NC Pumps closed

Question: 05-34

1 Pt(s) Given the following conditions:

- Unit 1 in Mode 4 cooling down to Mode 5.
- Pressurizer level is 85%.
- 1A and 1B NCP pumps are running.
- Pressurizer outflow cannot be verified.

Which of the following actions will re-establish pressurizer outflow?

A. Energized additional available heater banks.

B. Shutdown 1A NCP and close its spray valve.

C. Shutdown 1A and 1B NCP and close their spray valves.

D. Adjust charging and letdown to decrease pressurizer level.

Question: 05-34 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS010	Title	Pressurizer Pressure Control
	A2.01	Description	Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Heater failures
		Importance	3.3/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-IC-IPE
Objectives	18
REFERENCES	OP/1/A/6100/002 Controlling Procedure for Unit Shutdown: limit and precautions and references in Encl. 4.1. rev 155 Lesson plan page 27
Author	RJK
Time	7/19/2005 3:14 PM

Distracter Analysis:

A. **Correct**: Extra heaters will always increase flow.

B. **Incorrect**: This is correct if you shutdown the pump, but overall flow would decrease based on second bullet of limit and precaution 2.25.

C. **Incorrect:** This would stop nearly all outflows, but you do close the spray valve when that pump is shutdown.

D. **Incorrect**: This has no bearing on outflow.

OP/1/A/6100/002 Limits and Precaution

2.25 Maintain an outflow on the PZR to minimize PZR stratification. PZR outflow may be confirmed by the following:

- Extra heater capacity energized.
- NC, NV or ND PZR spray indicated by valve positive demand.
- PZR surge line temperature and PZR water space temperatures are approximately equal.
- PZR spray valve for idle NC Pumps closed

Enclosure 4.1

NOTE: PZR outflow shall be maintained until the PZR bubble is collapsed.

____ 2.17 Energize PZR heaters as necessary to achieve an outflow from the PZR.

____ 2.18 Ensure PZR outflow as follows:

☐ Extra PZR heater capacity is energized.

☐ NC, NV or ND PZR spray is indicated by valve positive demand.

☐ PZR surge line temperatures and PZR water space temperatures are approximately equal

☐ PZR spray valve for idle NC Pumps closed

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
17	State, from memory, the immediate actions required per AP/1/A/5500/011, (Pressurizer Pressure Anomalies) Case I			X	X	X
18	Explain IPE system operation during startup, shutdown and normal operation			X	X	X
19	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Spec/SLCs.			X	X	X
20	When given specific plant conditions determine the correct Abnormal Procedure flowpath			X	X	X
21	State from memory all Tech Spec actions for the applicable systems, subsystems and components that require remedial action to be taken in less than one (1) hour.			X	X	

L. Reactor Coolant System heatup and pressurization (**OBJ. #18)**

1. During plant startup from mode 5 to mode 3 the IPE system is used to raise the NC system pressure to normal operating pressure. First the PZR heaters are energized. By placing the heaters in service a constant spray flow is established via normal spray from the NC system or alternate spray from either the ND system or the NV system. By establishing spray flow a constant outflow of water is maintained through the PZR surge line. The purpose of the constant outflow is to prevent an in surge of water affecting the surge line temperature thus affecting the indicated PZR heat up rate. When NC system pressure reaches 1700 PSIG the pressurizer pressure master can now be utilized to control system pressure. The master may be operated manually with the raise and lower push buttons or automatically by adjusting the potentiometer to control the heaters and sprays to change the rate of pressurization. When normal system pressure of 2235 PSIG is reached the pot setting is verified correct vs. revised data book figure 25 and the system is placed in automatic.

2.7 Review AP/1/A/5500/011, Pressurizer Pressure Anomalies (**OBJ. #17, 20)**

A. Case I, Pressurizer Pressure Decreasing

B. Case II, Pressurizer Pressure Increasing

3. SUMMARY

3.1 Major Topics Covered

3.2 Review Objective

2.25 Maintain an outflow on the PZR to minimize PZR stratification. PZR outflow may be confirmed by the following:

- Extra heater capacity energized.
- NC, NV or ND PZR spray indicated by valve positive demand.
- PZR surge line temperature and PZR water space temperatures are approximately equal.
- PZR spray valve for idle NC Pumps closed.

2.26 Two positive reactivity additions shall **NOT** be made simultaneously per NSD 304 (Reactivity Management). {PIP 96-0586}

2.27 Ensure that a Written prejob briefing has been performed per Site Directive 3.0.21 (Prejob Briefing) that includes a discussion of reactivity management concerns with this procedure.

2.28 If BDMS is inoperable during a unit cooldown, the "HIGH FLUX AT SHUTDOWN" alarm setpoint should be reset periodically to ensure the alarm setpoint is within one half decade above the steady state count rate. (TS 3.3.9)

2.29 The CACST recirc should be aligned to the unit undergoing a heat up or power escalation or power decrease as a preemptive measure to establish a bleed on the Consensate System. {PIP 98-4147}

2.30 If hydrazine was added to the ND System prior to this shutdown, the Mixed Bed Demineralizer should be removed from service prior to placing ND in service. After ND has been placed in service, flow may be aligned through the Mixed Bed Demineralizer.

2.31 The Steamline N-16 Radiation Monitors (EMF-71, 72, 73, 74) become inaccurate at power levels below 40% due to inaccuracies in the algorithm used to calculate the output of these monitors. {PIP 99-3980}

3. Procedure

Refer to Section 4 (Enclosures).

Question: 05-35

1 Pt(s) Initial Conditions:

- Unit 1 was operating at 65% power.
- NI44 was removed from service per procedure and all appropriate bistables have been tripped.

Current Conditions:

- Water level in the exterior doghouse is 14"
- Operators attempted to manually trip the reactor but neither reactor trip breaker (RTB) opened.
- It has just been reported that all S/G NR levels are offscale low.
- Operators are manually inserting control rods.
- Operable NIs indicate ~46% power.

What is the condition of the main turbine and the reason for that condition?

A. Turbine is online and must be manually tripped. Both RTBs are still closed.

B. Turbine automatically tripped. Current S/G levels generated an automatic reactor trip signal.

C. Turbine is online and must be manually tripped. 3 of 4 P9 bistables are not met.

D. Turbine automatically tripped. AMSAC protection actuated.

***Question:* 05-35** ***Answer:* D**

LEVEL:	RO/SRO

K/A	SYS012	**Title**	Reactor Protection
	K3.02	**Description**	Knowledge of the effect that a loss or malfunction of the RPS will have on the following: **(CFR: 41.7 / 45.6)** T/G
		Importance	3.2/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-IC-IPX, OP-CN-CF-CF
Objectives	9
REFERENCES	Lesson plan listing
Author	JKS
Time	7/19/2005 3:40 PM 22 minutes

Distracter Analysis:

A. **Incorrect**: RTBs open generate a P4 signal which results in a turbine trip. This is a true statement, but the turbine WILL trip.

B. **Incorrect**: This is a true statement, but the turbine relies on the P4 signal which is not there. Student may think that the reactor trip SIGNAL causes the T/G to trip.

C. **Incorrect**: This would be a correct statement related to P9, however the logic is backwards. P9 is for turbine trip causes reactor trip. The turbine WILL trip.

D. **Correct**: AMSAC protection will initiate a turbine trip on loss of both CF pumps.

IPX lesson plan page 18

P-4	A or B Reactor Trip	• Turbine Trip • Feedwater Isolation less than Low T_{ave}(564°F) • Arms condenser dumps • Allows block of Safety Injection Signal after time delay • Runs back CF pumps on reactor trip

Question: 05-35

1 Pt(s) A reactor trip from 100% power occurred with the following equipment status:

- Turbine did not trip
- Feedwater did not isolate
- Condenser dump valves are closed
- CF pump turbine speed demand is 65%

Which one of the following signals has failed to actuate?

A. P-4

B. P-8

C. P-9

D. P-14

Question*: 05-35** ***Answer: A

LEVEL:	RO/SRO

K/A	SYS012	**Title**	Reactor Protection
	K3.02	**Description**	Knowledge of the effect that a loss or malfunction of the RPS will have on the following: **(CFR: 41.7 / 45.6)** T/G
		Importance	3.2/3.3

SOURCE	Modified (South Texas Initial Exam Bank)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-IC-IPX
Objectives	9
REFERENCES	Lesson plan listing
Author	RJK
Time	7/19/2005 3:40 PM 22 minutes

Distracter Analysis:

A. Correct: P-4 inputs all these system actuations.
B. Incorrect: Only inputs a reactor trip on loss of one NCP, but is a real P signal.
C. Incorrect: It would cause a reactor trip above 69% power..
D. Incorrect: Only causes feedwater isolation and turbine trip.

IPX lesson plan page 18

P-4	A or B Reactor Trip	• Turbine Trip • Feedwater Isolation less than Low T_{ave}(564°F) • Arms condenser dumps • Allows block of Safety Injection Signal after time delay • Runs back CF pumps on reactor trip

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Reactor Protection System (IPX) System.	X	X	X	X	
2	List the reactor trips.	X	X	X	X	X
3	List the setpoint for each reactor trip.		X	X	X	X
4	List the logic and interlocks associated with each reactor trip.			X	X	X
5	Describe the function of the Solid State Protection System (SSPS).	X	X			
6	Describe the operation of the following breakers and associated interlocks: • Reactor trip breakers • Reactor trip bypass breakers	X	X	X	X	X
7	Explain the derivation of the reactor trip setpoints.			X	X	
8	Define the following: • Safety Limit • Limiting Safety System Setting • Nominal Setpoint			X	X	
9	List all permissive and control "P" and "C" interlocks related to reactor trips and their function, setpoint and logic.			X	X	X
10	Describe the function of the "First Out" annunciator panel.			X	X	X
11	Describe the function of all instrumentation and controls associated with the Reactor Protection System (IPX).			X	X	X
12	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs.			X	X	X
13	State from memory all Tech Spec actions for the system, subsystem or components which require remedial action to be taken in less than one hour.			X	X	

TIME: 2.0 HOURS

7. Permissive and Control Interlocks (Obj. #9)

INTERLOCKS	LOGIC	FUNCTION
P-4	A or B Reactor Trip	• Turbine Trip • Feedwater Isolation less than Low T_{ave}(564°F) • Arms condenser dumps • Allows block of Safety Injection Signal after time delay • Runs back CF pumps on reactor trip
P-6	1/2 I.R. greater than 10^{-10} amps	Allows manual block of S.R Reactor Trip. Manual block de-energizes high voltage to the Source range detectors. On decreasing power, Source Range Level trips are automatically reactivated and high voltage restored.
P-7	2/4 P.R. greater than 10% FP or 1/2 impulse pressure greater than 10% (P-13)	On increasing power P-7 automatically enables the following trips: • Pzr High Level • Pzr Low Pressure • Low NC Flow 2/4 Loops • NCP Undervoltage • NCP Underfrequency On decreasing power these trips are automatically blocked.
P-8	2/4 P.R. greater than 48% FP	On increasing power P-8 enables the 1/4 loop loss of flow Reactor Trip. On decreasing power, P-8 automatically blocks this trip.
P-9	2/4 P.R. greater than 69% FP	On increasing power P-9 automatically enables Reactor trip on Turbine trip. On decreasing power, P-9 automatically blocks this trip.
P-10	2/4 P.R. greater than	On increasing power P-10 allows

Question: 05-36

1 Pt(s) Initial Conditions:

- Unit 1 was performing a heatup following a refueling outage
- NC Temperature was 400 °F
- NC pressure was 1600 psig
- "A" and "B" shutdown banks were withdrawn
- Containment Pressure Channel II failed high

Current Conditions:

- 1ERPD has lost power
- Containment pressure channels read:
    - Channel I: 0 psig
    - Channel II: +5 psig
    - Channel III: 0 psig
    - Channel IV: -5 psig

Which of the following statements explains the impact on the Engineered Safeguards Features (ESF) system and expected operator actions?

A. Only Train "A" safety injection actuation logic was satisfied.
Implement EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

B. Only Train "A" safety injection actuation logic was satisfied.
Implement AP/1/A/5500/005, Reactor Trip or Inadvertent S/I Below P-11.

C. Train "A" and "B" safety injection actuation logic were satisfied.
Implement EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

D. Train "A" and "B" safety injection actuation logic were satisfied.
Implement AP/1/A/5500/005, Reactor Trip or Inadvertent S/I Below P-11.

Question:* 05-36** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS01 3	Title	Engineered Safety Features Actuation
	A2.04	Description	Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Loss of instrument bus
		Importance	3.6/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-ECCS-ISE
Objectives	2 & 3
REFERENCE S	AP/1/A/5500/029 Enclosure 17 (1ERPD load list) rev 013
Author	RJK
Time	7/22/2005 1:39 PM 3 minutes plus 40 minutes

Distracter Analysis:

A. **Incorrect**: Bistables for channels 2&4 are actuated and SSPS receives the input.

B. **Incorrect**: Bistables for channels 2&4 are actuated and SSPS receives the input.

C. **Incorrect**: Since both trains of input bay receive any signal from the process cabinets, and operator may assume that 2 pressure channels would satisfy both SSPS output bays. E-0 is not used in Mode 4, AP-05 does have you transfer to E-0 only on valid indication of high containment pressure ie greater than 200 degrees in the NC system.

D. **Correct**: Bistables for channels 2&4 are actuated and SSPS receives the input. Because the actuations were made in Mode 4, AP-05 is the correct mitigation procedure path.

ESFAS information due to power failure: AP-29 Enclosure 17

1. **Reactor Protection System and SSPS:**
__ • All Channel IV bistables (except for "CONT HI-HI PRESS") - LIT
__ • All Channel IV control board meters - FAILED
__ • SSPS Train B Output Slave Relays will lose ability to generate any Train B ESF or RPS actuations (Train B General Warning)

Question*: *05-36

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

- Containment Pressure Channel II fails high
- Loss of 1ERPD

Containment pressure channels read:

- Channel I: 0 psig
- Channel II: +5 psig
- Channel III: 0 psig
- Channel IV: -5 psig

Which of the following statements explains the impact on the Engineered Safeguards Features (ESF) system and expected operator actions?

A. Only train "A" safety injection actuation logic is satisfied.
Only train "A" safety injection equipment starts.
Perform EP/1/A/5000/E-0, Reactor Trip or Safety Injection actions.

B. Neither train of safety injection actuation logic is satisfied.
Perform AP/1/A/5500/029, Loss of Vital or Aux Control Power to restore power to 1ERPD.

C. Train "A" and "B" safety injection actuation logic are satisfied.
Train "A" and "B" safety injection equipment starts.
Perform EP/1/A/5000/E-0, Reactor Trip or Safety Injection actions.

D. Train "A" and "B" safety injection actuation logic are satisfied.
Only train "A" safety injection equipment starts.
Perform EP/1/A/5000/E-0, Reactor Trip or Safety Injection actions.

Question*: 05-36** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS013	**Title**	Engineered Safety Features Actuation
	A2.04	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Loss of instrument bus
		Importance	3.6/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-ECCS-ISE
Objectives	2 & 3
REFERENCES	AP/1/A/5500/029 Enclosure 17 (1ERPD load list) rev 013
Author	RJK
Time	7/22/2005 1:39 PM 3 minutes plus 40 minutes

Distracter Analysis:

A. **Incorrect**: Operator may think that one channel inputs to only one train of the input bays. Train A output is actuated.

B. **Incorrect**: Containment pressure for spray would not actuate.

C. **Incorrect**: Since both trains of input bay receive any signal from the process cabinets, and operator may assume that 2 pressure channels would satisfy both SSPS output bays (power failure is blocking the "B" train output.

D. **Correct**: Bistables for channels 2&4 are actuated and SSPS receives the input. But train B is prevented from actuating the output relay due to the power failure.

AP-29 Enclosure 17

1. **Reactor Protection System and SSPS:**

__ • All Channel IV bistables (except for "CONT HI-HI PRESS") - LIT

__ • All Channel IV control board meters - FAILED

__ • SSPS Train B Output Slave Relays will lose ability to generate any Train B ESF or RPS actuations (Train B General Warning)

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Engineered Safeguards Actuation System.			X	X	
2	Describe the sequence of events that occur if an Engineered Safeguards Actuation System setpoint is reached.			X	X	X
3	Explain the purpose of each of the Engineered Safeguards System Components.			X	X	
4	List all the Engineered Safeguards Signals with their setpoints, logic and interlocks.			X	X	X
5	Describe how each ESF Signal is reset.			X	X	X
6	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs / SLC's.			X	X	X
7	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.			X	X	

NOTE The following actions occur when 1ERPD is deenergized. This enclosure requires no action and provides information for the following:

- Tech Spec implications
- Operational impacts
- Increased surveillance
- Equipment to be restored after power restoration.

1. **Reactor Protection System and SSPS:**

__ • All Channel IV bistables (except for "CONT HI-HI PRESS") - LIT

__ • All Channel IV control board meters - FAILED

__ • SSPS Train B Output Slave Relays will lose ability to generate any Train B ESF or RPS actuations (Train B General Warning)

__ • Loss of Train B interlock logic for ECCS valve auto alignment on swapover to Cold Leg Recirc from Cold Leg Injection.

• Loss of Control board indications for the following Train B lights:

__ • ECCS Trn B Pzr Press - "BLOCKED"

__ • ECCS Trn B Stm Press - "BLOCKED"

__ • ECCS Trn B - "RESET"

__ • KC NC NI NM Train B ST Valves - "RESET"

__ • NS Trn B Reset - "RESET"

__ • Phase B Cont Isol Trn B Reset - "RESET"

__ • Phase A Cont Isol Trn B Reset - "RESET"

__ • Cont Vent Trn B Reset - "RESET".

Question: 05-37

1 Pt(s) Given the following:

- Unit 1 is shutdown and being cooled down for an outage.
- Primary temperature is 257 °F
- Upper and lower containment temperatures are 90 °F
- Control Rod Drive Mechanism fans are shutdown

Assuming no operator action, which one of the following explains the effect on containment cooling system operation as containment temperature continues to decrease?

A. Chilled water flow control is automatically bypassed to prevent containment temperature from decreasing to less than 60 °F.

B. Reduced heat load in containment will trip the containment chillers on low chilled water flow.

C. Reduced heat load in containment will over pressurize the chilled water piping and trip the chilled water pumps.

D. Chilled water flow control is automatically selected to "MAX COOL" to provide an additional heat load on the containment chillers.

Question: 05-37 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS022	Title	Containment Cooling
	A1.04	Description	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCS controls including: **(CFR: 41.5 / 45.5)** Cooling water flow
		Importance	3.2/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CNT-VV rev 18
Objectives	13
REFERENCE S	Lesson plan information
Author	RJK
Time	7/22/2005 2:14 PM 41 minutes

Distracter Analysis:

A. **Incorrect**: The bypass action of the flow control valve is used if fans are in high speed or CNT pressure reaches 0.5 psig. But it does occur and may confuse the unsure.

B. **Correct:**

C. **Incorrect**: The over pressure part is true, but there are no trips for a chilled water pump.

D. **Incorrect**: This would be the correct answer IF THE OPERATOR performed the step.

VV lesson plan page 8

4. LCVU operation during periods of low containment heat load (Obj. # 13)
   a) During periods when the Control Rod Drive Mechanism Fans are secured the amount of YV flow through the LCVUs is reduced as the control valves modulate closed due to low fan inlet air temperature.
   b) Flow reductions can cause the YV chillers to trip on low chill water flow.
   c) Flow reductions can also cause the pressure in the YV piping to increase to the point of relief valve actuation.
   d) Enhancements were made to OP/1(2)/A/6450/001 (Containment Ventilation Systems) to direct the operator to place additional LCVUs in service or shift the LCVUs to MAX COOL to prevent the YV chillers from tripping.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
11	Describe the Containment Ventilation (VV) System configuration for the following operating modes: • Normal Cooling • Lower Containment Additional Cooling • Upper Containment Additional Cooling	X	X	X	X	X
12	Describe the automatic actions that occur in the VV System on a Blackout Load Sequencer actuation.			X	X	X
13	Describe the effects on the Containment Chilled Water (YV) system and associated piping when the Containment Ventilation (VV) System is not configured properly during periods of low containment heat load.			X	X	X
14	Given appropriate plant conditions, apply Limits and Precautions associated with related station procedures.			X	X	X
15	Given a copy of Tech Specs, associated Bases, and a set of plant conditions, determine compliance with the LCO and apply any Required Actions or Surveillance Requirements.			X	X	X

d) A cooling water bypass valve or "full flow" valve is installed in parallel with the normal cooling water flow control valve. This valve will automatically open for each of the following conditions:

1) An LCVU is selected to HIGH speed.

2) Containment pressure rises to greater than or equal to 0.5 psig.

e) Nuclear Service Water (RN) may be automatically or manually aligned when YV is unavailable. YV will not be available to provide cooling to the LCVUs during a loss of offsite power.

4. LCVU operation during periods of low containment heat load (Obj. # 13)

a) During periods when the Control Rod Drive Mechanism Fans are secured the amount of YV flow through the LCVUs is reduced as the control valves modulate closed due to low fan inlet air temperature.

b) Flow reductions can cause the YV chillers to trip on low chill water flow.

c) Flow reductions can also cause the pressure in the YV piping to increase to the point of relief valve actuation.

d) Enhancements were made to OP/1(2)/A/6450/001 (Containment Ventilation Systems) to direct the operator to place additional LCVUs in service or shift the LCVUs to MAX COOL to prevent the YV chillers from tripping.

5. Two Pipe Tunnel Booster Fans (PTBFs) are provided to circulate air outside of the crane wall.

a) Like the LCVUs. The PTBFs are two speed fans with "OFF-LOW-HIGH" selector switches on the Main Control Board.

b) The PTBFs do NOT contain cooling water coils. The PTBFs draw cool air from the "D" LCVU supply duct and discharge to the pipe tunnel and DRPI Cabinet area.

c) Normally only one of the two PTBFs is in service operating at the same speed as the inservice LCVUs.

d) PTBFs are available on a "blackout".

6. Local indication of fan discharge air flow is provided on a local panel in the Auxiliary Building. PTBF vibration resets are provided on this same panel.

2.3 Control Rod Drive Mechanism (CRDM) Cooling System (Obj #6).

A. The purpose of this system is to cool the Control Rod Drive Mechanisms during normal plant operation. (Obj #4)

B. This system performs no function during a LOCA and is <u>not</u> Nuclear Safety Related. The system is available on "blackout" power.

Question: 05-38

---

1 Pt(s) Prior to which of the following actions should an operator reduce ice condenser glycol expansion tank level?

A. Reduce the number of glycol chillers from 3 to 2.

B. Glycol containment isolation valves are to be opened.

C. Glycol containment isolation valves are to be closed.

D. Reduce the number of glycol pumps from 2 to 1.

Question: 05-38 **Answer: C**

LEVEL:	RO/SRO

K/A	SYS025	Title	Ice Condenser
	G2.1.32	Description	Ability to explain and apply all system limits and precautions **(CFR: 41.10 / 43.2 / 45.12)**
		Importance	3.4/3.8

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CNT-NF
Objectives	4
REFERENCES	OP/0/A/6200/008 Limits and Precaution 2.5 rev 047
Author	RJK
Time	7/22/2005 3:02 PM 68 minutes

Distracter Analysis: Expansion tank is located in containment. If the headers are isolated, the temperature increase will result in spillage of glycol to the ice condenser floor areas.

A. Incorrect: May think there is some required balance which could be implied by L&P 2.3.
B. Incorrect: May think that if the valves are opened, an increase in level would result.
C. Correct:
D. Incorrect: May think there is some required balance which could be implied by L&P 2.3.

OP/0/A/6200/008 Limits and Precautions

2.3 NF glycol chillers/pumps duties are as follows:

- If 1 or 2 chillers are in service, 1 pump is required.
- If 3 chillers are in service, 2 pumps are required.
- If 4 chillers are in service, 3 pumps are required.

2.4 When gate valves in glycol service have been closed, briefly loosen the bonnet plug before opening to relieve pressure across the valve which could prevent it from opening.

2.5 When isolating a portion of the NF System for any reason, always allow for expansion of the cold glycol to ambient temperatures. If containment isolation valves are to be closed, consider reducing glycol expansion tank level.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Ice Condenser System.	X	X	X	X	
2	Describe the flow path of steam through the ice condenser in the event of a LOCA.	X	X	X	X	
3	Describe the operation of the ice condenser components and ice condenser refrigeration system during both normal and accident conditions.	X	X	X	X	
4	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
5	State the safety and environmental hazards associated with glycol solution.	X	X	X	X	X
6	State the consequences of closing the NF containment isolation valves.	X	X			
7	Given an Ice Bed temperature and that the NF System is secured; determine if NF System returned to service is required.	X	X			
8	Describe how the ice condenser lower inlet door position is monitored.			X	X	X
9	When given plant conditions and a copy of Tech. Specs., and SLC's , determine compliance with LOC's and apply Action statements: • TS 3.6.12 • TS 3.6.13 • TS 3.6.14 • TS 3.6.15 • SLC 16.6-3			X	X	X

Ice Condenser Refrigeration System

1. Purpose

To define the operation of the Ice Condenser Refrigeration System.

2. Limits and Precautions

2.1 The maximum allowable ΔT between the ice bay floor and the glycol coolant is 20°F.

2.2 If eaten, sodium tetraborate ice will cause immediate diarrhea.

2.3 NF glycol chillers/pumps duties are as follows:

- If 1 or 2 chillers are in service, 1 pump is required.
- If 3 chillers are in service, 2 pumps are required.
- If 4 chillers are in service, 3 pumps are required.

2.4 When gate valves in glycol service have been closed, briefly loosen the bonnet plug before opening to relieve pressure across the valve which could prevent it from opening.

2.5 When isolating a portion of the NF System for any reason, always allow for expansion of the cold glycol to ambient temperatures. If containment isolation valves are to be closed, consider reducing glycol expansion tank level.

2.6 A lo-lo level signal on the Glycol Expansion Tank will close containment isolation valves 1(2)NF-228A and 1(2)NF-234A. A bypass switch is provided to allow opening these valves with a lo-lo level.

2.7 When venting or draining glycol, catch the glycol by using hoses and buckets to ensure no spillage occurs.

2.8 The maximum pressure drop across Ice Condenser Glycol Bypass Filter is 10 psid.

2.9 To prevent freezing of KR water in the condensers, do **NOT** close KR bypass valves around chiller package condenser control valves.

2.10 Glycol is a serious health hazard. Avoid skin contact and inhalation of vapors. Refer to MSDS #0645.

2.11 If glycol is spilled, take immediate action to prevent the glycol from entering floor drains.

Question: 05-39

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1 Pt(s) A LOCA has occurred on Unit 1. Given the following:

- Containment pressure peaked at 4.6 psig, decreased to 0.2 psig and then slowly increased to 0.5 psig
- The following signals have been reset:
    - Phase "A" containment isolation signal
    - Both trains of ECCS
    - Both D/G load sequencers
    - NS Train "A"

Which one of the following describes the current status of the containment spray (NS) system?

	1A Train NS	1B Train NS
A.	ON	ON
B.	ON	OFF
C.	OFF	ON
D.	OFF	OFF

Question: 05-39 ***Answer: D***

LEVEL:	RO/SRO

K/A	SYS026	**Title**	Containment Spray
	A3.01	**Description**	Ability to monitor automatic operation of the CSS, including: **(CFR: 41.7 / 45.5)** Pump starts and correct MOV positioning
		Importance	4.3/4.5

SOURCE	CNS BANK (NS-028-D)
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-ECCS-NS rev 32
Objectives	6
REFERENCES	Lesson plan information
Author	RJK
Time	8/15/2005 10:26 AM 34 minutes

Distracter Analysis:

A. **Incorrect**: With new setpoints, an operator may be confused with pump status.
B. **Incorrect**: Operator thinks "A" train is still running.
C. **Incorrect**: This would be true with older setpoints.
D. **Correct**: See setpoint discussion below.

<u>Lesson plan page 10</u>

C. Start Signals (Obj #6)

1. A "High-High Containment Pressure" condition exists when 2/4 containment pressure transmitters reach 3.0 psig or greater and is known as a "Sp" signal. This condition generates a Containment Spray initiation "NS/VX Init" signal. When the "NS/VX Init" signal is combined with a CPCS signal that is 0.9 psid or greater, the NS and VX systems are actuated.
2. An operator can manually initiate spray with the "Phase B, NS/VX, Cont Vent Isol" pushbutton.
3. Remember that the above start signals are dependent on the CPCS permissive. If any transmitter pressure decreases to less than 0.35 psid, the associated component will no longer function. The pumps shutdown and the spray header valves will close and in the VX system, the air return fans will shutdown.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the containment spray system.	X	X	X	X	
2	State the purpose and operation of the following components: • Containment Spray pumps • Heat exchangers. • Spray headers • Refueling Water Storage Tank (FWST) • Containment sump • Containment Pressure Control System (CPCS) transmitters	X	X	X	X	
3	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.			X	X	X
4	Describe the normal alignment of the containment spray system.			X	X	X
5	Describe how NS is manually initiated.	X	X	X	X	X
6	List the automatic start signals for the NS System.	X	X	X	X	X
7	Describe the system response to an automatic start signal.			X	X	
8	Describe the flow path and list the source(s) of cooling water.	X	X	X	X	X
9	Explain the procedure to realign the pump suction path and when cooling water is aligned.			X	X	X
10	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X
11	Draw the Containment Spray System simplified drawing.	X	X	X	X	
12	State the system designator and nomenclature for major components.	X				

C. Start Signals (Obj #6)

1. A "High-High Containment Pressure" condition exists when 2/4 containment pressure transmitters reach 3.0 psig or greater and is known as a "Sp" signal. This condition generates a Containment Spray initiation "NS/VX Init" signal. When the "NS/VX Init" signal is combined with a CPCS signal that is 0.9 psid or greater, the NS and VX systems are actuated.

2. An operator can manually initiate spray with the "Phase B, NS/VX, Cont Vent Isol" pushbutton.

3. Remember that the above start signals are dependent on the CPCS permissive. If any transmitter pressure decreases to less than 0.35 psid, the associated component will no longer function. The pumps shutdown and the spray header valves will close and in the VX system, the air return fans will shutdown.

D. Automatic system operation (Obj #7 & 8)

1. When containment pressure increases to 3 psig or greater on 2 out of 4 Containment Pressure channels, the "Phase B, NS/VX, Cont Vent Isol " signal is activated for each train.

2. Separately, CPCS pressure instruments have also measured the containment pressure increase and provide the needed permissive to each component. The components then do the following:

   a) The spray pumps have the permission to start; the diesel generator load sequencer closes their circuit breakers so they start. These are E/S load sequencer type loads.

   b) The spray header isolation valves open.

   c) The pumps take suction on the FWST and spray containment through the spray isolation valves. Flow through the heat exchangers is only on the NS side. RN remains isolated during the initial injection mode.

3. Should the NS system components be allowed to operate until CPCS sensed containment pressure decreases to 0.35 psid or less, the following occurs:

   a) Each containment spray pump stops.

   b) Each spray header isolation valve closes.

4. As long as the operators do nothing to remove (i.e. RESET) the NS/VX signal, if containment pressure again increases to 0.9 psid or greater, the components operate again.

Question: 05-40

1 Pt(s) Given the following events:

- Unit 1 is at 50% at end of cycle.
- Control rods are in manual.
- Turbine control is "MW OUT" and "1st STG OUT"
- One moisture separator reheater relief valve fails open.

Which one of the following correctly describes the initial effects on turbine load and core reactivity?

A. Turbine load decreases.
Positive reactivity is added.

B. Turbine load increases.
Negative reactivity is added.

C. Turbine load increases.
Positive reactivity is added.

D. Turbine load decreases.
Negative reactivity is added.

Question*: 05-40** ***Answer: A

LEVEL:	RO/SRO

K/A	SYS039	**Title**	Main and Reheat Steam
	K5.08	**Description**	Knowledge of the operational implications of the following concepts as the apply to the MRSS: **(CFR: 41.5 / 45.7)** Effect of steam removal on reactivity
		Importance	3.6/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	BNT-RT08, Reactor Operational Physics rev 5
Objectives	23
REFERENCES	Lesson plan information.
Author	RJK
Time	7/25/2005 9:47 AM 29 minutes

Distracter Analysis:
Steam flow from the failed relief valve will cause turbine load to decrease. Initially NC temperature decreases and the –MTC causes a +reactivity addition.
Power increases as temperature changes until an equilibrium condition is reached. Note that the turbine and Rod control system do nothing in response to this transient. It is only a function of the -MTC

A. Correct:
B. Incorrect:
C. Incorrect:
D. Incorrect:

SEQ	REACTOR OPERATIONAL PHYSICS ENABLING OBJECTIVES	BOT	GFES
12	Describe reactor power once criticality is obtained. RT08010	X	X
13	Describe how to determine if a reactor is critical. RT08011	X	X
14	List the parameters that should be monitored and controlled during the intermediate phase of a reactor startup (from criticality to POAH). RT08012	X	X
15	Describe reactor power response prior to reaching the POAH. RT08014	X	X
16	Discuss the concept of the point of adding heat (POAH) and its relationship to reactor power. RT08013	X	X
17	Explain the characteristics to look for when the POAH is reached. RT08015	X	X
18	Describe reactor power response after reaching the POAH. RT08016, RT08017	X	X
19	Describe the means by which reactor power will be increased to rated power. RT08021	X	X
20	Describe the monitoring and control of reactor power and primary temperature from 0% to 15% (B&W). RT08018	X	X
21	Describe the monitoring and control of Tave, Tref, and power during power operation. RT08019	X	X
22	Explain the effects of control rod motion, boration, and dilution on reactor power. RT08022	X	X
23	Explain the relationship between steam flow and reactor power given specific conditions. RT08023	X	X
24	Explain reactor response to a control rod insertion. RT08026	X	X

than demand (still +PMM). Moderator temperature continues to increase, adding negative reactivity and driving K_{eff} below 1. Power now decreases and fuel temperature decreases, adding positive reactivity. When power decreases back to match steam demand (PMM = 0), moderator temperature stops increasing, and power stops decreasing. The positive reactivity added by the rod withdrawal is balanced by an increase in moderator temperature (reactivity is balanced) and the reactor is back to steady state. Reactor power has returned to its original value and moderator temperature is higher.

For control rod insertions, the opposite of the above occurs, the insertion adds negative reactivity, K_{eff} becomes less than 1, power starts to decrease (net reactivity becomes negative), adding positive reactivity as fuel temperature decreases, and the negative PMM causes moderator temperature to decrease, adding positive reactivity. The power decrease stops when the reactivity is balanced but power is still less than steam demand (still –PMM). Moderator temperature continues to decrease, adding positive reactivity and power increases back to match steam demand, adding negative reactivity as fuel temperature increases. When the PMM = 0 the moderator temperature stops decreasing, and power remains constant. The reactivity is balanced, the PMM = 0, and the reactor is back to steady state. The negative reactivity added by the rod insertion is balanced by a decrease in moderator temperature.

This example illustrates the inherent stability of the reactor. We disturbed the reactivity balance by moving control rods. With no further actions, the reactor returned to steady state through the interaction of moderator temperature reactivity feedback and fuel temperature reactivity feedback. The reactor always tries to return to a steady state condition, not necessarily the same as before the transient but a steady state condition with reactivity balanced and PMM = 0.

Example 5 – Changes in steam demand with no automatic or operator action

Now assume that steam demand is increased with no control rod motion available (rod control system in manual). As steam flow increases, the additional steam necessary is produced by taking more energy from the Reactor Coolant System. The PMM becomes negative, causing T_c to begin decreasing. The colder water returning to the core provides better neutron moderation, adding positive reactivity (reactivity balance becomes positive), causing reactor power to begin increasing. The increasing fuel temperature adds negative reactivity. Eventually, the positive reactivity added by the decrease in moderator temperature will be offset by the increase in fuel temperature (reactivity balance becomes zero) and reactor power will be equal to steam demand (PMM becomes zero). The reactor is now at steady state at a higher power level and a lower moderator temperature. The negative reactivity associated with the increased power level is balanced by the positive reactivity added by the reduced moderator temperature.

In the second example, note that the amount of power increase depended on the amount of change in steam demand – this is the "load following" behavior that was mentioned. The reactor always attempts to match power to steam demand. We say "attempts" because we have protective actions to limit the amount of power output based on plant conditions.

Normally it is most economical to maintain the power level of nuclear generating plants as close to full rated power as possible and allow fossil-fueled plants to vary their output as the demand on the electric distribution system change. Sometimes this is not possible and power must be reduced in response to other conditions (maintenance and testing or environmental effects, for example).

The major concern during power level changes is the asymmetric xenon distribution that can result. In order to prevent large distortions in the axial power profile which could lead to peaking factors outside of design limits, there are strict technical specification requirements that limit the

***Question*: 05-41**

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1 Pt(s) Given the following conditions:

- Unit 1 is at 95% power.
- 1CF-37 (S/G 1B CF Ctrl) feedwater regulating valve in automatic.
- 1CF-39 (S/G 1B CF Byp Ctrl) feedwater regulating bypass valve in manual.
- 1B steam generator level is 63% and slowly increasing.

Select the correct statements that return 1B steam generator level control to automatic without causing a transient.

A. Decrease 1CF-39 by 5% and ensure 1CF-37 opens.
Depress manual for 1CF-37.
Depress automatic for 1CF-37 and 1CF-39.

B. Ensure 1CF-37 demand is 100%.
Stabilize S/G level within 2% of setpoint.
Depress manual for 1CF-37.
Depress automatic for 1CF-37 and 1CF-39.

C. Manually open 1CF-39 to 100%.
Stabilize S/G level within 2% of setpoint.
Depress manual for 1CF-37 and 1CF-39.
Depress automatic for 1CF-37 and 1CF-39.

D. Increase 1CF-37 by 5% and ensure 1CF-39 closes.
Depress manual for 1CF-37 and 1CF-39.
Depress automatic for 1CF-37 and 1CF-39.

Question*: 05-41** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS059	Title	Main Feedwater
	A4.08	Description	Ability to manually operate and monitor in the control room: **(CFR: 41.7 / 45.5 to 45.8)** Feed regulating valve controller
		Importance	3.0/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-CF-IFE
Objectives	9
REFERENCES	AP/1/A/5500/006 Case 3 rev 34
Author	RJK
Time	7/25/2005 10:50 AM 52 minutes

Distracter Analysis: Based on ensuring that there is no transient when the valves are returned to automatic. It is required that levels be within 2% and that the bypass be fully open.

A. **Incorrect**: the desired effect would be to ensure the other valve responds in automatic to the operators moving the other valve.
B. **Incorrect**: Cannot set CF-39 to 100% without increasing S/G levels. Used a similar set of instruction based on the correct set of actions.
C. **Correct**:
D. **Incorrect**: Same as choice "A" but changed requirement.

AP-06 step 9
a. Verify 1CF-37 (S/G 1B CF Ctrl) – IN AUTOMATIC.
AP-06 step 10
10. Ensure feed reg bypass valves in automatic and DFCS tracking logic reset as follows:
IF 1CF-39 (S/G 1B CF Byp Ctrl) has been in manual at any time during this event, **THEN** perform the following for S/G 1B:
a. **IF** reactor power greater than 90%,
THEN ensure 1CF-39 (S/G 1B CF Byp Ctrl) demand - AT 100%.
b. **IF** reactor power less than or equal to 90%, **THEN** ensure 1CF-39 (S/G 1B CF Byp Ctrl) demand – AT SETPOINT DETERMINED BY PLANT ENGINEERING.
c. Ensure S/G 1B N/R level – WITHIN 2% OF S/G N/R LEVEL SETPOINT.
d. Ensure S/G 1B N/R level - STABLE.
e. Place 1CF-37 (S/G 1B CF Ctrl) in manual.
f. Momentarily depress 1CF-39 (S/G 1B CF Byp Ctrl) "MAN" pushbutton.
g. Place 1CF-39 in automatic.
h. Place 1CF-37 in automatic.

	Objective	LPRO	LPSO	PTRQ
1	State the purpose of the Steam Generator Water Level Control and Feedwater Pump Speed Control Systems.	X	X	
2	Explain the phenomena and mechanism of steam generator level shrink and swell and explain the causes of each.	X	X	X
3	State the setpoints and bases for the following reactor trips and protection signals generated by the Steam Generator Water Level Control System Control System: • Reactor Trip • Auxiliary Feedwater Auto Start • Feedwater Isolation • Main Turbine Trip	X	X	X
4	Explain the SGWLC level program including the reasons for programming level and the bases for the upper and lower program limits.	X	X	X
5	Explain the purpose and function of SGWLC input signal processing and selection.	X	X	X
6	List the field inputs to the SGWLC and CFPT Speed Control Systems.	X	X	X
7	Explain the purpose and function of SGWLC High and Low power controllers, including when each is in service.	X	X	X
8	Explain the purpose and function of SGWLC flow demand modification features.	X	X	X
9	Explain the purpose and function of Feedwater Regulating Valve (FRV) and Feedwater Regulating Bypass Valve (FRBV) valve programmers and controls, including the process of shifting between manual and automatic operation.	X	X	X
10	Explain the response of the Unit 2 SGWLC system to a Loss of One Main Feed Pump (LOMFP) at 100% RTP	X	X	X
11	Describe the SGWLC system response to a failure of a specified field input signal.	X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Return CF main feed reg valve(s) to automatic as follows:**	
• For S/G 1A:	
__ a. Verify 1CF-28 (S/G 1A CF Ctrl) - IN AUTOMATIC.	a. Perform the following: __ 1) Momentarily depress 1CF-28 "MAN" pushbutton. __ 2) Place 1CF-28 in automatic.
• For S/G 1B:	
__ a. Verify 1CF-37 (S/G 1B CF Ctrl) - IN AUTOMATIC.	a. Perform the following: __ 1) Momentarily depress 1CF-37 "MAN" pushbutton. __ 2) Place 1CF-37 in automatic.
• For S/G 1C:	
__ a. Verify 1CF-46 (S/G 1C CF Ctrl) - IN AUTOMATIC.	a. Perform the following: __ 1) Momentarily depress 1CF-46 "MAN" pushbutton. __ 2) Place 1CF-46 in automatic.
• For S/G 1D:	
__ a. Verify 1CF-55 (S/G 1D CF Ctrl) - IN AUTOMATIC.	a. Perform the following: __ 1) Momentarily depress 1CF-55 "MAN" pushbutton. __ 2) Place 1CF-55 in automatic.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

10. **Ensure feed reg bypass valves in automatic and DFCS tracking logic reset as follows:**

- **IF** 1CF-30 (S/G 1A CF Byp Ctrl) has been in manual at any time during this event, **THEN** perform the following for S/G 1A:

__ a. **IF** reactor power greater than 90%, **THEN** ensure 1CF-30 (S/G 1A CF Byp Ctrl) demand - AT 100%.

__ b. **IF** reactor power less than or equal to 90%, **THEN** ensure 1CF-30 (S/G 1A CF Byp Ctrl) demand - AT SETPOINT DETERMINED BY PLANT ENGINEERING.

__ c. Ensure S/G 1A N/R level - WITHIN 2% OF S/G N/R LEVEL SETPOINT.

__ d. Ensure S/G 1A N/R level - STABLE.

__ e. Perform Steps f. through i. without delay.

__ f. Place 1CF-28 (S/G 1A CF Ctrl) in manual.

__ g. Momentarily depress 1CF-30 (S/G 1A CF Byp Ctrl) "MAN" pushbutton.

__ h. Place 1CF-30 in automatic.

__ i. Place 1CF-28 in automatic.

***Question*: 05-42**

---

1 Pt(s) Unit 1 is being transferred to the Standby Shutdown Facility (SSF).

After the transfer to the SSF is complete, which one of the following valves has been aligned to the SSF 600 Volt AC distribution system?

A. CAPT #1 Trip And Throttle Valve

B. 1CA-188 (S/G 1 CA Nozz Tempering Isol)

C. 1CA-48 (CA Pmp #1 Flow to S/G 1C)

D. 1CA-50A (CA Pmp #1 Disch to S/G 1C Isol)

Question: 05-42 **Answer: D**

LEVEL:	RO/SRO

K/A	SYS061	Title	Auxiliary Feedwater
	K2.01	Description	Knowledge of bus power supplies to the following: **(CFR: 41.7)** AFW system MOVs
		Importance	3.2/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CF-CA
Objectives	
REFERENCES	OP/0/A/6100/013
Author	RJK
Time	

Distracter Analysis:

A. **Incorrect**: Valve is transferred from 1EDE to the SSF DC power system.

B. **Incorrect**: 1CA-188 is a solenoid operated valve from 1EPA

C. **Incorrect**: 1CA-48 is an air operated valve

D. **Correct:** Located on 1EMXS which is realigned to SLXG during SSF operations. SLXG is a 600 VAC system

OP/0/A/6100/013 Standby Shutdown Facility Operations
Enclosure 4.6 page 3 of 3.

NOTE: The following valve opens when 1(2)EMXS is swapped to SMXG.

1(2) CA-50A (CA Pmp 1(2) Disch to S/G 1(2)C Isol)

Question: 05-42

---

1 Pt(s) Which of the following electrical power systems supply power to the auxiliary feedwater system (CA) motor operated valves?

A. Vital auxiliary and control power AC busses.

B. Vital auxiliary and control power DC busses.

C. Blackout powered motor control centers.

D. Essential powered motor control centers.

Question*: 05-42** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS061	**Title**	Auxiliary Feedwater
	K2.01	**Description**	Knowledge of bus power supplies to the following: **(CFR: 41.7)** AFW system MOVs
		Importance	3.2/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPC
Objectives	6
REFERENCES	
Author	RJK
Time	7/25/2005 11:31 AM 17 minutes

Distracter Analysis:

A. Incorrect: All MOVs at CNS are 600 volt.

B. Incorrect: All MOVs at CNS are 600 volt.

C. Incorrect: Blackout motor control would not be powered back on a LOCA

D. Correct:

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the 4.16 KV Essential and Blackout Power Systems and the 600 V Essential and Blackout Power Systems.	X	X	X	X	
2	Describe the 4160 V Essential and Blackout Power Systems and the 600 V Essential and Blackout Power Systems.	X	X	X	X	X
3	Explain how the 4160 V Essential Bus is assured a power source.	X	X	X	X	X
4	Explain how to shift 4160 V Essential Bus power to the standby transformer.	X	X	X	X	X
5	Explain how to shift the 4160 V Essential Bus to the emergency D/G.			X	X	X
6	List the loads off of the 4160 V Essential and Blackout Busses.	X	X	X	X	X
7	Describe how to supply the 4160 V Blackout Bus from an alternate source.	X	X	X	X	X
8	Explain how to shift 600 V Blackout MCC's to the alternate source.	X	X	X	X	
9	Describe the terms "Hot Bus" and "Dead Bus" Transfer and how they apply to Essential and Blackout Power Systems.	X	X			
10	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
11	Describe the normal alignment of the Essential and Blackout Power Systems.	X	X	X	X	X
12	Explain the purpose of all K-Key interlocks in the 4.16 KV Essential and the 600 V Essential Power Systems.	X	X	X	X	X
13	Draw the Essential and Blackout Power Systems per training drawing EL-EP-35.	X	X			
14	Describe the response for any alarm on 1AD-11 pertaining to the Essential and Blackout Power Systems.			X	X	
15	Given a copy of the Annunciator Response Procedure for 1AD-11, correctly determine the required response for any given alarm.					X
16	Explain the available power source operability check procedure.			X	X	X

***Question*: 05-43**

1 Pt(s) Given the following conditions and sequence of events:

0900 1B diesel generator breaker is closed and load is increased.

0910 1B diesel generator is operating in parallel per PT/1/A/4350/002B, Diesel Generator 1B Operability Test with the following readings:

- 4000 Volts
- 950 amps
- 5749 kilowatts (KW)
- 2900 kilovars (KVAR)
- Power Factor 0.9 lagging

0920 Main generator voltage is reduced from 21.7 kilovolts to 21.5 kilovolts per dispatcher request.

0955 1B D/G load is reduced to 1000 KW in preparation for shutdown.

1015 1B D/G is shutdown per the PT.

Assuming no D/G parameters were adjusted by the operator between 0910 and 0955, was the D/G load limit exceeded (other than any momentary transients) and what was the resulting D/G test classified?

A. D/G load limit was exceeded; test is an INVALID FAILURE

B. D/G load limit was exceeded; test is an INVALID TEST

C. D/G load limit was not exceeded; test is a VALID SUCCESS

D. D/G load limit was not exceeded; test is an INVALID TEST

***Question*: 05-43** ***Answer:* D**

LEVEL:	RO/SRO

K/A	SYS062	Title	AC Electrical Distribution
	A1.01	Description	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ac distribution system controls including: **(CFR: 41.5 / 45.5)** Significance of D/G load limits
		Importance	3.4/3.8

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-DG-DG3 rev 44	BNT-CP05 (Motors and Generators)
Objectives	DG3 Obj13	CP05 Obj 29 & 30
REFERENCES	Lesson plan information, OMP 2-28	
Author	RJK	
Time	7/25/2005 12:21 PM	46 minutes

Distracter Analysis:
As the main generator voltage is decreased, the 4160 volt busses are held up by diesel generator voltage.

KVARS for the D/G increase and the system transfers reactive load to the D/G and amps increase. KW is a function of governor setting and does not change, KW remains the same.

Since no load limits were exceeded the test is NOT afailure, however, the test did not run for > 1 hour therefore it is an invalid test.

A. Incorrect:
B. Incorrect:
C. Incorrect:
D. Correct:

<u>Lesson plan info.</u>

When in parallel with another source: (Obj #12)
Voltage is controlled by other power source. Adjusting voltage setting affects P.F. and KVAR Load. (Voltage Control)
Frequency is controlled by other power source. Adjusting speed control affects KW Load.

Question: 05-43

1 Pt(s) 1B diesel generator is operating in parallel for a performance test with the following readings:

- 4000 Volts
- 890 amps
- 5600 kilowatts (KW)
- 2900 kilovars (KVAR)
- Power Factor 0.9 lagging
- Main generator voltage is 21.7 kilovolts

Main generator voltage is reduced to 21.5 kilovolts.

Which one of the following describes the current status of diesel generator parameters and operational limits?

A. KW increased, KVAR remained the same, amps increased, and the generator is operating closer to a limit.

B. KW decreased, KVAR decreased, amps decreased, and the generator is operating further from a limit.

C. KW remained the same, KVAR decreased, amps decreased, and the generator is operating further from a limit.

D. KW remained the same, KVAR increased, amps increased, and the generator is operating closer to a limit.

Question*: 05-43** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS062	Title	AC Electrical Distribution
	A1.01	Description	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ac distribution system controls including: **(CFR: 41.5 / 45.5)** Significance of D/G load limits
		Importance	3.4/3.8

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-DG-DG3 rev 44	BNT-CP05 (Motors and Generators)
Objectives	DG3 Obj13	CP05 Obj 29 & 30
REFERENCES	Lesson plan information	
Author	RJK	
Time	7/25/2005 12:21 PM	46 minutes

Distracter Analysis:

As the main generator voltage is decreased, the 4160 volt busses are held up by diesel generator voltage.

KVARS for the D/G increase and the system transfers reactive load to the D/G.

Amps also increase and the diesel is operating closer to any given overload limit.

KW is a function of governor setting and does not change, KW remains the same.

A. Incorrect:

B. Incorrect:

C. Incorrect:

D. Correct:

<u>Lesson plan info.</u>

When in parallel with another source: (Obj #12)

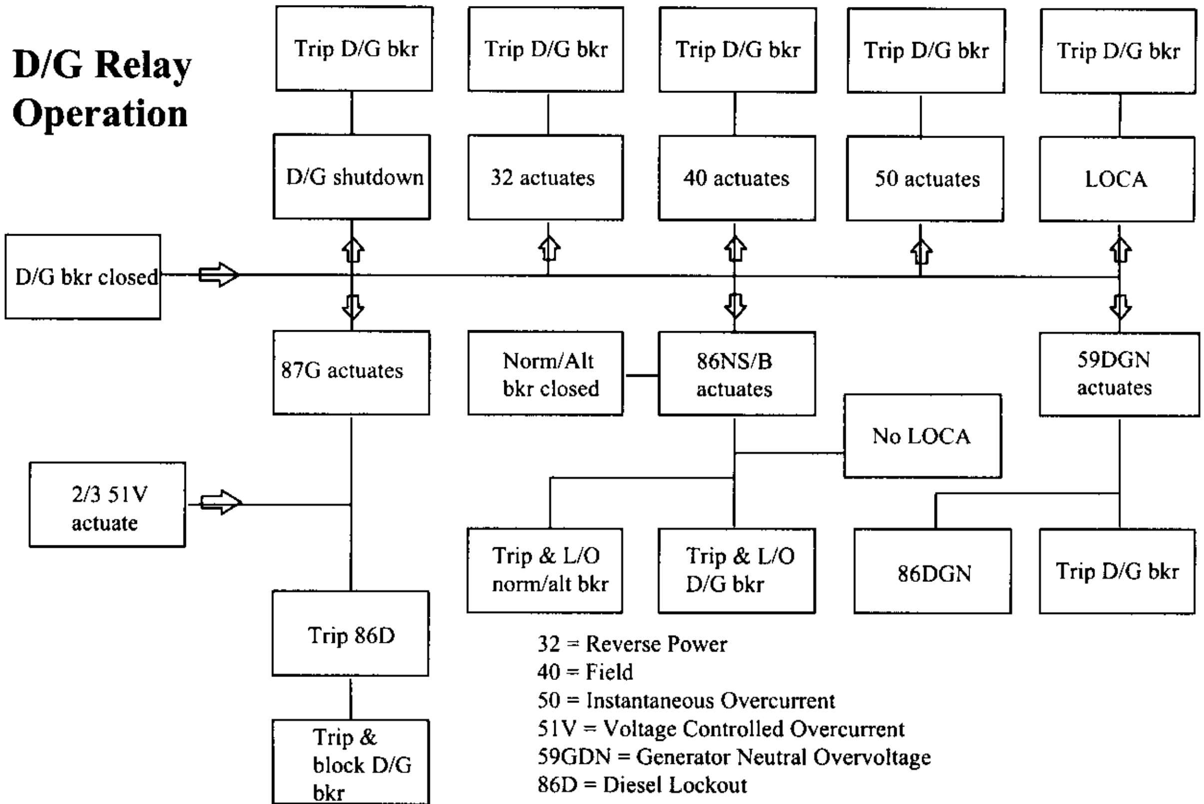
Voltage is controlled by other power source. Adjusting voltage setting affects P.F. and KVAR Load. (Voltage Control)

Frequency is controlled by other power source. Adjusting speed control affects KW Load.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Diesel Generator.	X	X	X	X	
2	Summarize the events that occur on a general starting sequence.	X	X			
3	Summarize the sequence of events that occur on a manual or automatic start of the Diesel Generator.			X	X	X
4	Explain the four methods of operation for the D/G, when and how each is used.	X	X			
5	Explain the purpose of the Control Room Override button and how to reset.	X	X			
6	Explain the procedure for swapping diesel generator control to the local control panel.			X	X	X
7	Explain how to place the diesel generator in the “operational” or “maintenance” mode, and the reasons for placing the diesel in one of the above modes.	X	X	X	X	X
8	Explain how the operator can shutdown the diesel	X	X	X	X	X
9	List the diesel generator trips, set points and know which of these trips must be manually reset.	X	X	X	X	X
10	Discuss the operations for paralleling the diesel generator to the bus.	X	X	X	X	X
11	Discuss the conditions, which must be met in order to operate the diesel generator breaker.	X	X	X	X	X
12	Explain the effects of adjusting Speed Control or Voltage Control when the diesel is paralleled or separated from the grid.	X	X			
13	Explain the purpose of the RUN/STOP Knob, how it operates and how to reset.	X	X			
14	Discuss items covered in and requirements of the diesel generator logbook.	X	X	X	X	X
15	Given a set of conditions, classify a test performed on the Diesel Generator.	X	X	X	X	X
16	Interpret the different items from a D/G Gould TA11 Chart Recorder Trace.	X	X	X	X	X

SEQ	MOTORS AND GENERATORS ENABLING OBJECTIVES	BOT	GFES
25	Describe the function of each of the following in an AC generator:		
	A. Stator CP05040	X	
	B. Rotor CP05041	X	
	C. Prime mover CP05042	X	
	D. Field winding CP05043	X	
	E. Armature winding CP05044	X	
	F. Exciter CP05045	X	
26	Describe armature reaction in a generator. CP05057	X	
27	Describe the results of armature reaction when the generator power factor is leading, lagging, and unity. CP05058	X	
28	Describe motor action in a generator. CP05059	X	
29	Describe how to adjust generators connected in parallel for variations in shared load. CP05061	X	X
30	Describe the effect of changing the excitation of a generator connected to the grid. CP05062	X	X
31	List the three conditions required for paralleling AC sources. CP05060	X	X

D/G Relay Operation



32 = Reverse Power
40 = Field
50 = Instantaneous Overcurrent
51V = Voltage Controlled Overcurrent
59GDN = Generator Neutral Overvoltage
86D = Diesel Lockout
86DGN = Generator Neutral Ground Lockout
86NSB = Normal,Standby or Breaker Failure Lockout
87G = Generator Differential

H. Operating D/G in parallel with another Power Source. (Obj #10)

1. In order to connect the D/G to the essential bus without causing damage to the generator and/or breaker, a paralleling procedure must be used.

   a) Adjust voltage, using "Voltage Control", such that the generator output voltage is slightly higher than bus voltage (50-200 volts), to ensure a lagging power factor when D/G is paralleled to the bus.

   b) Turn on synchroscope.

      1) Indicates phase and frequency differences.

   c) Adjust governor setting, using "Speed Control" to cause synchroscope to rotate slowly in fast direction. (Diesel Speed Raise/Lower Pushbuttons)

   d) Close the diesel generator output breaker when the synchroscope is rotating slowly in the "FAST" direction, the pointer is less than 1.5 min before vertical position, and the "SYNCHRONIZED" light is lit. The diesel must be properly synchronized and loaded expeditiously to preclude reverse power situations.

   e) Increase generator load to 2500 KW (2400-2600 KW) using "Speed Control" only. {00-2323}

f) Adjust power factor to 0.98 lagging (less than or equal to .9 lagging for 24 hr run) by adjusting "Voltage Control"..

g) Place the "Synchroscope Selector Switch" in the "OFF" position

2. When in parallel with another source: (Obj #12)

a) Voltage is controlled by other power source. Adjusting voltage setting affects P.F. and KVAR Load. (Voltage Control)

b) Frequency is controlled by other power source. Adjusting speed control affects KW Load.

I. Operating D/G when not in Parallel with another Power Source. (Obj #12)

1. Once D/G is at rated voltage and speed (frequency) close the breaker to energize the dead bus.

2. In this form of operation the following occurs:

a) The number of loads on essential bus controls KW load. Adjusting diesel speed effects generator frequency. (Speed Control)

b) The type of loads on the essential bus controls KVAR and P.F. Adjusting excitation DOES NOT affect KVAR load or P.F. but only changes bus voltage. (Voltage Control)

J. Unloading Generator and Engine Shutdown (Obj #8) (OP/1(2)/A/6350/002, ENC. 4.10)

1. Verify another power source available, and notify dispatcher.

2. If normal and alternate feeder breakers are open parallel diesel across either feeder breaker.

3. Reduce diesel load to 200KW while maintaining P.F. at .95 lagging to prevent motoring the D/G, then trip D/G breaker.

4. Idle until jacket water and lube oil outlet temps are less than or equal to 170°F.

5. Depress "Stop" button and remove key from Manual Test Start key Switch.

6. Ensure the following:

a) Prelube oil pump starts.

b) Jacket Keep Warm Pump starts.

c) Record total run time.

d) RN Isol from the KD HX.

7. Go to "CTRL RM" on control location.

8. Start normal vent fan.

9. If diesel run greater than or equal to 1 hour drain water from F.D. day tank.

10. Perform D/G checklist for ES Actuation.

***Question:* 05-44**

1 Pt(s) Given the following conditions:

- Unit 2 is in Mode 6
- Core defueling is in progress
- One assembly is currently in the mast above the core
- Crews in the spent fuel pool (SFP) area are moving the most recently transferred assembly to its storage location
- 2B D/G and "B" main power are de-energized for outage related work
- 2EDE has been declared inoperable

Which one of the following action(s) is required per technical specifications?

A. Immediately suspend core alterations and movement of spent fuel in the SFP area.

B. Immediately suspend core alterations. Movement of spent fuel in the SFP area may continue.

C. Within 1 hour, initiate actions to restore 2EDE to operable.

D. Within 1 hour, initiate actions to restore affected busses for Low Temperature Overpressure Protection (LTOP) features.

Question: 05-44 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS063	**Title**	DC Electrical Distribution
	G2.1.33	**Description**	Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications. **(CFR: 43.2 / 43.3 / 45.3)**
		Importance	3.4/4.0

SOURCE	Bank question EPL-078D
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPL
Objectives	22
REFERENCES	Tech Spec 3.8.4
Author	RJK
Time	7/25/2005 3:07 PM 65 minutes

Distracter Analysis:

A. **Correct**:
B. **Incorrect:** All movements are suspended not just core alts.
C. **Incorrect**: This is the other low power DC power spec and is not applicable for EDE, but this is an actual action.
D. **Incorrect**: This is the other low power DC power spec and is not applicable for EDE, but this is an actual action.

Question: 05-44

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1 Pt(s) Given the following conditions:

- Unit 2 is in Mode 6 defueling the core
- 2B D/G and "B" main power are de-energized for outage related work
- Outage control center contacts the Control Room Supervisor and reports that 2EDE has been declared inoperable.

Which one of the following actions is required per technical specifications?

A. Immediately suspend core alternations.

B. Immediately perform Available Power Source PT.

C. Initiate actions to restore 2EDE to operable in 6 hours.

D. Initiate actions to restore affected busses for Low Temperature Overpressure Protection (LTOP) features within 6 hours.

Question: 05-44 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS063	**Title**	DC Electrical Distribution
	G2.1.33	**Description**	Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications. **(CFR: 43.2 / 43.3 / 45.3)**
		Importance	3.4/4.0

SOURCE	Bank question EPL-078D
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EL-EPL
Objectives	22
REFERENCES	Tech Spec 3.8.4
Author	RJK
Time	7/25/2005 3:07 PM 65 minutes

Distracter Analysis: Per TS 3.8.4 for a loss of one DG DC subsystem, requires immediate enter into 3.8.1 for "B" train.

A. Correct:
B. Incorrect:
C. Incorrect:
D. Incorrect:

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
19	Using the Annunciator Alarm Response Procedure for 1AD-11, correctly describe the annunciator alarms associated with the Vital I & C System			X	X	X
20	Given a set of specific plant conditions and access to reference material, determine the actions necessary to comply with Tech Specs/SLC's.			X	X	X
21	Summarize DC battery operation under loaded conditions • State where to obtain accurate indication of a battery's condition • State actions to be taken to minimize the drain on a battery • Describe the operational characteristics when subjected to heavy loads for long periods of time	X	X	X	X	X
22	State from memory all Technical Specification actions for the applicable Systems, subsystems and components which require remedial action to be taken in less than 1 hour.			X	X	

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 Four channels of DC electrical power subsystems and the Train A and Train B Diesel Generator (DG) DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One channel of DC electrical power subsystem inoperable.	A.1 Verify associated bus tie breakers are closed between DC channels.	8 hours
	AND	
	A.2 Restore channel of DC electrical power subsystem to OPERABLE status.	10 days
B. Required Action and Associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours
C. One or more DG DC electrical power subsystem(s) inoperable.	C.1 Enter applicable Condition(s) and Required Action(s) of LCO 3.8.1, "AC Sources - Operating", for the associated DG made inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. A and/or D channel of DC electrical power subsystem inoperable. AND Associated train of DG DC electrical power subsystem inoperable.	D.1 Enter applicable Condition(s) and Required Action(s) of LCO 3.8.9, "Distribution Systems-Operating", for the associated train of DC electrical power distribution subsystem made inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify DC channel and DG battery terminal voltage is ≥ 125 V on float charge.	7 days
SR 3.8.4.2	Verify DG nickel cadmium battery cell voltage ≥ 1.36 V on float charge.	7 days
SR 3.8.4.3	Verify no visible corrosion at the DC channel and DG battery terminals and connectors. OR (For the DC channel and DG batteries utilizing lead acid cells only) Verify battery connection resistance of these items is ≤ 1.5 E-4 ohm.	92 days

(continued)

***Question*: 05-45**

1 Pt(s) Which one of these 1A D/G loads is powered from 125VDC distribution center 1DGDA?

A. Generator field flash

B. 1A D/G fuel oil booster pump

C. 1VADA supply

D. Engine startup and shutdown circuits

Question*: 05-45** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS064	**Title**	Diesel Generator
	K2.02	**Description**	Knowledge of bus power supplies to the following: **(CFR: 41.7)** Fuel oil pumps
		Importance	2.8/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-DG-DG1 rev 28
Objectives	13
REFERENCES	Lesson plan information below
Author	RJK
Time	7/25/2005 3:28 PM 13 minutes

Distracter Analysis: This is the only DC electrically driven pump for the d/g and is used during maintenance periods. All loads are DC loads but only one comes from DGDA panel.

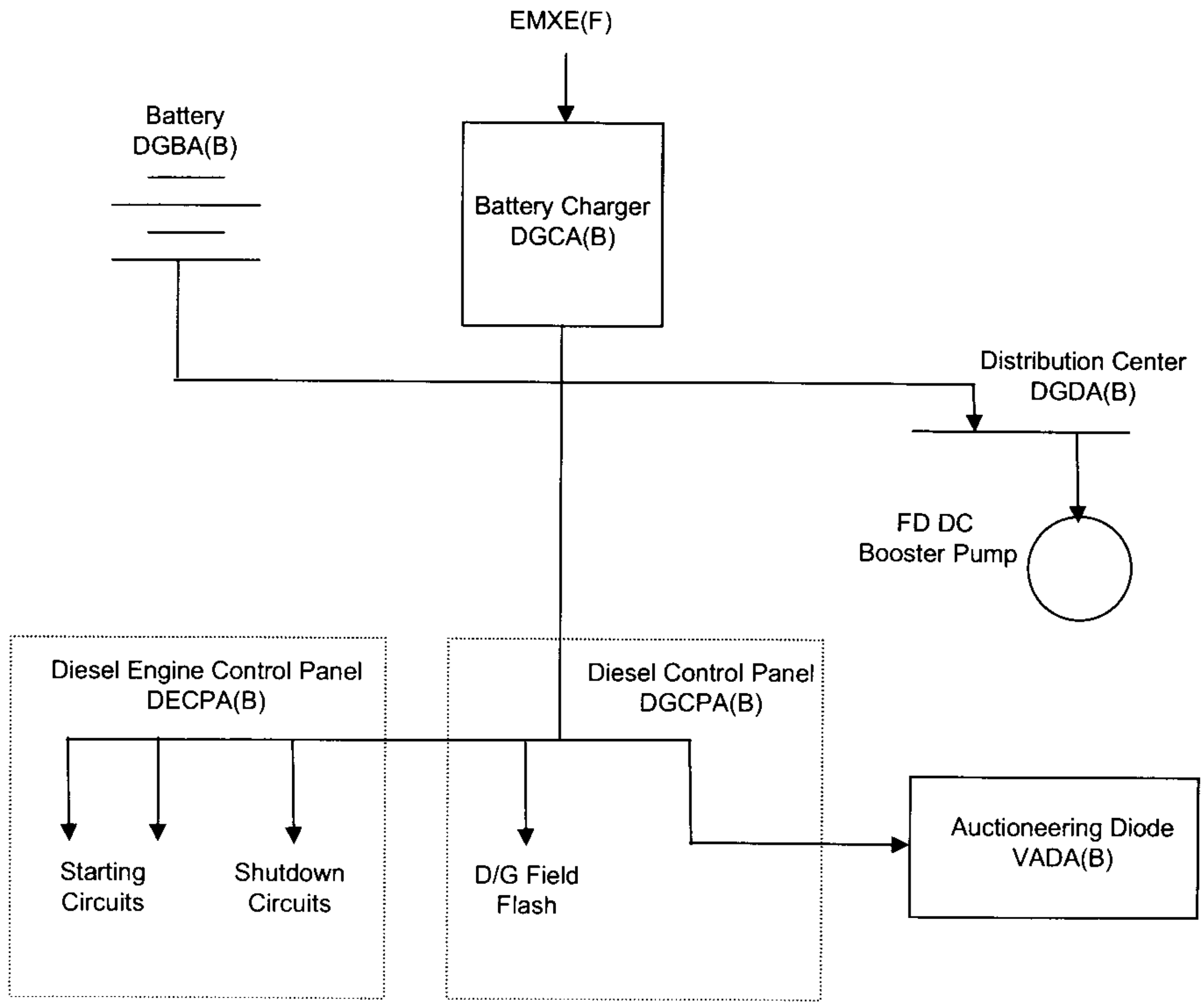
A. Incorrect:
B. Correct:
C. Incorrect:
D. Incorrect:

Lesson plan page 13

2.1B.1.g 125VDC Distribution Center DGDA(B) – sub-loads include:

- DC Fuel Oil Booster Pump

125VDC Diesel Auxiliary Power System (EPQ)



Question*: *05-45

1 Pt(s) Which one of these diesel support system components is powered from the 125VDC Diesel Generator Auxiliary Power (EPQ) system?

A. Lubricating oil pre-lube pump and heater.

B. Diesel fuel oil booster pump.

C. Jacket water keep warm components.

D. Diesel starting air compressors.

Question: 05-45 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS064	**Title**	Diesel Generator
	K2.02	**Description**	Knowledge of bus power supplies to the following: **(CFR: 41.7)** Fuel oil pumps
		Importance	2.8/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-DG-DG1 rev 28
Objectives	13
REFERENCES	Lesson plan information below
Author	RJK
Time	7/25/2005 3:28 PM 13 minutes

Distracter Analysis: This is the only DC electrically driven pump for the d/g and is used during maintenance periods. The EPQ system lists this as the only component loads other than panel and other non-operator used components.

A. Incorrect: AC powered
B. Correct:
C. Incorrect: AC powered
D. Incorrect: AC powered

Lesson plan page 13

2.1B.1.g 125VDC Distribution Center DGDA(B) – sub-loads include:

- DC Fuel Oil Booster Pump

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Diesel Building Ventilation System (VD)	X	X	X	X	X
2	Given a training diagram, trace the VD System flowpaths for the following operating modes: • Standby (Diesel Generator NOT running) • Test or Diesel Generator Operation • Purge	X	X	X	X	X
3	Explain the operation of the VD System while in Standby	X	X	X	X	X
4	Explain the operation of the VD System in Test or while the Diesel Generator is running.	X	X	X	X	X
5	Explain the VD System response to a CO_2 system actuation.	X	X	X	X	X
6	Explain the operation of the VD System when being used to purge the diesel room after a CO_2 system actuation.	X	X	X	X	X
7	State the purpose of the Diesel Generator Starting Air System (VG)	X	X	X	X	X
8	Given a flow diagram, explain how starting air pressure is supplied to the Diesel Generator.	X	X	X	X	X
9	Explain how the VG Compressors automatically operate to maintain VG receiver tank pressure.	X	X	X	X	X
10	State the reason Diesel Generator automatic starts are blocked on low VG pressure.	X	X	X	X	X
11	Explain the effect of a loss of control air pressure on the Diesel Generator.	X	X	X	X	X
12	State the purpose of the 125VDC Diesel Generator Auxiliary Power System (EPQ).	X	X	X	X	X
13	List the major DC Loads supplied by the EPQ System.	X	X	X	X	X
14	Given a one-line diagram, explain how the EPQ system provides DC power to the major DC Loads.	X	X	X	X	X
15	State the power supplies to the EPQ System battery chargers.	X	X	X	X	X
16	Describe the ground detection controls and indications used at Catawba Nuclear Station	X	X	X	X	X

5. Loss of Diesel Engine Control Air (Obj. #11)
    a) Control Air is used to actuate the Diesel Engine Shutdown Cylinder should a trip signal occur.
    b) 250 psig VG pressure is provided to the Diesel Engine Control Panel where it is regulated down to 60 psig.
    c) Loss of Control Air pressure results in the inability to shutdown the diesel engine by normal means.

C. Review OP/1/A/6350/002 (Diesel Generator Operation) Limits and Precautions associated with the VG System (Obj.#39).

2.3 125VDC Diesel Generator Auxiliary Control Power System (EPQ)

A. Purpose (Obj. #12)

The 125VDC Diesel Generator Auxiliary Control Power System provides DC power to the diesel engine controls, generator field flash, and may provide control power to the associated 4160V Essential bus switchgear.

B. System Description and Operation

1. Major DC Loads (Obj. #13)
    a) The Diesel Engine Control Panel DECPA(B)
    b) The Diesel Generator Control Panel DGCPA(B)
    c) Auctioneering Diode Assembly VADA (B) - Essential switchgear control power may be provided by the diesel auxiliary control power system or the vital instrument and control power system via an auctioneering diode arrangement.
    d) Diesel Generator Field Flash
    e) Starting Air Solenoid Valves
    f) Miscellaneous Diesel Engine Controls
    g) 125VDC Distribution Center DGDA(B) – sub-loads include:
        - DC Fuel Oil Booster Pump
2. One Line Diagram (Obj. #14)
3. Battery DGBA(B) and Charger DGCA(B) (Obj. #15)
    a) Converts 600v AC input into 125VDC output
    b) Powered from EMXE (EMXF)
    c) Normal power supply to DC loads.
    d) Battery DGBA(B)
        1) Backup power supply to DC loads.

Question: 05-46

1 Pt(s) Initial Conditions:

- A Unit 1 containment air release (VQ) is in progress
- 1EMF39 (Containment Gas) Trip 2 setpoint is set to 13,000 counts per minute (CPM) per the gas waste release permit
- 1EMF36 (Unit Vent Gas) is operable
- A small reactor coolant leak develops around an instrument line
- 1EMF39 countrate is 10,000 cpm and increasing

Current Conditions:

- 1RAD-1 D/4, 1EMF-38/39/40 Containment Loss of Flow alarm is LIT

Which one of the following describes the response to this situation?

A. 1EMF39 can no longer monitor containment atmosphere. Operator action is required to manually terminate the VQ release.

B. 1EMF39 loss of flow alarm actuates a containment ventilation isolation (Sh) signal. The Sh signal terminates the VQ release.

C. 1EMF36 will detect the activity released and actuates a containment ventilation isolation (Sh) signal. The Sh signal terminates the VQ release.

D. 1EMF36 will detect the activity released and terminate the VQ release.

Question: 05-46 ***Answer: D***

LEVEL:	RO/SRO

K/A	SYS073	Title	Process Radiation Monitoring
	K1.01	Description	Knowledge of the physical connections and/or cause- effect relationships between the PRM system and the following systems: **(CFR: 41.2 to 41.9 / 45.7 to 45.8)** Those systems served by PRMs
		Importance	3.6/3.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CNT-VQ rev 21
Objectives	16
REFERENCES	Lesson plan information
Author	RJK
Time	

Distracter Analysis:

A. Incorrect: This is a required action if 1EMF36 were inoperable.

B. Incorrect: As the controlling EMF, the trip setpoints would generate a "Sh" containment ventilation isolation if the sample flow was not lost.

C. Incorrect: 1EMF36 generates a direct closure of VQ-10 which terminates the release not a Sh signal.

D. Correct: EMF36 would be a backup monitor and terminate the VQ by directly closing VQ-10

See annunciator response procedures:

OP/1/B/6100/010 X page 4 of 37 (EMF39 Trip 2)
OP/1/B/6100/010 X page 26 of 37 (EMF 39 loss of flow)

OP/1/B/6100/010 Y page 5 of 37 (EMF36 trip 2)

***Question*: 05-46**

1 Pt(s) Which of the following systems or components uses a process type radiation detection monitor (EMF)?

A. Steam line

B. Reactor coolant filters

C. Reactor coolant hot leg sample

D. Air ejector exhaust

Question: 05-46 ***Answer: D***

LEVEL:	RO/SRO

K/A	SYS073	**Title**	Process Radiation Monitoring
	K1.01	**Description**	Knowledge of the physical connections and/or cause- effect relationships between the PRM system and the following systems: **(CFR: 41.2 to 41.9 / 45.7 to 45.8)** Those systems served by PRMs
		Importance	3.6/3.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CF-SG rev 32
Objectives	16
REFERENCES	Lesson plan information
Author	RJK
Time	7/25/2005 3:49 PM 20 minutes

Distracter Analysis:

A. **Incorrect**: Considered an area monitor for rad levels only. Is used for that purpose but uses only a strap GM tube.

B. **Incorrect**: Considered an area monitor for rad levels only. Is used for that purpose.

C. **Incorrect**: Considered an area monitor for rad levels only. Is used for that purpose.

D. **Correct**: See summary below of actions.

SG lesson plan page

B. EMF 33 (Condenser Air Ejector Monitor)

1. Monitors a sample of Condenser Steam Air Ejector off gas.
2. Provides input to S/G Primary to Secondary Leak Rate calculation on the OAC.
3. Automatically closes the following valves:
   a) S/G blowdown flow control valves - BB-65, 69, 24 and 73
   b) S/G sample isolation valves - NM-269, 270, 271 and 272
   c) EMF-34 inlet isolation - NM-267
   d) BB pump discharge to TB sump - BB-48
   e) BB tank vent to atmosphere - BB27.
4. If in alarm (Trip 2), the operator should ensure CSAE off-gas is aligned to the Aux Building Filtered Exhaust.

	Objectives *Note:* ***Although Catawba Unit 1 and Unit 2 Steam generators are of a significantly different design, all lesson objectives are applicable to both units unless otherwise indicated.***	**ISS**	**NLO**	**LPRO**	**LPSO**	**PTRQ**
10	Describe the differences in design and operation between Unit 1 and Unit 2 S/Gs	X	X	X	X	X
11	Explain the purpose of and methods used to maintain secondary systems water chemistry control.	X	X	X	X	X
12	State the required action of AP/0/A/5500/034 (Secondary Chemistry Out of Specification) given an out of spec secondary chemistry condition and a copy of the AP			X	X	
13	State the purpose of the BB (Steam Generator Blowdown) System.	X	X	X	X	
14	Describe the normal and alternate flow paths of the BB system: • BB Tank Vent • BB Tank Outlet • BB System Discharge	X	X	X	X	X
15	Describe the BB (Steam Generator Blowdown) system response to a CA (Auxiliary Feedwater) Auto Start Signal			X	X	X
16	Describe the parameters monitored and automatic actions that are initiated by the following radiation monitors: • EMF 33 (Condenser Air Ejector Monitor) • EMF 34 (S/G Sample Monitor)			X	X	X
17	State the purpose of the BW (S/G Wet Layup Recirc) System.	X	X	X	X	
18	Describe the arrangement of the Wet Layup level instrumentation used on the Unit 2 steam generators.			X	X	X
19	Describe the flowpath of the BW (S/G Wet Layup Recirc) system.	X	X	X	X	X
20	List the sources of water available to fill a S/G from cold conditions.	X	X	X	X	
21	Describe the flowpaths and tanks available for draining a S/G during cold conditions.	X	X	X	X	
22	Explain the effect of throttling flow through the Gland Steam Condenser for BB (Steam Generator Blowdown) demineralizer temperature control on Condensate Booster Pump suction pressure.	X	X			
23	Given appropriate plant conditions, apply limits and precautions	X	X	X	X	X

4. BB System Response to CA Auto Start **(Obj. #15)**
   a) Steam Generator inventory preservation is important during an ATWS event. Isolation of flowpaths that would remove S/G water inventory is an important part of the ATWS Mitigation (AMSAC) strategy.
   b) The following valves close:
      1) NM S/G Sample Containment isolation valves.
      2) BB Flow control valves
      3) BB Containment isolation valves
      4) BB Containment isolation bypass valves
   c) CA must be RESET to reopen these valves.

2.7 Radiation Monitoring **(Obj. #16)**

A. Refer to OP/1/B/6100/010X (Annunciator Response For Radiation Monitoring Panel 1RAD-1).

B. EMF 33 (Condenser Air Ejector Monitor)
   1. Monitors a sample of Condenser Steam Air Ejector off gas.
   2. Provides input to S/G Primary to Secondary Leak Rate calculation on the OAC.
   3. Automatically closes the following valves:
      a) S/G blowdown flow control valves - BB-65, 69, 24 and 73
      b) S/G sample isolation valves - NM-269, 270, 271 and 272
      c) EMF-34 inlet isolation - NM-267
      d) BB pump discharge to TB sump - BB-48
      e) BB tank vent to atmosphere - BB27.
   4. If in alarm (Trip 2), the operator should ensure CSAE off-gas is aligned to the Aux Building Filtered Exhaust.

C. EMF 34 (S/G Sample Monitor)
   1. Monitors a sample of Steam Generator Blowdown flow.
   2. No automatic actions.
   3. Normally isolated.

Question: 05-47

1 Pt(s) Initial Conditions:

- Both Units operating at 100%.
- 1B RN pump is in service.

Current conditions:

- Unit 1 experienced a LOCA.
- Unit 1 containment pressure is 4.2 psig.
- Unit 2 is operating at 100%.
- An emergency low pit level alarm is received on the "B" train RN pit.

What capability provided by the RN system is lost based on the current conditions?

A. VA (Auxiliary Building Ventilation) supply unit cooling water on both units.

B. VF (Spent Fuel Pool Ventilation) supply unit cooling water on Unit 1 only.

C. Makeup to NW (Containment Valve Injection) on Unit 1 only.

D. Makeup to the spent fuel pool on both units.

Question: 05-47 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS076	**Title**	Service Water
	K4.01	**Description**	Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41/7)** Conditions initiating automatic closure of closed cooling water auxiliary building header supply and return valves
		Importance	2.5/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PSS-RN rev 56
Objectives	9 & 11
REFERENCES	Lesson plan page 38/39
Author	JKS
Time	7/26/2005 8:36 AM 7 minutes +68

Distracter Analysis: Based on the events, the unit 1 non-essential header isolates, but only one of 2 valves closes on the Unit 2 non-essential header.

A. **Incorrect**: Only Unit 1 is affected.

B. **Correct**:

C. **Incorrect**: This is not isolated on an Sp or emergency low pit level. This is plausible if students do not know where this taps off the RN system.

D. **Incorrect**: This is not isolated on an Sp or emergency low pit level. This is plausible if students do not know where this taps off the RN system.

RN lesson plan page 38/39

a) Starts train related pumps

b) Supplies cooling water to affected D/G

2. Emergency Low Pit Level
   a) Swaps suction and discharge to the SNSWP
   b) Starts all 4 pumps
   c) Closes supply crossover valve on opposite train for both units.
3. Safety Injection
   a) Starts all 4 pumps
   b) Isolates RN to VA AHUs
   c) Full flow to unit related KC hxs.
4. S_p signal
   a) Isolates non-essential header
   b) Separates RN trains
   c) Closes containment isolations (YV/RN)

***Question*: 05-47**

1 Pt(s) Which of the following signals directly isolates the nuclear service water (RN) non-essential header?

A. Emergency Low Pit Level.

B. Blackout.

C. Phase A Containment Isolation (St).

D. High-High Containment Pressure (Sp).

Question*: 05-47** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS076	Title	Service Water
	K4.01	Description	Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41/7)** Conditions initiating automatic closure of closed cooling water auxiliary building header supply and return valves
		Importance	2.5/2.9

SOURCE	NEW	
LEVEL of KNOWLEDGE	Memory	
Lesson	OP-CN-PSS-RN rev 56	
Objectives	9 & 11	
REFERENCES	Lesson plan page 38/39	
Author	RJK	
Time	7/26/2005 8:36 AM	68 minutes

Distracter Analysis:

A. Incorrect: Pit level does cause valves to close, but they only separate trains.

B. Incorrect: NO valves are positioned here.

C. Incorrect: An individual load is isolated but not the headers.

D. Correct:

RN lesson plan page 38/39

I. Auto Actions
   1. Blackout
      a) Starts train related pumps
      b) Supplies cooling water to affected D/G
   2. Emergency Low Pit Level
      a) Swaps suction and discharge to the SNSWP
      b) Starts all 4 pumps
      c) Closes supply crossover valve on opposite train for both units.
   3. Safety Injection
      a) Starts all 4 pumps
      b) Isolates RN to VA AHUs
      c) Full flow to unit related KC hxs.
   4. S_p signal
      a) Isolates non-essential header
      b) Separates RN trains
      c) Closes containment isolations (YV/RN)

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the RN System	X	X	X	X	
2	List the water sources to the RN System in normal and emergency operations.	X	X	X	X	X
3	State the discharge path for all RN System Hx's in service during normal operations.	X	X	X	X	X
4	List the three ways the RN strainers backwash.	X	X	X	X	
5	Explain why KC is used as an intermediate cooling system. Identify the one Hx, which is the exception.	X	X	X	X	
6	State the system designator and major component nomenclature.	X				
7	Given a copy of the RN system flow diagram or a one line symbolic diagram, label the major components and show the flow path through the major components.	X				
8	Explain the RN system alignment for the following conditions. • Normal operation • Compliance with Tech Specs. • SNSWP Ice Melt • SNSWP Makeup	X	X	X	X	X
9	List the loads on the essential and non-essential headers.	X	X	X	X	X
10	Describe how RN pumps minimum flow protection is accomplished.	X	X	X	X	X
11	Explain the action which takes place on: • A Blackout • An Emergency Low Pit Level • A Safety Injection signal • An Sp signal • ASP to local	 X X X X 	 X X X X 	 X X X X X	 X X X X X	 X X X X X

3. SUMMARY

3.1 Review Objectives

A. Purpose

1. Assured cooling water in normal and emergency situations

B. Water Sources

1. Normal - Lake Wylie
2. Emergency - SNSWP

C. Normal Discharge Path

1. Lake Wylie via RL

D. Strainer Backwash

1. Manual in C/R or Local.
2. Auto on timer or high DP.

E. KC used as intermediate boundary to prevent one Hx leak causing a release to the environment.

1. Exception - NS Hx

F. One RN pump normally runs to supply all loads in service on both units.

1. The discharge can be aligned to the SNSWP to makeup to the pond if level is low and suction and discharge can be aligned to the pond if ice is accumulating on the SNSWP.

G. Loads

1. Essential Header
    a) KC HX
    b) NS Hx
    c) YC Condenser
    d) D/G
    e) Assured Makeup (KF, KC, NW, CA)
2. Non-essential Header
    a) YV backup
    b) VA AHUs

H. RN pump miniflow

1. 19,000 gpm provided by selecting the idle KC hx to "miniflow".

I. Auto Actions

1. Blackout

a) Starts train related pumps
b) Supplies cooling water to affected D/G

2. Emergency Low Pit Level
    a) Swaps suction and discharge to the SNSWP
    b) Starts all 4 pumps
    c) Closes supply crossover valve on opposite train for both units.
3. Safety Injection
    a) Starts all 4 pumps
    b) Isolates RN to VA AHUs
    c) Full flow to unit related KC hxs.
4. S_p signal
    a) Isolates non-essential header
    b) Separates RN trains
    c) Closes containment isolations (YV/RN)

J. RN is not isolated to the non-essential header on a blackout to make sure it is available to backup YV and supply VA which is a blackout load. (Obj. #12)

K. YV is a closed loop chilled water system that provides cooling to the NCP motors and Upper and Lower Containment AHUs with RN as an Auto backup.

L. VZ provides adequate ventilation for the RN pumphouse to prevent overheating the RN pumps and prevent freezing of equipment.

M. Limits and Precautions
    1. Review L & Ps in OP/0/A/6400/006C

N. NLO actions on loss of RN
    1. If RN is lost to the KC Hx's, YD must be aligned to NV pump A if a safety injection is not in progress.

Question: 05-48

1 Pt(s) Which of the following components/systems is automatically isolated on decreasing instrument air header pressure?

A. Auxiliary feedwater flow control valve receiver tanks.

B. Instrument air dryers.

C. Backup air supply to station air.

D. Backup air supply to PZR PORVs.

Question*: 05-48** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS078	**Title**	Instrument Air
	K4.02	**Description**	Knowledge of IAS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41.7)** Cross-over to other air systems
		Importance	3.2/3.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-SS-VI rev 33
Objectives	8
REFERENCES	Lesson plan information
Author	RJK
Time	7/26/2005 9:13 AM 46 minutes

Distracter Analysis:

A. Incorrect: Due to their new pressure tanks, this might be a valid reason to ensure they remain pressurized for later use.

B. Incorrect: They are merely bypassed, not isolated.

C. Correct:

D. Incorrect: the backup system is isolated but it is from the Cold leg accumulators.

VI lesson plan page: 24

3. Loss of VI (Obj. #5, 8, 28, 30)
   a) Automatic actions
      1) 96 psig – Low Pressure Alarm - Standby Compressor starts and loads
      2) 94 psig - Standby Compressor "Quick-Starts" and loads
         (a) NOTE: The "Quick-Start" feature refers to a timer that is set in the CEM computer program. This timer allows the standby compressor time to start and reach normal operating temperatures prior to loading. This also allows for small fluctuations in system pressure without loading the standby compressor.
         (b) Upon receipt of the "Low Pressure Emergency" alarm at 94 psig, this time is halved by the CEM computer to allow the standby compressor to load faster.
      3) 80 psig – 1VI-670 "VI Dryer Auto Bypass" opens
      4) 80 psig - 1VI-500 "VI supply to VS" closes.
      5) 76 psig - 1VS-78 "VS supply to VI" opens - VS provides instrument air via oil removal filters.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the system designator(s) and nomenclature for major components	X				
2	Explain the purpose of the Instrument Air system	X	X	X	X	
3	Describe the basic flow paths through the Instrument Air system • Air flow • Recirculated Cooling water flow • Fire Protection water flow	X	X			
4	Identify the normal Instrument Air system header pressure.	X	X			
5	Identify the major components served by the Instrument Air system and describe the effect on plant operations on a loss of Instrument Air	X	X	X	X	
6	Describe the conditions which will cause an Instrument Air compressor to trip	X	X	X	X	X
7	Explain how the Instrument Air system will respond to a compressor trip	X	X	X	X	X
8	Describe how to cross-connect the Instrument Air and Station Air systems	X	X	X	X	X
	• Explain why the cross connection is made			X	X	X
	• Describe the flow path from VS to VI					
9	Describe the Instrument Air compressor automatic actions and their setpoints			X	X	X
10	Explain the purpose of the Instrument Air dryers			X	X	
11	Describe the automatic actions, alarms, and their setpoints associated with the Instrument Air Dryers			X	X	
12	Identify the type of power supplies to each compressor (VI, VS and VB)	X	X	X	X	
13	Explain the purpose of the Station Air system	X	X	X	X	
14	Describe the basic flow paths through the Station Air system • Air flow • Recirculated Cooling Water flow • Low Pressure Service Water flow	X	X			
15	Identify the normal Station Air system header pressure	X	X			

3. Loss of VI (Obj. #5, 8, 28, 30)

   a) Automatic actions

      1) 96 psig – Low Pressure Alarm - Standby Compressor starts and loads

      2) 94 psig - Standby Compressor "Quick-Starts" and loads

         (a) NOTE: The "Quick-Start" feature refers to a timer that is set in the CEM computer program. This timer allows the standby compressor time to start and reach normal operating temperatures prior to loading. This also allows for small fluctuations in system pressure without loading the standby compressor.

         (b) Upon receipt of the "Low Pressure Emergency" alarm at 94 psig, this time is halved by the CEM computer to allow the standby compressor to load faster.

      3) 80 psig – 1VI-670 "VI Dryer Auto Bypass" opens

      4) 80 psig - 1VI-500 "VI supply to VS" closes.

      5) 76 psig - 1VS-78 "VS supply to VI" opens - VS provides instrument air via oil removal filters.

   b) AP/0/A/5500/022 "Loss of Instrument Air"

      1) Reference a current copy of this AP

      2) Major actions

         - Ensure proper compressor operations
         - Locate and isolate leaks
         - Maintain stable plant conditions
         - Monitor plant equipment for status changes.

   c) Aux Feedwater (CA) System Response to a Loss of Instrument Air

      With a Loss of Instrument Air, the flow control valves for all S/G's will no longer fail open. A Mod has been completed on both units which added air receiver tanks to the CA flow control valves with enough air that will allow closure of these valves for 60 minutes after a loss of VI. This will also preclude S/G overfill on a SGTR with a loss of AC Power and a subsequent loss of VI.

Question: 05-49

1 Pt(s)

Unit 2 was operating at 100% power with a containment air release (VQ) is in progress. Given the following:

- A LOCA occurs
- "B" Train safety injection failed to actuate and was performed manually when it was recognized by the crew
- The following indications are noted for:
  - Containment pressure
  - 2EMF-37 (Unit Vent Monitor)
  - E/S Load Sequencers status lights

Time	0200	0201	0202	0203
Containment pressure (psig)	1.2	2.5	2.8	3.1
2EMF-37 Trip 1 Light	LIT	LIT	LIT	LIT
2EMF-37 Trip 2 Light	DARK	LIT	LIT	LIT
E/S LOAD SEQ ACTUATED TRAIN "A" status light	LIT	LIT	LIT	LIT
E/S LOAD SEQ ACTUATED TRAIN "B" status light	DARK	DARK	LIT	LIT

Based on the above indications and conditions, what is the earliest time that an operator can be assured that 2VQ-3B (VQ Fan Suct From Cont Isol) has received a close signal?

A. 0200

B. 0201

C. 0202

D. 0203

Question: 05-49 ***Answer: C***

LEVEL:	RO/SRO

K/A	SYS103	Title	Containment
	A3.01	**Description**	Ability to monitor automatic operation of the containment system, including: **(CFR: 41.7 / 45.5)** Containment isolation
		Importance	3.9/4.2

SOURCE	New
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-ECCS-ISE rev 040
Objectives	21
REFERENCES	Lesson plan information attached
Author	JEG
Time	7/26/2005 10:02 AM 19 minutes

Distracter Analysis: A manual St or Sp generates a train related Sh signal. Automatic St or Sp signals do not cause Sh. Student must know the initiation signals for St, Sp, Sh and signals that terminate a VQ release.

A. Incorrect: 1.2 psig in containment gives a Safety injection, the SI initiates Phase A (St) and Containment ventilation (Sh) signal. The Sh signal would normally close this valve, however, with the failure of the B train Ss to actuate, no St or Sh signal is generated on B train, so the valve does not get a close signal from Sh.

B. Incorrect: 2EMF-37 trip 2 (Unit Vent) closes 2VQ-10 air release flow control valve. This valve is in the flowpath for a VQ release but is not the cont isolation valve.

C. Correct:

D. Incorrect: Phase B setpoint has been reached. This isolates some additional containment isolation valves not closed by the Phase A but VQ-3B is not one of those.

D. Containment Ventilation Isolation (S_H)

1. 4 Signals can actuate an S_H.
   a) Manual "Phase A" (S_T): Train A (B) S_T will actuate train A (B) S_H.
   b) Manual "Phase B, NS-VX Initiate, Cont Vent Isol": Train A (B) (Phase B, NS-VX Initiate, Cont Vent Isol) will actuate train A (B) S_H. This is a single pushbutton that actuates three functions.
   c) S_s Signal: Train A (B) S_s will actuate Train A (B) S_H.
   d) EMF 38 L, 39 L, 40 TRIP 2: High Containment Particulate, Gas, or Iodine will actuate BOTH Trains of S_H.
2. S_H will shutdown and will isolate VP and isolate VQ Containment Isolation valves.

Question: 05-49

1 Pt(s) Unit 2 was operating at 100% power with a VQ release in progress. Given the following:

- A LOCA occurs
- "B" Train safety injection failed to actuate and was performed manually when it was recognized by the crew
- The following indications are noted for:
    - Containment pressure
    - 2EMF-37 (Unit Vent Monitor)
    - E/S Load Sequencers status lights

Time	**0200**	**0201**	**0202**	**0203**
Containment pressure (psig)	1.2	2.5	2.8	3.1
2EMF-37 Trip 1 Light	LIT	LIT	LIT	LIT
2EMF-37 Trip 2 Light	DARK	LIT	LIT	LIT
E/S LOAD SEQ ACTUATED TRAIN "A" status light	LIT	LIT	LIT	LIT
E/S LOAD SEQ ACTUATED TRAIN "B" status light	DARK	DARK	LIT	LIT

Based on the above indications and conditions, at what time does 2VQ-3B (containment isolation valve) receive a close signal?

A. 0200

B. 0201

C. 0202

D. 0203

Question*: 05-49** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS103	Title	Containment
	A3.01	Description	Ability to monitor automatic operation of the containment system, including: **(CFR: 41.7 / 45.5)** Containment isolation
		Importance	3.9/4.2

SOURCE	New
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-ECCS-ISE rev 040
Objectives	21
REFERENCES	Lesson plan information attached
Author	JEG
Time	7/26/2005 10:02 AM 19 minutes

Distracter Analysis: A manual St or Sp generates a train related Sh signal. Automatic St or Sp signals do not cause Sh. Student must know the initiation signals for St, Sp, Sh and signals that terminate a VQ release.

A. Incorrect: 1.2 psig in containment gives a Safety injection, the SI initiates Phase A (St) and Containment ventilation (Sh) signal. The Sh signal would normally close this valve, however, with the failure of the B train Ss to actuate, no St or Sh signal is generated on B train, so the valve does not get a close signal from Sh.

B. Incorrect: 2EMF-37 trip 2 (Unit Vent) closes 2VQ-10 air release flow control valve. This valve is in the flowpath for a VQ release but is not the cont isolation valve.

C. Correct:

D. Incorrect: Phase B setpoint has been reached. This isolates some additional containment isolation valves not closed by the Phase A but VQ-3B is not one of those.

D. Containment Ventilation Isolation (S_H)

1. 4 Signals can actuate an S_H.
   a) Manual "Phase A" (S_T): Train A (B) S_T will actuate train A (B) S_H.
   b) Manual "Phase B, NS-VX Initiate, Cont Vent Isol": Train A (B) (Phase B, NS-VX Initiate, Cont Vent Isol) will actuate train A (B) S_H. This is a single pushbutton that actuates three functions.
   c) S_s Signal: Train A (B) S_s will actuate Train A (B) S_H.
   d) EMF 38 L, 39 L, 40 TRIP 2: High Containment Particulate, Gas, or Iodine will actuate BOTH Trains of S_H.
2. S_H will shutdown and will isolate VP and isolate VQ Containment Isolation valves.

***Question*: 05-49**

1 Pt(s) Given the following sequence of events on Unit 2:

1130 High Containment pressure safety injection (Ss)
1135 High-High Containment Pressure (Sp)

At which time is containment isolation fully established?

A. 1130

B. 1131

C. 1135

D. 1136

***Question*: 05-49** ***Answer:* D**

LEVEL:	RO/SRO

K/A	SYS103	**Title**	Containment
	A3.01	**Description**	Ability to monitor automatic operation of the containment system, including: **(CFR: 41.7 / 45.5)** Containment isolation
		Importance	3.9/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-CNT-CNT rev 042
Objectives	21
REFERENCES	Lesson plan information attached
Author	RJK
Time	7/26/2005 10:02 AM 45 minutes

Distracter Analysis:

A. **Incorrect**: St does not fully isolate containment.

B. **Incorrect**: St does not fully isolate containment.

C. **Incorrect**: Sp isolated containment, but it takes 60 seconds for the NW valves to stroke.

D. **Correct**: Count 60 seconds past the SP signal, all SP valves should have stroked and NW is now open.

Lesson plan page: 21

3. Operation (Obj. #18)

   a) A solenoid valve in the common line to both S_t and S_p containment isolation valves opens 60 seconds after the receipt of an S_t signal to supply water to containment isolation valves receiving a S_t signal. The 60-second time delay allows all serviced containment isolation valves to reach the closed position prior to supplying injection water.

   b) A solenoid valve that opens 60 seconds after the receipt of a S_p signal supplies containment isolation valves closing on a S_p signal. The 60-second time delay allows all serviced containment isolation valves to reach the closed position prior to supplying injection water.

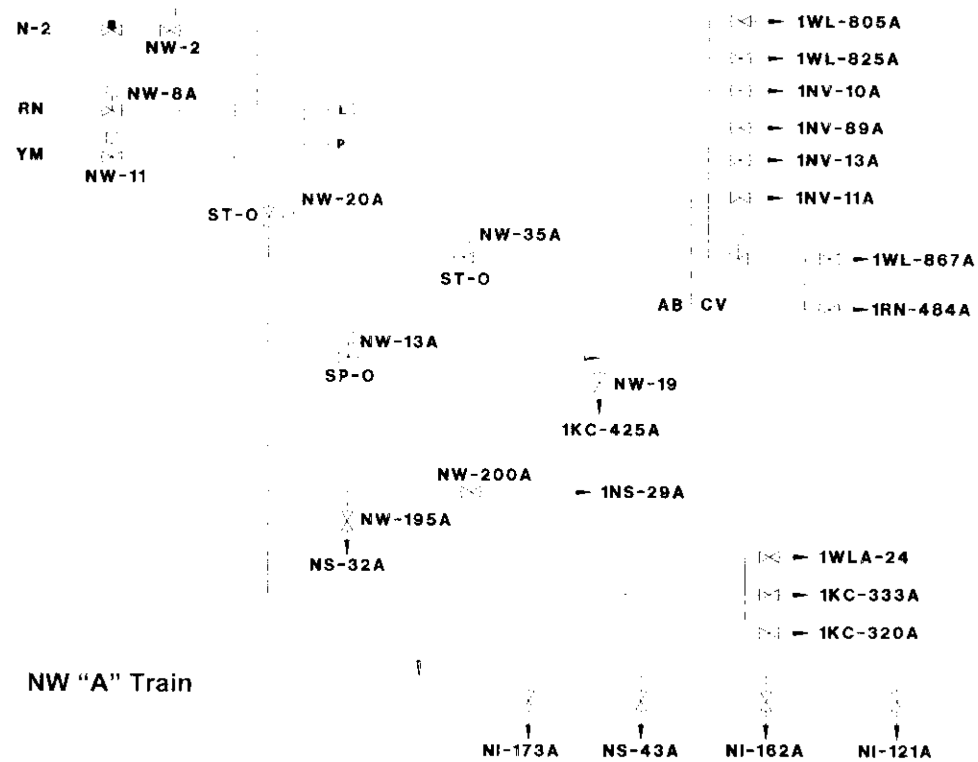
   c) Some containment isolation valves that are serviced by NW have a solenoid valve in their individual NW supply lines that opens on a S_t or S_p following a time delay. This solenoid valve is also interlocked with the containment isolation valve it supplies such that, when the containment isolation valve is closed, the solenoid valve is open.

   d) Makeup to the surge chambers is from YM during normal operations. Manual operation is required for makeup. (Obj. #16)

   e) RN automatically supplies assured makeup under either of two sets of conditions(Obj. #16):

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
14	**EXPLAIN** the operation of the personnel airlock doors for emergency entry and exit.	X	X	X	X	X
15	Given appropriate plant conditions, **APPLY** limits and precautions associated with station procedures related to Personnel Air Lock Operations.	X	X			
16	**DESCRIBE** the operation of the Containment Isolation ESF systems for a Phase 'A' Containment Isolation.			X	X	
17	**DESCRIBE** the operation of the Containment Isolation ESF systems for a Phase 'B' Containment Isolation.			X	X	
18	**STATE** the purpose of the Containment Valve Injection Water (NW) system.	X	X	X	X	
19	**STATE** the Normal and Assured makeup water sources to the NW system and state when each is used.	X	X			
20	Given appropriate plant conditions, **APPLY** limits and precautions associated with station procedures related to the Containment Valve Injection Water (NW) System.	X	X	X	X	
21	**DESCRIBE** the operation of NW system following the receipt of an ESF signal.			X	X	X
22	**DESCRIBE** the purpose and method for performing Type A, B, and C leak rate tests and NW valve leakage tests.	X	X	X	X	X
23	**STATE** the purpose for establishing containment closure / integrity during shutdown conditions.	X	X	X	X	X
24	**STATE** when containment closure / integrity is required.	X	X	X	X	X
25	**STATE** the definition of Thermal Margin and explain its significance in relation to containment closure.	X	X	X	X	X

d) NW Surge Chamber Pressure A(B) is indicated on the Main control board, MC7, 0-150 psig



e) NW surge chamber level A(B) is indicated on the Main control board, MC7, 0-100%

3. Operation (Obj. #18)

a) A solenoid valve in the common line to both S_t and S_p containment isolation valves opens 60 seconds after the receipt of an S_t signal to supply water to containment isolation valves receiving a S_t signal. The 60-second time delay allows all serviced containment isolation valves to reach the closed position prior to supplying injection water.

b) A solenoid valve that opens 60 seconds after the receipt of a S_p signal supplies containment isolation valves closing on a S_p signal. The 60-second time delay allows all serviced containment isolation valves to reach the closed position prior to supplying injection water.

c) Some containment isolation valves that are serviced by NW have a solenoid valve in their individual NW supply lines that opens on a S_t or S_p following a time delay. This solenoid valve is also interlocked with the containment isolation valve it supplies such that, when the containment isolation valve is closed, the solenoid valve is open.

d) Makeup to the surge chambers is from YM during normal operations. Manual operation is required for makeup. (Obj. #16)

e) RN automatically supplies assured makeup under either of two sets of conditions(Obj. #16):

Question: 05-50

1 Pt(s) Given the following electrical loads:

- 1A reactor coolant pump (NCP)
- 1B condenser circulating water pump (RC)
- 1C hotwell pump (HWP)
- 1ATD transformer

Voltage decreases to 50% of normal on "A" main buss line.
If you assume a slow transfer took place, which one of these loads remained energized during the power transfer?

A. 1A NCP.

B. 1B RC.

C. 1C HWP.

D. 1ATD.

Question: 05-50 **Answer: D**

LEVEL:	RO/SRO

K/A	SYS062	Title	AC Electrical Distribution
	K3.01	Description	Knowledge of the effect that a loss or malfunction of the ac distribution system will have on the following: **(CFR: 41.7 / 45.6)** Major system loads
		Importance	3.5/3.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-EL-EPB rev 0
Objectives	4
REFERENCES	Lesson plan information page 14
Author	RJK
Time	7/26/2005 11:16 AM 98 minutes

Distracter Analysis:

A. Incorrect: 1A NCP is from 1TA short side powered from 1T2A

B. Incorrect: 1B RC is from 1TB long side and powered from 1T2A

C. Incorrect: 1C HWP is from 1TD long side and powered from 1T1A

D. Correct: 1ATD is from TD short side and powered from "B" buss line transformer 1T1B and not affected

Page 14

8. Transfer can occur automatically or manually. (OBJ. #4)
   a) Auto Transfer
      1) Mode select switch in "Auto"
      2) Auto transfer initiated by a Zone Lockout or 75% UV on the incoming line (No fault on affected bus).
      3) If in synch, a fast transfer will occur. The incoming breaker opens before the tie breaker closes, but the transfer occurs within a few cycles with no loss of load.
      4) If **not** in sync a slow transfer will occur. The transfer is delayed to allow voltage to decay to a point that synchronization is not a concern (25% voltage). This will take approximately one second and a loss of load will occur.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the 6.9 KV and 600 V Unit and Shared Power Systems.	X		X	X	
2	Describe the 6.9 KV and 600 V Unit and Shared Power Systems.	X	X	X	X	X
3	List the loads powered from 6.9 KV bus.	X	X	X	X	X
4	Describe how a transfer of power on the 6.9 KV bus can be accomplished.	X	X	X	X	X
5	Explain how to shift 600 V Unit and Shared load centers to the alternate source.	X	X	X	X	
6	Explain how to shift 600 V Unit and Shared MCCs to the alternate source.	X	X	X	X	
7	Describe the term "Hot Bus" Transfer and how it applies to Unit and Shared MCCs.	X	X			
8	Describe the term "Dead Bus" Transfer and how it applies to Unit and Shared MCCs.	X	X			
9	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
10	Describe the normal alignment of the 6.9 KV and 600 V Unit and Shared Power Systems.	X	X	X	X	X
11	Explain the purpose of all K-Key interlocks in the 6.9 KV and 600 V Unit and Shared Power Systems.	X	X	X	X	X
12	Draw the 6.9 KV and 600 V Unit and Shared Power Systems per training drawing EL-EP-35.	X	X			
13	Describe the response for any alarm on 1AD-11 pertaining to the 6.9 KV and 600 V Unit and Shared Power Systems.			X	X	
14	Given a copy of the Annunciator Response Procedure for 1AD-11, correctly determine the required response for any given alarm.					X
15	Given a set of specific plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X

8. Transfer can occur automatically or manually. (OBJ. #4)
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      4) If **not** in sync a slow transfer will occur. The transfer is delayed to allow voltage to decay to a point that synchronization is not a concern (25% voltage). This will take approximately one second and a loss of load will occur.
      5) The AUTOMATIC FAST TRANSFER ENABLE, DEFEAT switch will allow defeat of the fast transfer when the unit is off line.
         (a) This switch is located in the 6.9KV bus rooms on the control panels with the under voltage transfer relays.
         (b) The purpose of this switch is to eliminate possible equipment damage from surges on fast transfer.
         (c) With the Main Generator off line, this switch is placed in the defeat position and then only slow transfers will occur. This switch controls the tie breaker.
         (d) The defeat removes the sync check relays (25s) from the circuit and provides for only a slow transfer.
   b) Manual Transfer (Example: Transfer 1TA to 1T2B)
      1) Select "Man A and TIE" - these are the breakers to be operated.
      2) Close the Tie breaker, the "A" feeder will open (Hot Bus).
      3) The transfer switch should always be selected to the position for the breakers to be operated.
9. 6900V Breaker - Gould ITE Power Circuit Breaker
      1) Operation of these breakers is discussed in the Breaker Lab lesson.
10. Protective Relaying
   a) Synch Check Relay (25) - allows fast transfer.
   b) Lock out relay - operates on:
      1) Overcurrent
      2) Ground Fault
      3) Breaker Failure

1TB Loads

- Short Side (1T1B)
  - SATB
  - 1STXB
  - 1B NC Pump
- Long Side (1T2A)
  - 1YV-C-2
  - 1B RC Pump
  - 1B Hotwell Pump
  - 1B Booster Pump
  - 1B RL Pump
  - 1TXB
  - 1TXN
  - Switchyard Auxiliaries feeder

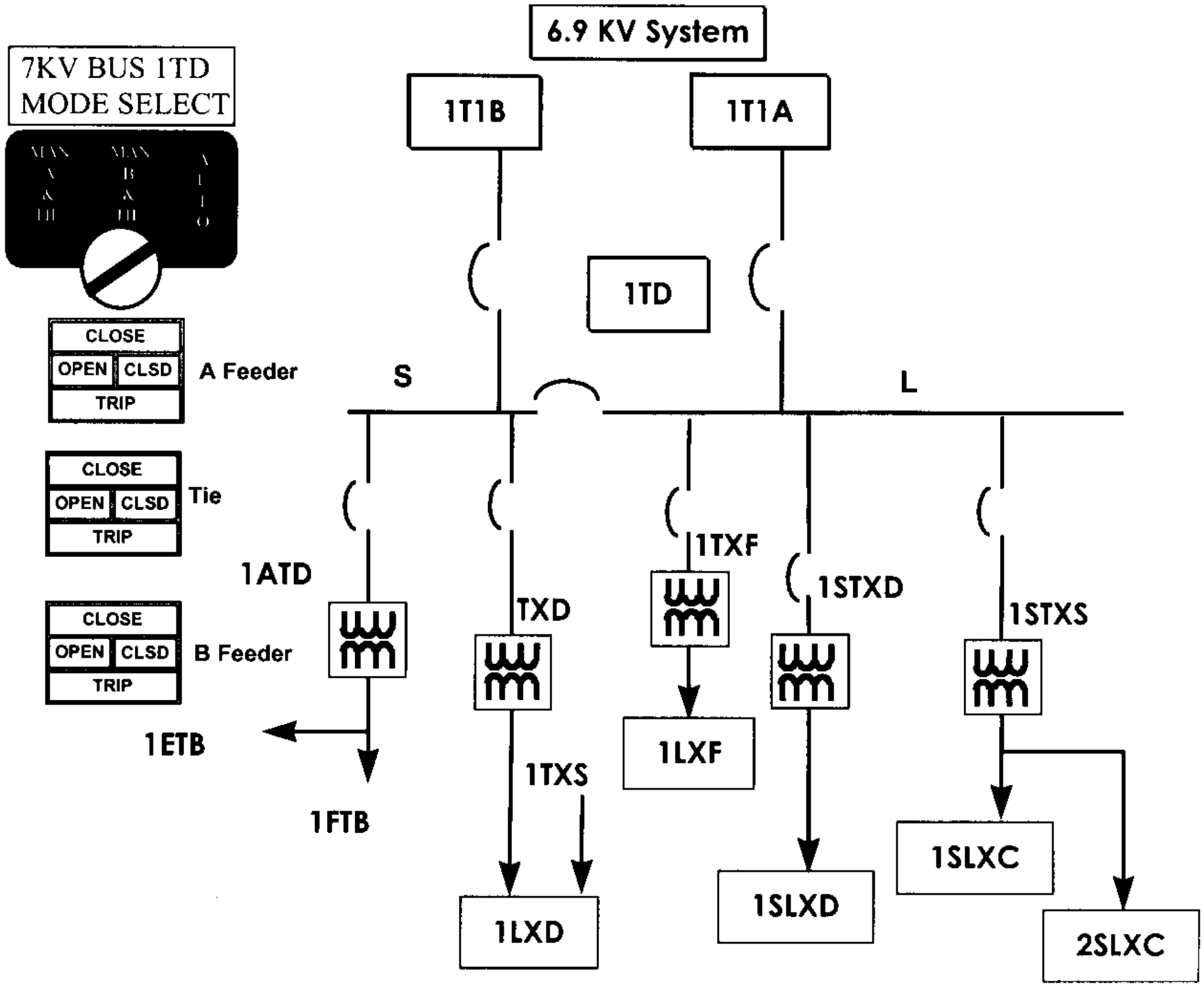
1TC Loads

- Short Side (1T1A)
  - SATA
  - 1TXC
  - 1 C NCP
- Long Side (1T2B)
  - STXC
  - 1 C RC Pump
  - "C" RL Pump
  - 1TXG
  - RY Pump A
  - 1C1 Heater Drain Pump
  - 1-YV-3 Chiller
  - 1TXE

1TD Loads

- Short Side (1T1B)
  - ATD
  - 1TXD
  - 1D NC Pump
- Long Side (1T1A)
  - 1TXF
  - 1D RC Pump
  - 1C Booster Pump
  - 1C Hotwell Pump
  - 1C2 Heater Drain Pump
  - STXS
  - 1STXD

d) 1TD - 1T1B (shortside) 1T1A (longside)



5. Below is a list of loads off of 6900V buses. (OBJ. #3)

1TA Loads

- Short Side (1T2A)
  - ATC
  - 1STXA
  - 1A NC Pump
- Long Side (1T2B)
  - 1STXG
  - 1A RC Pump
  - 1YV-C-1
  - 1A Hotwell Pump
  - 1TXS
  - 1A Booster Pump
  - 1TXA

e) RC PMP Mon PNL Test Switch

1) UV Test Initiate

2) OFF

3) UF Test Initiate

*Similar for B, C and D Pumps

2. NC Pump Monitor System (OBJ #8)

a) Purpose: To initiate a reactor protective action whenever a significant loss of reactor coolant flow is imminent due to a sustained reduction in voltage or frequency on the power cables to the NC pump motors.

b) Monitor System Description

1) Solid State

(a) ONE Undervoltage and ONE Undefrequency detector monitors each NCP power supply.

(b) If the voltage or frequency drops below an acceptable pre-set level for a pre-set time, the associated monitor channel provides a trip signal to SSPS.

2) Status lights

(a) Indicates channel trip

(b) Located on NCP monitor panel

(c) Recorded by event recorder

3) SSPS

(a) Activates annunciator alarm in Control Room

(b) Control Room status lights in Control Room

(c) Utilizes 2/4 logic scheme to evaluate the signal.

c) Reactor Trip greater than P-7

1) Undervoltage on 2/4 NCPs trips the Reactor if power level greater than or equal to 10% (P-7). UV detectors are located between the Safety Breaker and the NCP motor.

2) Underfrequency on 2/4 NCPs trips the Reactor if power level greater than 10% (P-7). UF detectors are located between the 6.9 KV Supply Breaker and the Safety Breaker.

NOTE: The P-7 interlock is used in the circuit as the NC pumps are not required during reactor operation below 10%.

3) Underfrequency also trips all four (4) NC pump motor safety breakers - Not dependent on P-7, always enabled.

4) Component Location
   (a) NCP monitor panel (1RCP)
      (1) Contains all components of system.
      (2) Located in control room.
   (b) Contents (channel)
      (1) Voltage module
      (2) Frequency Module
      (3) Test Switch
      (4) Asst. Aux. Relays
      (5) Status Lights
   (c) Voltage/frequency Monitor Modules
      (1) Major components of system.
      (2) Variable sensing circuits.
      (3) Adjustable trip.
      (4) Adjustable timer.
5) Trip Setpoint Ranges
   (a) Voltage - 5082 VAC (77% of RCP motor nominal operating voltage.)
   (b) Frequency - 56 hertz

d) Monitor operation
1) Trips adjustable trip components
   (a) Triggers adjustable timing ckt.
   (b) After pre-set timer, contacts open to de-energize aux. relay.
   (c) Aux. relay contacts
      (1) De-energize status light on monitor panel
      (2) Activate event recorder
      (3) Sends channel voltage + trip signal to SSPS

e) Test Feature
1) Individual channel test
   (a) Installed
   (b) Key-operated
   (c) 3-position

(d) Spring-return-to-center

2) Energizes test delay

(a) VMT (Volt)

(b) FMT (Freq)

3) Relay contacts provide test signal

(a) Computer

(b) Annunciator

NOTE: Contacts also interrupt input ckt. to volt/freq monitor. The 2/4 channel logic scheme in the SSPS allows one channel to be tested during reactor operation without reactor/NC motor bkr. trip.

B. Trips and Interlocks

1. NCP Interlocks (OBJ #10)

a) The 6.9 KV Supply Breaker (located in the 6.9 KV switch gear) trips are:

1) ground fault

2) overcurrent

3) <u>over</u>frequency

4) phase balance

5) motor differential

This breaker has <u>NO</u> UV or UF trips.

b) The Safety Breaker (located in the Aux Bldg) trips are:

1) ground fault

2) overcurrent

3) associated 6.9 KV Supply Breaker trip

* 4) underfrequency on <u>any</u> two NCP Power supplies

c) If Supply (Non-safety) breaker for an individual pump opens, the safety breaker for that pump opens

d) Oil lift pressure must be greater than 500 psi (2/3 switch logic) to close safety breaker.

e) 3/4 supply breakers closed to close a Safety breakers (to clear UF trip of all Safety Breakers)

2. Oil Lift Trips

a) Flasher wired to starter if overload condition.