Draft Submittal
(Pink Paper)

CATAWBA DECEMBER 2005 EXAM

05000413/2005301 & 05000414/2005301

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

RO + SRO

Senior Reactor Operator Written Exam

51 – 100

12/19/05

Question: 05-51

1 Pt(s) Unit 1 tripped from 100% power with the following conditions:

- "B" Reactor trip breaker did not open
- EP/1/A/5000/ES-0.1 (Reactor Trip Response) in progress
- Enclosure 2 (NC Temperature Control) is in effect
- S/G PORVs are cycling in automatic
- "% STM DUMP DEMAND" indicates 0 %
- "STM DUMP CTRL" indicates 0%

Which of the following describes:

1. Which steam dump controller is in control initially?
2. How will temperature control be accomplished after the steam dump control switch has been swapped to pressure control mode?

A. 1. The load rejection controller is in control.
   2. Verify steam dumps automatically stabilize T-avg at 557°F.

B. 1. The load rejection controller is in control.
   2. Manually operate steam dumps to stabilize T-avg at 557°F.

C. 1. The plant trip controller is in control.
   2. Manually operate steam dumps to stabilize T-avg at 557°F.

D. 1. The plant trip controller is in control.
   2. Verify steam dumps automatically stabilize T-avg at 557°F.

Question*: 05-51** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS039	**Title**	Main and Reheat Steam
	A2.04	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the MRSS; and (b) based on predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Malfunctioning steam dump
		Importance	3.4/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-STM-IDE
Objectives	9 & 10
REFERENCES	EP/1/A/5000/ES-0.1 rev 21
Author	RJK
Time	7/27/2005 12:56 PM 129 minutes

Distracter Analysis: % STM DUMP DEMAND reading 0 indicates that the Tavg controller has failed. STM DUMP CTRL reading 0 indicates that the steam pressure controller will not work in automatic. The only way to control steam dumps in Pressure Mode in MANUAL. Plant trip controller and load reject controller control are based on P4B being instated or not. Load reject controller has a 3 degree dead band.

A. **INCORRECT** - Controller is correct. Only manual control is available.

B. **CORRECT**

C. **INCORRECT** – Only manual is correct, but this is the wrong controller due to P4B not being instated.

D. **INCORRECT** – Only manual control is available and this is the wrong controller.

2) The second method matches the steam dump demand signal on the "Stm Dump Ctrl" with "% Stm Dump Demand" meter before swapping to pressure mode.

3) Method 1 is found in AP/002, 003, 010; EP/ES-0.1, 0.2, 1.2, 3.1, 3.2, 3.3; ECA-1.1, 3.1, 3.2; FR-C.2.

4) Method 2 is found in AP/027, EP/ES-0.2 (this procedure uses both methods), E-1, E-3, FR-C.1, H.1, H.4.

5) Bottom line: If there is a demand signal set on the "Stm Dump Ctrl", there will be dump operation when taken to pressure mode, regardless of the indication on the "% Stm Dump Demand" meter.

H. Load Rejection Controller (Obj. # 4)

1. Used during a load rejection to prevent a large Tavg increase on a loss of load.

2. Enabled by Steam Dump Select switch being in "Tavg" position and no reactor trip (P-4 Train B).

3. Compares auctioneered high Tavg to Tref and sends a signal to modulate all banks as necessary. A lead/lag circuit conditions the auctioneered high Tavg signal. This circuit initially boosts the magnitude of any change in auctioneered high Tavg by a factor of 2. This is to make the steam dumps respond in an anticipatory manner and to prevent overshoot.

4. A 3 degree deadband exists on the controller to allow rod control to actuate to decrease Tavg.

5. Sends signal to modulate dumps open one bank at a time.

   a) Bank one open fully, then Bank 2 starts opening, etc.

6. Arming Signals (Obj. # 5)

   a) "T_{avg}" mode selected

   b) C-7A or C-7B actuated.

      1) C-7A arms condenser dumps.

      2) C-7B arms atmospheric dumps.

   c) NO Reactor Trip (P-4 Train A) - atmospheric dumps.

   d) C-9 - Condenser Dumps

7. Load Rejection Signals

   a) Load detected by turbine impulse pressure channel II.

      1) Different channel than reactor control uses for T_{ref} calculation.

   b) Load signal goes thru Isol amp to derivative circuit.

   c) Derivative circuit generates output signal proportional to rate of change of impulse pressure.

1) Output zero for nonchanging pressure signal.

d) Load Reduction Bistables

1) C7A Loss of Load Interlock (Obj. # 7)

(a) 10% Step load decrease or a ramped load decrease over a given period of time.

(b) Energizes latching relay.

(c) Activates C-7A loss of load interlock status light

(1) LOSS OF LOAD INTLK COND DMP VLVS.

(d) With C-9 activated, will arm banks 1, 2, 3.

(1) Energizes arming solenoid valves.

(2) C-9 not activated will block arming signals (Banks 1, 2, 3)

(e) C-7A Reset-take "STM DUMP SELECT SWITCH" to "RESET"

2) C7B Loss of Load Interlock (Obj. # 7)

(a) 30% step load decrease or a ramped load decrease over a period of time.

(b) Energizes latching relay

(c) Activates C-7B interlock status light

(1) LOSS OF LOAD INTLK ATMOS DUMP

(d) Arms Banks 4 and 5 with:

(1) NO (Train A - P-4) Reactor Trip

(2) STM DUMP SEL. SWITCH IN "Tavg"

(3) (Train A P-4) Reactor Trip blocks arming signal for Bank 4 and 5.

(e) C-7B Reset - Take STM DUMP SELECT SW. to RESET

C. After the steam dump valves have closed following a transient, turn the steam dump select switch momentarily to the RESET position to clear the loss of load interlocks C-7A and C-7B. This action is directed by procedure.

D. All steam dump banks are fully open on a 24.7°F Tavg deviation.

4.4 Reactor Trip

A. On a Reactor trip, the Steam Dump System will automatically dump to the condenser as required providing that the condenser is available to receive steam dump (C9).

B. If the condenser is not available, excess steam will be vented by the ASME Code safety valves. The power operated relief valves will also handle a limited amount (10% of full load) of steam dump.

C. Full open setpoint on Plant Trip Controller is 31.8°F.

4.5 Normal Shutdown (Obj. # 11)

A. Below 10% power, select STEAM PRESS control mode.

1. Ensure STM DUMP CTRL in Auto and set at 8.43.
2. Verify T_{avg} is $\pm$ 2°F of T_{ref}.
3. Verify % STM DUMP DEMAND Indicated "Zero".
4. Select PRESS on STEAM DUMP SELECT switch.

B. Set pressure controller to maintain no-load operating conditions of 1092 psig.

C. If the unit is to be maintained in hot standby condition, the venting of steam will be reduced to zero as the residual heat removal requirements are reduced.

D. If the unit is to be brought to cold shutdown, steam dump is continued to the condenser. (Obj. 11)

When cooldown reaches the P-12 Lo-Lo T_{avg} point (553°F), turn both steam dump channel switches to the "BYP INTLK" positions (momentary). It is not necessary to operate both steam dump channel switches simultaneously.

E. Steam dump will be permitted to Bank 1 cooldown condenser dump valves providing condenser is available.

F. Turning both steam dump channel switches momentarily to OFF/RESET resets the bypass.

G. If T_{avg} rises above P-12, the bypass will be reset automatically.

5.3 Main Steam Header Pressure

A. Fails High - affects Steam Pressure Controller.

1. Would cause an opening signal to be generated. If "STM PRESS" is selected, the dumps will open to bring pressure down.

B. Fails Low

1. Steam dumps would not actuate in pressure mode.

5.4 Turbine Impulse Pressure Channel I

A. Fails High - would affect Load Rejection Controller

1. The Load Rejection Controller would not generate an output since T_{ref} would in most cases, always be higher than Auctioneered Hi T_{avg}.
2. This situation would require manual operation of the steam dump system to reduce T_{avg} unless T_{avg} increased above the failed T_{ref} value by more than 3 degrees.

B. Fails Low - would affect Load Rejection Controller

1. Generates a T_{avg} - T_{ref} mismatch causing an output signal to be generated from the Load Rejection Controller when indicated T_{avg} exceeds T_{ref} by $3^{O}F$.
2. Steam Dump Valves will not open until C-7A or C-7B arming signals are generated by a subsequent failure or actual load rejection/reduction.

5.5 Turbine Impulse Pressure Channel II

A. Affects C-7A and C7-B loss of load interlock arming signals

1. A high failure would prevent the C-7A and C-7B loss of load interlocks from actuating.
2. If Channel II impulse pressure fails low, loss of load interlocks C-7A and C-7B will actuate to arm the steam dumps.

5.6 Reactor Trip Breaker Failures

A. Breaker "A" fails to open on a reactor trip

1. The Plant Trip controller is enabled due to P-4 Train B.
2. P-4 Train A arming signal to the condenser dumps is not available.
3. Condenser dumps could still be armed if C7A or C7B are actuated on the reactor trip.
4. Atmospheric dumps will be armed if C7B is actuated on the reactor trip, but the Plant Trip controller output is limited to 49% demand. This demand is insufficient to open the atmospheric dumps.

B. Breaker "B" fails to open on a reactor trip

1. Plant Trip controller is not enabled due to no P-4 Train B.

2. Load Rejection controller is enabled due to no P-4 Train B. Demand based on Auct H. T_{avg} - T_{ref} signal is sent to the steam dumps.
3. Condenser dumps are armed due to P-4 Train A and will open.
4. Atmospheric dumps are not armed because of P-4 Train A is present.

6. POWER SUPPLY

6.1 The Steam Dump Control system is contained in the 7300 Process Controller, Auxiliary Relay Rack, Solid State Protective System and Auxiliary Safeguards Cabinets. Refer to documentation of these systems for specific power supply information.

7. OPERATING EXPERIENCE

7.1 Review any pertinent Operating Experience if not covered at a more opportune time in the lesson. For example, Operating Experience may be covered when discussing system purpose, components, system alignments, etc.

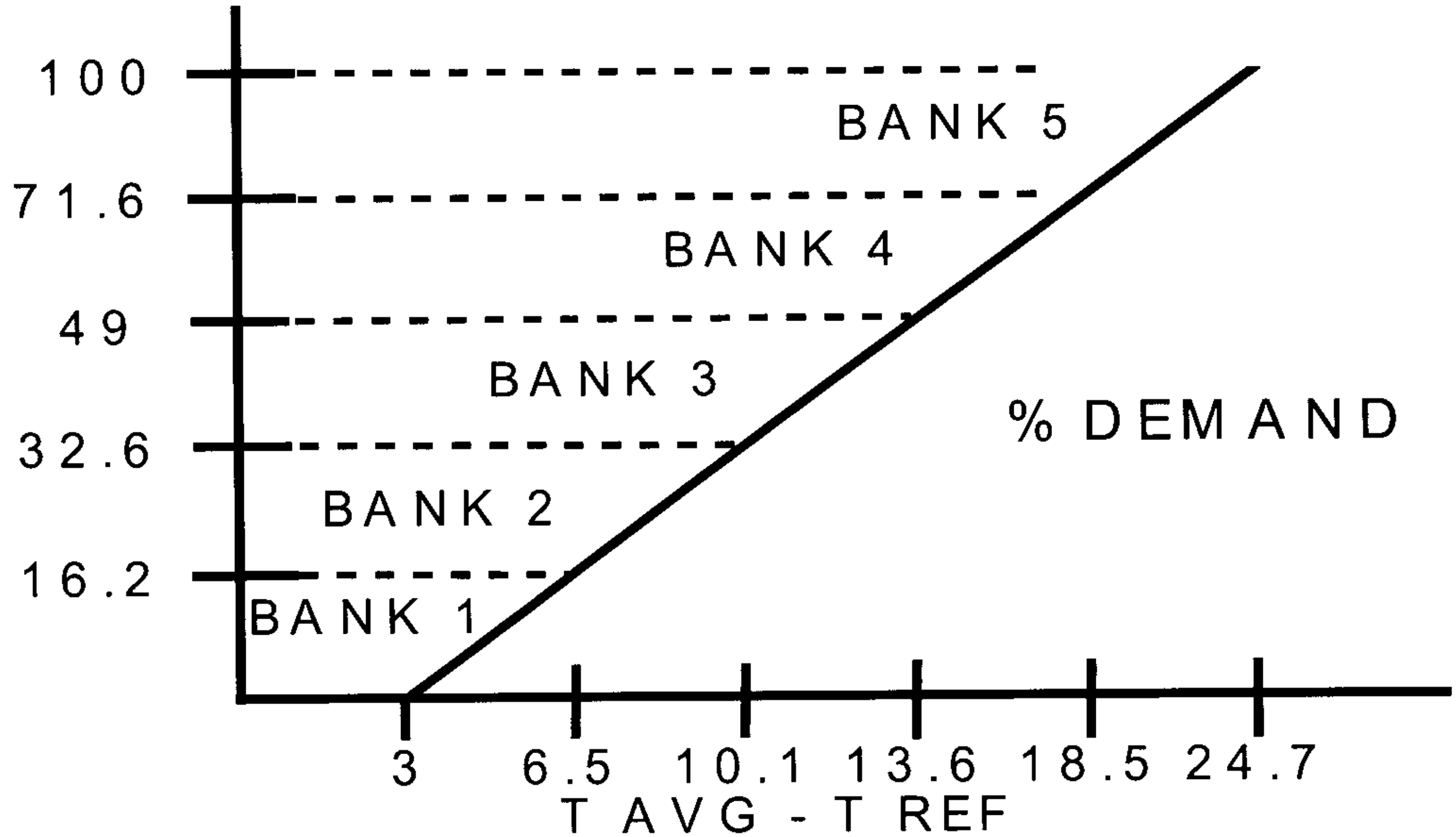
7.2 Cover the System Health Report.

8. SUMMARY

8.1 Purpose

8.2 Objectives

LOAD REJECTION CONTROLLER



Question: 05-51

1 Pt(s) Unit 1 tripped from 100% power with the following conditions:

- EP/1/A/5000/ES-0.1 (Reactor Trip Response) in progress.
- Enclosure 2 (NC Temperature Control) is in effect.
- S/G PORVs cycling in automatic.
- "% STM DUMP DEMAND" indicates 0 %.
- "STM DUMP CTRL" indicates 0%

Which of the following statements describes the actions to regain control of T-Avg using the steam dumps?

A. Remain in T-Avg mode.
Reset C7A and C7B interlocks.
Verify steam dump valves automatically stabilize T-Avg at 557 °F.

B. Transfer to pressure mode.
Place steam dump control in manual.
Manually operate steam dump valves to stabilize T-Avg at 557 °F.

C. Transfer to pressure mode.
Ensure steam dump control in automatic.
Verify steam dump valves automatically stabilize T-Avg at 557 °F.

D. Remain in T-Avg mode.
Reset C7A and C7B interlocks.
Manually operate steam dump valves to stabilize T-Avg at 557 °F.

Question: 05-51 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS039	**Title**	Main and Reheat Steam
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		Importance	3.4/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
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Objectives	9 & 10
REFERENCES	EP/1/A/5000/ES-0.1 rev 21
Author	RJK
Time	7/27/2005 12:56 PM 129 minutes

Distracter Analysis: % STM DUMP DEMAND reading 0 indicates that the Tavg controller has failed. STM DUMP CTRL reading 0 indicates that the steam pressure controller will not work in automatic. The only way to control steam dumps in in Pressure Mode in MANUAL.

ES-0.1 step 13d and Enclosure 2 step 7

d. **WHEN the steam dump valves are closed, THEN:**

__ 1) **Reset C-7A and C-7B.**

__ 2) **Place "STM DUMP CTRL" in manual.**

__ 3) **Adjust "STM DUMP CTRL" to 0% demand.**

__ 4) **Place the steam dumps in pressure mode.**

__ 5) **Place the "STM DUMP CTRL" in automatic.**

__ 7. **Verify NC temperature - LESS THAN 557°F AND DECREASING.**

Perform the following:

a. **IF NC temperature is greater than 557°F AND increasing, THEN stabilize NC temperature at 557°F as follows:**

__ 1) **IF steam dumps are available, THEN use steam dumps.**

__ 2) **IF steam dumps are not available, THEN use S/G PORVs.**

Question: 05-51

1 Pt(s) Unit 1 tripped from 100% power with the following conditions:

- EP/1/A/5000/ES-0.1 (Reactor Trip Response) in progress.
- Enclosure 2 (NC Temperature Control) is in effect.
- S/G PORVs cycling in automatic.
- "% STM DUMP DEMAND" indicates 0 %.
- "STM DUMP CTRL" indicates 0%

Which of the following statements describes the actions to regain control of T-Avg using the steam dumps?

A. Remain in T-Avg mode.
Reset C7A and C7B interlocks.
Verify steam dump valves stabilize T-Avg at 557 °F.

B. Transfer to pressure mode.
Place steam dump control in manual.
Operate steam dump valves to stabilize T-Avg at 557 °F.

C. Transfer to pressure mode.
Ensure steam dump control in automatic.
Verify steam dump valves stabilize T-Avg at 557 °F.

D. Remain in T-Avg mode.
Bypass the P-12 interlock.
Operate steam dump valves to stabilize T-Avg at 557 °F.

Question: 05-51 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS039	**Title**	Main and Reheat Steam
	A2.04	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the MRSS; and (b) based on predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Malfunctioning steam dump
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Distracter Analysis: % STM DUMP DEMAND reading 0 indicates that the Tavg controller has failed. STM DUMP CTRL reading 0 indicates that the steam pressure controller will not work in automatic. The only way to control steam dumps in in Pressure Mode in MANUAL.

ES-0.1 step 13d and Enclosure 2 step 7

d. WHEN the steam dump valves are closed, THEN:

__ 1) Reset C-7A and C-7B.

__ 2) Place "STM DUMP CTRL" in manual.

__ 3) Adjust "STM DUMP CTRL" to 0% demand.

__ 4) Place the steam dumps in pressure mode.

__ 5) Place the "STM DUMP CTRL" in automatic.

__ 7. **Verify NC temperature - LESS THAN 557°F AND DECREASING.**

Perform the following:

a. IF NC temperature is greater than 557°F AND increasing, THEN stabilize NC temperature at 557°F as follows:

__ 1) IF steam dumps are available, THEN use steam dumps.

__ 2) IF steam dumps are not available, THEN use S/G PORVs.

I. Plant Trip Controller (Obj. # 4)

1. Used to reduce T_{avg} to $T_{no\text{-}Load}$ following a Reactor trip.
2. Enabled by select switch in "T_{avg}" with a Reactor Trip (P-4 Train B).
3. Compares T_{avg} to $T_{no\text{-}Load}$ and modulates Banks 1, 2 and 3 (Condenser Dumps). A lead/lag circuit conditions the auctioneered Hi Tavg signal. This circuit initially boosts the magnitude of any change in auctioneered Hi Tavg by a factor of 2. This is to make the steam dumps respond in an anticipatory manner and to prevent overshoot.
4. Arming Signals (Obj. # 5)
   a) Reactor Trip (P-4 Train A)
   b) C-9
5. Trip signal is similar to Load Rejection.
6. Output limited to 49% steam dump demand, which is not enough of a control signal to open the atmospheric steam dumps.

J. P-12 Lo-Lo T_{avg} Interlock (Obj. # 7)

1. **Blocks dump actuation to prevent excessive cooldown below minimum temperature for criticality.**
2. Set at 553°F on 2/4 NC loops.
3. Solenoid valves that shut off control air for each steam dump valve.
4. Steam Dump INTLK Byp TRN (A) B
   a) Either Switch in OFF
      1) Steam dumps blocked
   b) Both switches in ON
      1) Normal plant operation
      2) Steam dump actuation permitted.
   c) Both switches to BYP INTLK momentarily. (Spring return to "ON")
      1) Bypasses P-12 block signal for Bank 1 dump valves.
      2) Allows Bank 1 to be used for plant cooldown below P-12 setpoint.
      3) Activates Status light STM DUMP INTLK TRAIN A (B) BYPASSED.
      4) If P-12 clears (3/4 NC loops greater than 553°) - bypass automatically reset.
   d) Both switches to OFF/RESET
      1) Resets bypass signal
      2) Blocks All steam dumps

Question: 05-51

1 Pt(s) Unit 1 tripped from 100% power with the following conditions:

- EP/1/A/5000/ES-0.1 (Reactor Trip Response) in progress.
- Enclosure 2 (NC Temperature Control) is in effect.
- T-Avg is 564 °F and increasing.
- S/G PORVs cycling in automatic.
- Steam header pressure instrument has failed and indicates 0 psig.
- No steam dump actuation was noted following the trip.

Which of the following statements describes the actions to regain control of T-Avg using the steam dumps?

A. Steam pressure controller will not control, remain in T-Avg mode.
Reset C7A and C7B interlocks.
Verify steam dump valves stabilize T-Avg at 557 °F.

B. T-Avg controller failed, transfer to pressure mode.
Place steam dump control in manual.
Operate steam dump valves to stabilize T-Avg at 557 °F.

C. T-Avg controller failed, transfer to pressure mode.
Ensure steam dump control in automatic.
Verify steam dump valves stabilize T-Avg at 557 °F.

D. Steam pressure controller will not control, remain in T-Avg mode.
Bypass the P-12 interlock.
Operate steam dump valves to stabilize T-Avg at 557 °F.

Question*: 05-51** ***Answer: B

LEVEL:	RO/SRO

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		Importance	3.4/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-STM-IDE
Objectives	9 & 10
REFERENCES	EP/1/A/5000/ES-0.1 rev 21
Author	RJK
Time	7/27/2005 12:56 PM 129 minutes

Distracter Analysis: A post trip scenario with steam dumps closed means that the T-AVG PLANT TRIP controller has failed. The only method to regain control of T-Avg is to use the steam pressure mode.

A. **Incorrect**: All 3 actions are wrong. 557 °F is the correct temperature to control for but 560 °F is a number associated with the T-Avg controller and whether its armed or not.

B. **Correct**:

C. **Incorrect**: With the steam header pressure meter failed, this option will not work. Also, you do not stabilize at any temperatures greater than 557 °F, this temperature would generate high S/G pressures.

D. **Incorrect**: All 3 are wrong. But you would control for 557 °F. P-12 is for temperatures less than 553 °F.

ES-0.1 step 13d and Enclosure 2 step 7

d. WHEN the steam dump valves are closed, THEN:

__ 1) Reset C-7A and C-7B.

__ 2) Place "STM DUMP CTRL" in manual.

__ 3) Adjust "STM DUMP CTRL" to 0% demand.

__ 4) Place the steam dumps in pressure mode.

__ 5) Place the "STM DUMP CTRL" in automatic.

__ 7 Verify NC temperature - LESS THAN 557°F AND DECREASING.

Perform the following:

a. IF NC temperature is greater than 557°F AND increasing, THEN stabilize NC temperature at 557°F as follows:

__ 1) IF steam dumps are available, THEN use steam dumps.

__ 2) IF steam dumps are not available, THEN use S/G PORVs.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Describe the purpose of the IDE System.			X	X	
2	List the banks of steam dumps and the number of valves in each bank.			X	X	
3	Describe the capacity of the Steam Dump System.			X	X	X
4	Describe the controllers in the Steam Dump System. • Describe the inputs to each controller • Discuss the plant conditions required to "enable" the controller			X	X	X
5	Discuss the conditions required to "arm" each bank of dump valves. • Discuss the plant conditions that would cause Steam Dump "actuation"			X	X	X
6	State the number of steam dumps that can be isolated with the unit at 100% power.			X	X	X
7	Discuss the purpose and state the setpoint of each of the following: • P-12 Lo-Lo T_{avg} Interlock • C-7A • C-7B • C-9			X	X	X
8	Describe the controls associated with the IDE System.			X	X	X
9	Describe the system response to a failure of each input to IDE.			X	X	X
10	Describe how to transfer modes of operation of the IDE System.			X	X	X
11	Discuss how a cooldown is accomplished using the IDE System.			X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
13. **Transfer condenser steam dump to pressure control mode as follows:**	
__ a. Verify "C-9 COND AVAILABLE FOR STM DUMP" status light (1SI-18) - LIT.	a. Perform the following: __ 1) Dump steam using S/G PORV(s) in subsequent steps. __ 2) Observe Note prior to Step 14 and **<u>GO</u> <u>TO</u>** Step 14.
__ b. Verify all MSIVs - OPEN.	b. Perform the following: __ 1) Dump steam from isolated S/G(s) using S/G(s) PORV in subsequent steps. __ 2) **<u>IF</u>** all MSIVs are closed, **<u>THEN</u>** observe Note prior to Step 14 and **<u>GO</u> <u>TO</u>** Step 14.
__ c. Ensure "STM DUMP CTRL" pot - SET AT 8.43 (1090 PSIG STEAM HEADER PRESSURE).	
d. **<u>WHEN</u>** the steam dump valves are closed, **<u>THEN</u>**: __ 1) Reset C-7A and C-7B. __ 2) Place "STM DUMP CTRL" in manual. __ 3) Adjust "STM DUMP CTRL" to 0% demand. __ 4) Place the steam dumps in pressure mode. __ 5) Place the "STM DUMP CTRL" in automatic.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. **Do not continue in this enclosure until one of the following occurs:** __ • NC temperature - GREATER THAN 557°F AND INCREASING IN AN UNCONTROLLED MANNER. OR __ • NC temperature - GREATER THAN 557°F AND STABLE. OR __ • NC temperature - LESS THAN 557°F AND DECREASING IN AN UNCONTROLLED MANNER.	
__ 7. **Verify NC temperature - LESS THAN 557°F AND DECREASING.**	**Perform the following:** a. **<u>IF</u>** NC temperature is greater than 557°F **<u>AND</u>** increasing, **<u>THEN</u>** stabilize NC temperature at 557°F as follows: __ 1) **<u>IF</u>** steam dumps are available, **<u>THEN</u>** use steam dumps. __ 2) **<u>IF</u>** steam dumps are not available, **<u>THEN</u>** use S/G PORVs. b. **<u>IF</u>** the following conditions exist: __ • NC temperature is greater than 557°F and stable __ • Time and manpower is available, **<u>THEN</u>** stabilize NC temperature at 557°F as follows: __ 1) **<u>IF</u>** steam dumps are available, **<u>THEN</u>** use steam dumps. __ 2) **<u>IF</u>** steam dumps are not available, **<u>THEN</u>** use S/G PORVs. __ c. **<u>GO TO</u>** Step 9.

***Question*: 05-52**

1 Pt(s) Component cooling (KC) system is being placed in service by starting the first KC pump. By procedure, the pump discharge valve is throttled to 10% open, the pump is started and then the valve is positioned full open.

How are the following control room indications expected to change as the valve is positioned from 10% to 100% open.

	Motor amps	KC header pressure	KC header flow
A.	Decrease	Increase	Increase
B.	Decrease	Decrease	Increase
C.	Increase	Decrease	Decrease
D.	Increase	Increase	Increase

Question: 05-52 *Answer: D*

LEVEL:	RO

K/A	SYS008	Title	Component Cooling Water
	A4.06	Description	Ability to manually operate and/or monitor in the control room: **(CFR: 41.7 / 45.5)** Remote operation of hand-operated throttle valves to regulate CCW flow rate
		Importance	2.5/2.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	BNT-CP04 rev 4
Objectives	15 & 16
REFERENCES	OP/1/A/6400/005 rev 102
Author	RJK
Time	7/27/2005 2:14 PM 42 minutes

Distracter Analysis: As the discharge valve is opened, the system flows and pressure will increase. Pump amps were initially limited during the start by throttling this valve. When the valve is fully opened, the power required to increase flow and pressure will also increase.

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

Op/1/A/6400/005 Enclosure 4.1

_ 2.4.4 Unlock the corresponding pump discharge isolation valve for the KC pump to be initially started:

- ❑ 1KC-6 (1A1 KC Pump Disch) (AB-563, HH-59, Rm 300)
- ❑ 1KC-9 (1A2 KC Pump Disch) (AB-565, HH-58, Rm 300)

_ 2.4.5 Throttle the valve indicated in Step 2.4.4 to ~ 90% closed to reduce pump motor starting current.

N: 5700 gpm discharge header flow for each operating KC pump should NOT be exceeded.

_ 2.4.6 Start the corresponding KC Train 1A pump for the valve indicated in Step 2.4.4:

- ❑ "KC PMP A1"
- ❑ "KC PMP A2"

_ 2.4.7 Ensure 1KC-C37A (Train A Miniflow Isol) opens.

_ 2.4.8 As header pressure increases, slowly open the pump discharge valve indicated in Step 2.4.4 to the full open position.

_ 2.4.9 Lock the pump discharge valve indicated in Step 2.4.4.

SEQ	PUMPS ENABLING OBJECTIVES	BOT	GFES
13	Describe the operation of positive displacement pumps, including requirements for:		
	A. Net positive suction head (NPSH) CP04053	X	X
	B. Starting a positive displacement pump CP04054	X	X
	C. Operation with a positive displacement pump dead-headed CP04055	X	X
14	Describe how flow rates are controlled using positive displacement pump. CP04056		X
15	Explain the three centrifugal pump laws. CP04057		X
16	Calculate changes in volumetric flow rate, pump head, pump power, and/or pump speed using the centrifugal pump laws. CP04058		X
17	Draw and explain the characteristic curve for a centrifugal pump, including the effects of system changes on pump operation. CP04059, CP04060, CP04061	X	X
18	Describe how flow rates are controlled using centrifugal pumps. CP04052	X	X
19	Describe the operation of centrifugal pumps in series and parallel arrangements. CP04062	X	X
20	Draw and explain the characteristic curve for a positive displacement pump. CP04063	X	X
21	Explain safety precautions for positive displacement pumps. CP04064, CP04065	X	X
22	State the consequences of adding heat to a closed system. CP04066	X	

____ ____ 2.4.2 Ensure 1RN-287A (KC Hx 1A Inlet Isol) is open.

____ 2.4.3 Ensure "KC HX 1A OTLT MODE" is in "KC TEMP".

____ ____ 2.4.4 Unlock the corresponding pump discharge isolation valve for the KC pump to be initially started:

- ☐ 1KC-6 (1A1 KC Pump Disch) (AB-563, HH-59, Rm 300)
- ☐ 1KC-9 (1A2 KC Pump Disch) (AB-565, HH-58, Rm 300)

____ ____ 2.4.5 Throttle the valve indicated in Step 2.4.4 to ~ 90% closed to reduce pump motor starting current.

CAUTION: 5700 gpm discharge header flow for each operating KC pump should **NOT** be exceeded.

____ 2.4.6 Start the corresponding KC Train 1A pump for the valve indicated in Step 2.4.4:

- ☐ "KC PMP A1"
- ☐ "KC PMP A2"

____ ____ 2.4.7 Ensure 1KC-C37A (Train A Miniflow Isol) opens.

____ ____ 2.4.8 As header pressure increases, slowly open the pump discharge valve indicated in Step 2.4.4 to the full open position.

____ ____ 2.4.9 Lock the pump discharge valve indicated in Step 2.4.4.

NOTE: One pump running is preferred as long as flow is < 5700 gpm.

2.4.10 **IF** KC flow requirement is > 5700 gpm, perform the following:

____ ____ 2.4.10.1 Ensure 1KC-C37A (Train A Miniflow Isol) is closed.

____ 2.4.10.2 **IF** KC flow is > 5700 gpm, start the remaining KC Train A pump.

- ☐ "KC PMP A1"
- ☐ "KC PMP A2"

6.0 CENTRIFUGAL PUMP OPERATION

Objective 8A, B

Before operating a centrifugal pump, the driver should be tested for its direction of rotation. The arrow on the pump casing indicates the proper direction for rotation.

The suction valve should be verified open and positive suction pressure available to ensure adequate $NPSH_A$.

The bearings should be supplied with the proper grade of lubricant and oil lubricated bearings should be filled to the overflow level.

Cooling water should be introduced carefully to pump bearings and lubricating oil. Use only sufficient water to keep the lubricant at a safe working temperature. Before starting the pump, bearing temperatures should be near ambient temperature. Prior to pump start, the main concern is that the bearings are too cold, due to cooling water being supplied with the pump off. If bearing temperatures are low, cooling water should be isolated until pump bearings are at normal operating temperatures.

Final inspection of all parts should be made carefully before starting the pump. It should be possible to rotate the shaft by hand. This starts the flow of oil to the bearing surfaces.

Objective 3

A centrifugal pump should not be operated until it is filled with fluid. If the pump is run without fluid, there is danger of damage to liquid lubricated internal parts. Several methods can be used to ensure that all the air is vented from the pump. The process of filling the pump with liquid and evacuating all gases is called priming. Adequate priming can normally be assured once a solid stream of fluid issues from the vent valve. In some systems, automatic priming is accomplished utilizing a priming pump controlled by a float switch.

Priming the pump and venting the casing during system startup will prevent gas binding. Once the pump is started, the occurrence of gas binding would be indicated by low flow and low discharge pressure readings. Additionally, the motor would be drawing minimum current.

Objective 8B,9

Centrifugal pumps are normally started with the discharge valve closed. Pumps operate at only 35-50 percent of full load when the discharge valve is closed. Pumps started with the discharge valve open require more starting torque. If the liquid on the discharge side of the pump is under sufficient head, the pump can be started with the discharge valve open. When the pump is started, the normal electrical response is high starting amps (three to seven times the normal operating current). This rapidly drops off to a lower equilibrium value.

Additionally, motor current is affected by system (fluid) temperature. At low temperatures, more current is required to circulate the cooler (denser) fluid. As fluid temperature rises, less power is necessary to maintain a constant volumetric flow rate.

Example 3 (GFES)

A pump motor that is circulating water at 180°F in a closed system is drawing 100 amps of current. If the temperature of the fluid decreases such that the fluid density increases by 4 %, how much current will the motor require?

Assume pump head and volumetric flow rate remain constant.

Work is force times distance. Power is the rate of doing work. Therefore:

$$\text{Power} = \frac{\text{force x distance}}{\text{time}}$$

On earth, $lb_f = lb_m$, so:

$$\text{Power} = \frac{lb_m \text{ x distance}}{\text{time}}$$

$$= \frac{md}{t}$$

Where: m= mass flow rate

d = distance

t = time

$\dot{m}$ is also equal to $\rho A \vec{V}$ (density, area and velocity) so:

$$\text{Power} = \rho A \vec{V} d$$

Electrical power is equal to current times voltage:

$$P = IE$$

Since voltage supplied to a motor is constant we can say that:

$$P \,\alpha\, I$$

And:

$$I \,\alpha\, \rho A \vec{V} d$$

Therefore, in a closed system with a constant volumetric flow rate, A, $\vec{V}$ and d are constant with time, so we can say that:

$$I \,\alpha\, \rho$$

In this problem $I_{initial}$=100 amps, $\rho_{initial}$ is 1.0 (100%), and ρ_{final} is 1.04 (104 %) as the fluid density increases with the decrease in temperature.

$$I_{final} = \rho_{final} \text{ x } I_{initial} / \rho_{initial}$$

$$I_{final} = 1.04 \text{ x } 100\text{amps} / 1$$

$$I_{final} = 104 \text{ amps}$$

3. The suction valve of a centrifugal pump must be verified open prior to pump start, to ensure an adequate flowpath to the pump impeller. The suction valve must remain open while the pump is running.
4. The discharge valve should be closed when a centrifugal pump is started, to prevent excessive starting torque and load on the motor. During pump start, observe pump motor current to ensure it drops to the normal operating range after the starting surge. The discharge valve should not be closed for an extended period unless minimum (recirculating) flow is verified adequate. Some recirculating flow is necessary to prevent overheating the pump.
5. A centrifugal pump should be shut down immediately if it becomes excessively noisy. Cavitation will cause excessive noise and can result in damage if the pump is not stopped and the cause corrected. Other sources of noise that may require pump shutdown include bearing failure, loss of lubricating oil or cooling water, and shaft alignment problems.

8.0 JET PUMPS

Objective 11

Jet pumps are static (static in this use means no moving parts) devices that convert high pressure developed by a centrifugal pump into a high velocity jet flow at low pressure. The high velocity jet is submerged in the fluid to be moved. The low pressure at the jet nozzle draws the surrounding fluid into the throat or mixing section, where the low pressure suction flow mixes with the drive flow (Figure 17). The mixed fluid flows into a divergent diffuser, where the expanding area converts the velocity back to high pressure. This results in a high pressure, high volumetric output pump. Air ejectors and eductors are of this type of pump. The entire assembly can be submerged and contains no moving parts. The benefits of this pump are low maintenance, high reliability, and small size when compared with other pumps of the same capacity. One disadvantage is the need for a supply pump to develop the required high head.

***Question*: 05-53**

1 Pt(s) Given the following conditions:

- 1B diesel load sequencer in "TEST"
- 2B nuclear service water (RN) pump is in service
- All other RN components are in normal alignment

Given the following events:

- Voltage on 2ETB decreases to 75% of normal
- A fault on 2EID causes 2ERPD to de-energize
- 2B diesel load sequencer operates as designed

How did the electrical system transient affect the operation of the RN pumps:

1. When the fault occurred?
2. Five minutes after the transient occurred?

A. 1. Only 1A, 2A, and 2B pumps started.
   2. All 4 pump start signals are still present.

B. 1. All 4 pumps started.
   2. All 4 pump start signals are still present.

C. 1. Only 1A, 2A, and 2B pumps started.
   2. Only the 1B and 2B pump start signals are still present.

D. 1. All 4 pumps started.
   2. Only the 1B and 2B pump start signals are still present.

Question: 05-53 ***Answer: C***

LEVEL:	RO/SRO

K/A	SYS076	**Title**	Nuclear Service Water
	K4.02	**Description**	Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41/7)** Automatic start features associated with SWS pump controls
		Importance	2.9/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-PSS-RN rev 056
Objectives	11
REFERENCES	Lesson plan summary
Author	RJK
Time	7/27/2005 2:55 PM 22 minutes

Distracter Analysis

A. **Incorrect**: False: pumps start on a Low Level UNLESS sequencers are in test.
True: After two (2) minutes the "A" train pit signal is removed.

B. **Incorrect**: False: pumps start on a Low Level UNLESS sequencers are in test.
False: After two (2) minutes the "A" train pit signal is removed.

C. **Correct**:

D. **Incorrect:** False: pumps start on a Low Level UNLESS sequencers are in test.
True: After two (2) minutes the "A" train pit signal is removed.

2ERPD power failure creates LOW PIT level conditions the same as an actual Emergency Low Pit level situation. All pumps receive the start signal EXCEPT if the RN pumps associated Sequencer is in test.

After 2 minutes, even with the power loss to 2ERPD, the "A" train low pit level signal is removed. Thus the "A" train pumps no longer have a start signal.

See RN lesson plan pages 33 and 34 for effects from the 2ERPD power loss.

See station PIP 03-06420 for additional comments, This occurred on 11/19/2003

Question: 05-53

1 Pt(s) Given the following conditions:

- 1B diesel load sequencer in "TEST".
- 2A diesel load sequencer in "TEST".
- 2B nuclear service water (RN) pump is in service.
- All other RN components are in normal alignment.
- "B" RN pit level emergency low level reached.

Which choice is a complete list of running RN Pumps?

A. 1A, 1B, 2A, 2B

B. 1A, 2B

C. 2A, 2B 1A, 2A

D. 1A,1B, 2B

Question: 05-53 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS076	**Title**	Nuclear Service Water
	K4.02	**Description**	Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41/7)** Automatic start features associated with SWS pump controls
		Importance	2.9/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-RN rev 056
Objectives	11
REFERENCES	Lesson plan summary
Author	RJK
Time	7/27/2005 2:55 PM 22 minutes

Distracter Analysis

A. Incorrect: All pumps start on a Emerg Low Level UNLESS sequencers are in test.

B. Correct:

C. Incorrect: If student thinks that start signals are PIT related and it overrides the sequencer in test.

D. Incorrect: If student thinks that the start signals are for ALL pumps but only the affected pit overrides the sequencer in test.

Lesson plan information page 31

4. Sequencer in Test
   a) If any sequencer is in "Test", its associated RN pump will not auto start on a blackout or LOCA on the opposite unit or emergency low pit level in either pit.

Lesson plan information page 39

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.

Question: 05-53

1 Pt(s) Given the following conditions:

- 2A diesel load sequencer in “TEST”.
- 1B nuclear service water (RN) pump running.
- “B” RN pit level emergency low level reached.

Which one of the RN pumps is <u>not</u> running?

A. 1A.

B. 2A.

C. 1B.

D. 2B.

Question*: 05-53**   ***Answer: B

LEVEL:	RO/SRO

K/A	SYS076	Title	Nuclear Service Water
	K4.02	Description	Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41/7)** Automatic start features associated with SWS pump controls
		Importance	2.9/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-PSS-RN rev 056
Objectives	11
REFERENCES	Lesson plan summary
Author	RJK
Time	7/27/2005 2:55 PM 22 minutes

Distracter Analysis

A. Incorrect: started from both LOCA and PIT level conditions.

B. Correct:

C. Incorrect: Continues to run ("B" pit transfers to pond and keeps going)

D. Incorrect: Started from both LOCA and PIT level conditions.

Lesson plan information page 31

4. Sequencer in Test
   a) If any sequencer is in "Test", its associated RN pump will not auto start on a blackout or LOCA on the opposite unit or emergency low pit level in either pit.

Lesson plan information page 39

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.

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	X	X	X	X	X
	• An Emergency Low Pit Level	X	X	X	X	X
	• A Safety Injection signal	X	X	X	X	X
	• An Sp signal	X	X	X	X	X
	• ASP to local			X	X	X

2) Therefore with one RN pump inoperable we must align the train with one operable pump for single pump flow to ensure either train will be capable of meeting the flow requirements.

3) One D/G or offsite source inoperable also requires RN to be declared inoperable.

(a) With one D/G inoperable, within 4 hours we verify that all equipment on the other train is still operable, which keeps us from having to assume that all equipment on the other train will fail for 72 hrs.

(1) But RN is different.

- Since RN is a shared system, the other unit's equipment still has to withstand a single failure. Therefore both units must be declared inoperable. This means if one RN pump will not start because its D/G is inoperable and the two opposite train pump's SNSWP suction isolation could fail to open, then we would be left with only one pump available (not acceptable) and not aligned for single pump flow balance.

(b) Any time a D/G is inoperable, we must ensure that the motor control center (i.e. 1EMXG for A train and 2EMXH for B train) that powers RN suction isolations and other equipment in the RN pumphouse, is powered from the unit which still has an operable D/G (e.g. if D/G 1A is inoperable, then 1EMXG should be aligned to 2ELXA vs. 1ELXA).

(1) Until this alignment is made both units of the affected RN train are inoperable, both units of the affected VA train are inoperable, and the affected VC/YC train is inoperable...

4. Sequencer in Test

a) If any sequencer is in "Test", its associated RN pump will not auto start on a blackout or LOCA on the opposite unit or emergency low pit level in either pit.

1) Therefore when a sequencer is placed in "Test" the associated RN pump must be declared inoperable.

C. Action on Blackout on ETA or ETB (Obj. #11)

1. Start associated train RN Pumps

a) Pump start

1) opens its discharge valve

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.

B. RN Pumphouse Section

1. RN Pumphouse Structure

a) The RN Pumphouse was designed to protect the RN pumps. The Pumphouse is a Category I seismically designed concrete structure capable of withstanding a safe shutdown earthquake, tornado missile, or maximum probable flood. It contains two separate pits from which independent channels of RN pumps draw suction. The train A section is physically separated from the train B section by a concrete wall.

b) Flow enters each pit from either Lake Wylie or the SNSWP and is diffused by a wall perforated with 3" holes. These "flow spreaders" prevent excessive vortices and flow irregularities. Flowing back to the pumps, the water is strained by 1" x 1" removable lattice screens that can be pulled out in sections by a monorail hoist.

c) The RN pump motors, RN strainers, and electric motor operators for the pit isolation valves are located on ground level.

2. RN Pumphouse Components

a) RN Pumps

Four nuclear service water pumps (RN pumps) supply nuclear service water to the entire station. The pumps are numbered 1A, 2A, 1B, and 2B (Obj. #6) to identify their Unit and emergency power sources. Pumps 1A and 2A draw water from the "A" pit and discharge into a common train A supply header that services both units. Likewise, pumps 1B and 2B draw water from the "B" pit and discharge into a common train B supply header that serves both units.

1) Powered from 4160V essential Bus

(a) 1A - 1ETA

(b) 1B - 1ETB

(c) 2A - 2ETA

(d) 2B - 2ETB

2) Cooled by RN

(a) Upper bearing oil cooler

(b) Motor cooler

(c) Shaft bearing and seals

3) Pumps (Obj. #11)

(a) S_s on either unit starts all 4 RN pumps

Question: 05-54

1 Pt(s) Initial Conditions:

- Unit 1 is operating at 100% with all systems in normal alignment.
- 2A RN pump is in service.

One minute later, the following indications are noted:

- 1RNP5020 (RN ESS HDR A PRESS) indicates 0 psig
- 1RNP5030 (RN ESS HDR B PRESS) indicates 0 psig
- 1RN-291 (KC Hx 1A Outlet Throttle Valve) is full open
- 1RN-351 (KC Hx 1B Outlet Throttle Valve) is full open

Assuming no operator actions are taken after the initiating event, which one of the following has occurred?

A. The 2A RN pump has tripped

B. A complete loss of offsite power occurred

C. The VI system is fully depressurized (0 psig)

D. 1RN-67A (RN Hdr 1A Supply Isolation) and 1RN-69B (RN Hdr 1B Supply Isolation) have been closed

Question: 05-54 *Answer: C*

LEVEL:	RO/SRO

K/A	SYS078	Title	Instrument Air
	A4.01	Description	Ability to manually operate and/or monitor in the control room: **(CFR: 41.7 / 45.5 to 45.8)** Pressure gauges
		Importance	3.1/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-SS-VI rev 33
Objectives	28
REFERENCES	Lesson plan setpoints. AP/22 rev 23statements attached
Author	RJK
Time	7/27/2005 4:01 PM 111 minutes

Distracter Analysis: On a loss of VI, essential header pressure gauges fail low. 1RN-351 and 1RN291 are air operated fail open valves that get demand based on KC temperature or RN flow based on switch position (KC TEMP or MINIFLOW). Normally both valves are throttled.

A. **Incorrect**: header pressure would go to zero, however, only one valve would go full open (the one in miniflow mode) and the other would remain throttled and slowly come open as KC temperature heats up (this would not occur within 1 minute).

B. **Incorrect**: header pressure would go to zero, however the D/Gs would start and once it reloaded (less than one minute total) the RN pumps and other equipment associated with blackout would auto-start. The valve in TEMP mode would be throttled. The valve in mini-flow would be full open.

C. **Correct**:

D. **Incorrect**: If these valves were closed, essential header pressure would go to zero, but the RN valve in temp mode would respond to KC temperature and open slowly over time, but not within 1 minute.

Question: 05-54

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1 Pt(s) Per AP/1/A/5500/022 (Loss of Instrument Air), control room indication of instrument air (VI) pressure reads downstream of the VI dryers and reads less than actual pressure.

If you assume that the control room pressure instrument reads 10 psi below VI compressor discharge pressure what is the maximum indicated pressure in the control room at which the operator can assume that the standby VI compressor has started?

A. 100

B. 90

C. 80

D. 70

Question*: 05-54** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS078	**Title**	Instrument Air
	A4.01	**Description**	Ability to manually operate and/or monitor in the control room: **(CFR: 41.7 / 45.5 to 45.8)** Pressure gauges
		Importance	3.1/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-SS-VI rev 33
Objectives	28
REFERENCES	Lesson plan setpoints. AP/22 rev 23statements attached
Author	RJK
Time	7/27/2005 4:01 PM 111 minutes

Distracter Analysis: The statement about control room pressure is stated in the Loss of VI AP/22. If the control room indications are 10 psi less than VI header pressure then the following pressure should be 96 and 94 psig (the setpoint for the standby compressor to start and load) minus 10 psi = 86 and 84 psig. Based on the choices, C is the correct answer.

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

AP/22 statement at beginning of procedure:

NOTE Control Room indication of VI system pressure is measured downstream of the VI dryers. This pressure will be 6 - 10 PSIG less than compressor discharge pressure.

Lesson plan stated auto action page 24

a) Automatic actions

1) 96 psig – Low Pressure Alarm - Standby Compressor starts and loads

2) 94 psig - Standby Compressor "Quick-Starts" and loads

Annunciator Response for VI AD-08 A/3

NOTE: The standby VI Compressor will start if VI header pressure reaches 86 psig as indicated on control room gauge 0VIP5260.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
16	Identify the major components served by Station Air system and describe the effect on plant operation of a loss of Station Air	X	X	X	X	
17	Describe the alarms, automatic actions and their setpoints associated with the Station Air system	X	X	X	X	X
18	Explain the purpose of the Breathing Air system	X	X	X	X	
19	Describe the basic flow paths through the Breathing Air system • Air flow • Recirculated Cooling Water flow	X	X	X	X	
20	Identify the normal Breathing Air system header pressure	X	X	X	X	
21	Explain the importance of the limits placed on the Breathing Air system • Air pressure limits • Oil • Particulates	X	X	X	X	X
22	Describe the Alarms, Automatic actions, associated setpoints, and trips for the Breathing Air system.	X	X	X	X	
23	State the actions required of a NLO during a loss of VI and why those actions are performed	X	X			
24	Describe the basic operation and purpose of all major components on the VI dryer skid • Pre-filters • Dryers • After-filters	X	X			
25	Given appropriate plant conditions, apply limits and precautions associated with related station procedures.	X	X	X	X	X
26	Describe the action which is required upon receipt of the VB system alarm in the Control Room			X	X	
27	List two common mode failures of the Instrument Air system and describe the potential consequences to the Reactor core			X	X	X
28	Discuss the actions of the Loss of VI AP/0/A/5500/022			X	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.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
NOTE Control Room indication of VI system pressure is measured downstream of the VI dryers. This pressure will be 6 - 10 PSIG less than compressor discharge pressure.	
__ 1. **Verify VI pressure - GREATER THAN 85 PSIG.**	**Perform the following:** __ a. Dispatch operator to start the Backup VI compressor. **REFER TO** OP/0/A/6450/005 (Instrument Air System). __ b. Dispatch operator to ensure the VI dryer purge valves are closed. **REFER TO** Enclosure 2 (Isolating VI Dryer Purge Valves). __ c. **GO TO** Step 3.
__ 2. **IF AT ANY TIME VI pressure is less than 85 PSIG, THEN RETURN TO Step 1.**	
3. **Verify the following pumps - ON:** __ • At least one RL pump __ • At least one KR pump.	**Perform the following:** __ a. Manually start at least one RL and KR pump. __ b. **IF** at least one RL and KR pump can be started, **THEN GO TO** Step 4. c. Perform the following: __ 1) Dispatch operator to align RF to VI compressors. **REFER TO** Enclosure 1 (RF To VI System Alignment). __ 2) **WHEN** RF is aligned to at least one VI compressor, **THEN** ensure E or F VI compressor(s) is in service. **REFER TO** OP/0/A/6450/005 (Instrument Air System). __ d. **GO TO** Step 5.

Question: 05-55

1 Pt(s) Given the following:

- Unit 1 experienced a reactor trip from 100% power.
- The crew is currently taking actions in EP/1/A/5000/ES-0.1, Reactor Trip Response.
- Steam generator levels are being maintained at 39% using 1A and 1B CA pumps.
- Both trains of auxiliary feedwater (CA) are reset.
- 1AD-5, H/4 "CACST LO LEVEL" has just alarmed.

Based on the given conditions, what is the current status of the 1A and 1B CA Pumps and the suction source?

A. Pumps running taking suction from the UST.

B. Pumps running taking suction from the Hotwell.

C. Pumps running taking suction from the RN system.

D. Pumps tripped, a suction source must be manually aligned.

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Question: 05-55 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS61	Title	Auxiliary/Emergency Feedwater (AFW) System
	A1.04	Description	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the AFW controls including: AFW source tank level
		Importance	RO 3.9, SRO 3.9

SOURCE	OP-CN-CF-CA
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-CF-CA rev 048
Objectives	2
REFERENCES	Lesson plan information AP/1/A/5500/006 rev 35
Author	JKS
Time	17 October 2005

Distractor Analysis: The CACST, UST and hotwell are all aligned using check valve arrangements such that the source with the highest pressure automatically provides the suction to the CA pumps. Once these sources are depleted, RN supplies the suction. If CA has been RESET (this resets the autostart signal), and the pumps receive a low suction pressure signal they will trip after 5 seconds and NOT swap to RN. If RESET has not been done, then they automatically swap to RN on low suction pressure (ie. Other three sources depleted). RC is another available source to the CAPT.

A. Correct

B. Incorrect: This source is used after the UST is depleted and would be correct if the UST were also empty.

C. Incorrect: This source is used after the UST and Hotwell are depleted and would automatically transfer except that after CA RESET, this feature is blocked.

D. Incorrect: This is a true statement at a future time for the motor driven pumps (after the UST and Hotwell are depleted). The CAPT does receive an autoswap to the RC system.

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Question: 05-55

1 Pt(s) Given the following:

- Unit 1 experienced a reactor trip from 100% power.
- The crew is currently taking actions in EP/1/A/5000/ES-0.1, Reactor Trip Response.
- Steam generators levels are being maintained at 39% using 1A and 1B CA pumps.
- Both trains of auxiliary feedwater (CA) are reset.
- 1AD-5, H/4 "CACST LO LEVEL" is LIT

Based on the given conditions, what is the status of the CA Pumps and the suction source?

A. Pumps running taking suction from the UST.

B. Pumps running taking suction from the Hotwell.

C. Pumps running taking suction from the RN system.

D. Pumps tripped, no suction source available.

Question: 05-55 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS61	**Title**	Auxiliary/Emergency Feedwater (AFW) System
	A1.04	**Description**	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the AFW controls including: AFW source tank level
		Importance	RO 3.9, SRO 3.9

SOURCE	OP-CN-CF-CA
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-CF-CA rev 048
Objectives	2
REFERENCES	Lesson plan information AP/1/A/5500/006 rev 35
Author	JKS
Time	17 October 2005

Distracter Analysis:

A. **Correct**
B. **Incorrect**: This source is used after the UST is depleted.
C. **Incorrect**: This source is used after the UST and Hotwell are depleted.
D. **Incorrect**: The UST, Hotwell and RN systems are available for suction.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the CA System.	X	X	X	X	
2	List all of the sources of water available to the CA pumps, and the order of preference of each.	X	X	X	X	X
3	Explain the normal and recirculation flow paths associated with the CA System.	X	X	X	X	X
4	List the automatic start signals (including setpoint) for the motor driven and turbine driven CA pumps	X	X	X	X	X
5	Explain the trip and reset procedures for the CAPT Trip/Throttle valve.	X	X			
6	Explain CAPT local operation.	X	X			
7	Given appropriate plant conditions apply Limits and Precautions associated with related station procedures.	X	X	X	X	X
8	Draw the CA system per the Simplified Flow Diagram.	X	X			
9	Describe the use of the Auto Start Defeat circuitry.			X	X	X
10	Describe the operation of CA System Valve Control reset circuitry.			X	X	X
11	Discuss how to regain control of CA pumps following CA auto start coincident with sequencer actuation.			X	X	X
12	Explain CA pump low suction pressure protection.			X	X	X
13	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
14	State from memory all Technical Specification actions for the applicable systems, subsystems, and components which require remedial action to be taken in less than one hour.			X	X	
15	List the system designator and major component nomenclature.	X				

Time: 3 hours

b) RN is used when the UST and Hotwell have been exhausted or when they are unavailable. RN will auto supply if CA Pumps auto start and low suction pressure exists at the CA pumps. Once the CA auto start signal is reset RN will not auto supply, and the CA Pumps will trip due to low suction pressure.

c) This is considered the **ASSURED SOURCE** of water to the CA pumps.

5. Condenser Circulating Water (RC)

   a) This source is used when no other source of water is available. The "SABOTAGE PROOF" source from the buried RC piping in the Turbine Building can be controlled from the SSF or Control Room.

   b) RC only supplies a suction to the CAPT.

   c) Should the valves for RN and RC open at same time, RN (at higher pressure) will actually be supplying if both system valves are open.

   d) It is assumed that if operations are being performed from the SSF that the essential switch gear is no longer energized and RN is not available.

   e) RC will supply suction to the T/D CA PUMP ANY TIME a low suction pressure exists; auto start is not required.

6. The CACST and UST are the only condensate sources suitable for direct supply to the CA pump suctions without manually defeating switchover to RN and RC. The contents of the hotwell will still be available for supply to the CA pumps without defeating switchover by transferring hotwell contents to the UST. This can be done, in Modes 3 and 4 under strict administrative controls using a hotwell pump and the normal CM System recirculation path through CM127 to the UST dome.

7. The order of preferred water sources is as follows: (Obj # 2)

   a) CACST

   b) UST

   c) Hotwell

   d) RN

   e) RC

C. Flow Path (Obj # 3)

1. Water supply is from whatever source of water is at the highest pressure to the suction of the pumps through the common header (this will normally be the CACST).

2. Normal CA Header Pressure (PIP C-05-02303 C/A # 2)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

NOTE

- If the CA pumps are taking a suction on the hotwell with the UST and CACST depleted and the CA auto start circuitry actuated, then the CA pump suction will automatically align to the RN assured makeup source.
- If CA has been reset and CA pump suction is aligned to the hotwell with the UST and CACST depleted, then the CA pumps will trip on low suction pressure.

__ 1. **IF AT ANY TIME 1AD-5, H/4 "CACST LO LEVEL" is LIT, THEN verify 1CA-6 (CA Pmps Suct From CA CST) - CLOSED.**

Perform the following:

__ a. Manually close 1CA-6 (CA Pmps Suct From CA CST).

__ b. **IF** 1CA-6 will not close, **THEN** dispatch operator to unlock and close 1CS-69 (U1 CACST To U1 & U2 CA Supplies) (SB-625, T-25) (Key #633).

2. **Initiate makeup to UST as follows:**

- __ Ensure CST pumps - ON.
- __ Throttle open 1YM-100 (UST M/U CTRL) as required to make up to UST.

Question: 05-56

1 Pt(s) Given the following:

- The Spent Fuel Pool (SFP) Crane is parked over the New Fuel Elevator.
- 1EMF-15 (Spent Fuel Pool Building Refueling Bridge Monitor) is de-energized.
- A 300 pound test canister is located in the New Fuel Elevator.
- The New Fuel Elevator is in the down position with power available.
- Normal Radiation levels exist in the Spent Fuel Pool Building.

Which one of the following correctly describes the New Fuel Elevator response if an operator attempts to raise it to the full up position?

A. The No-Load light will be DARK and the New Fuel Elevator will raise.

B. The No-Load light will be LIT and the New Fuel Elevator will raise.

C. The New Fuel Elevator will raise if the SFP crane is moved to the other end of the pool. 1EMF-15 losing power has no effect on New Fuel Elevator movement.

D. The New Fuel Elevator will raise if the SPF crane is moved to the other end of the pool and 1EMF-15 regains power and is clear of any alarm condition.

NEW QUESTION (YOUR SUGGESTION)

***Question:* 05-56** ***Answer:* D**

LEVEL:	RO/SRO

K/A	SYS034	**Title**	Fuel Handling Equipment
	K6.02	**Description**	Knowledge of the effect of a loss or malfunction on the following will have on the Fuel Handling System: **(CFR: 41.7 / 45.7)** Radiation monitoring systems
		Importance	2.6/3.3

SOURCE	BANK (CNS exam bank FHS-059-D) (2001 NRC Exam)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-FH-FHS rev 25
Objectives	8
REFERENCES	Lesson plan information
Author	RJK
Time	7/27/2005 5:45 PM 31 minutes

Distracter Analysis: Load light will be lit/dark based on load being less/greater than 330 lbs. SFP crane must not be over the NFE to allow the NFE to raise. Also, 1EMF-15 must have power and not be in alarm to allow the NFE to raise.

A. Incorrect:
B. Incorrect:
C. Incorrect:
D. Correct: See lesson plan information.

Lesson plan page 18

1. New Fuel Elevator (Obj. #8)
   d) Will not go up with high radiation alarm on EMF-15 or loss of power to EMF-15 (Spent Fuel Pool Building Refueling Bridge Monitor).
   e) Will not go up with loss of power to SFP crane or crane over the elevator.

Question*: *05-56

1 Pt(s) Given the following:

- Fuel handling crew is moving fuel in Unit 1 spent fuel building.
- The new fuel elevator will <u>not</u> operate in the up direction.

Which one of these events has caused the elevator failure?

A. No load detected in elevator (less than 330 lbs).

B. Spent fuel building crane <u>not</u> indexed over the elevator.

C. Excessive load detected in elevator (greater than 2700 lbs.)

D. High radiation detected on the spent fuel refueling bridge.

Question: 05-56 *Answer: D*

LEVEL:	RO/SRO

K/A	SYS034	Title	Fuel Handling Equipment
	K6.02	Description	Knowledge of the effect of a loss or malfunction on the following will have on the Fuel Handling System: **(CFR: 41.7 / 45.7)** Radiation monitoring systems
		Importance	2.6/3.3

SOURCE	BANK (CNS exam bank FHS-059-D) (2001 NRC Exam)
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-FH-FHS rev 25
Objectives	8
REFERENCES	Lesson plan information
Author	RJK
Time	7/27/2005 5:45 PM 31 minutes

Distracter Analysis:

A. Incorrect: This is a real condition but not an interlock.

B. Incorrect: This is the correct condition to raise the elevator but an operator would confuse this if it thinks the bridge must be over the elevator.

C. Incorrect: No elevator over there, but might be plausible to think its involved.

D. Correct: See lesson plan information.

Lesson plan page 18

1. New Fuel Elevator (Obj. #8)

   d) Will not go up with high radiation alarm on EMF-15 or loss of power to EMF-15 (Spent Fuel Pool Building Refueling Bridge Monitor).

   e) Will not go up with loss of power to SFP crane or crane over the elevator.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose and design features of the Fuel Handling System: • Fuel transfer canal • Spent fuel pool • Cask area • Transfer tube associated with fuel handling operations • New fuel storage vault			X	X	
2	Describe in general terms the actions required per AP/1/A/5500/025 (Damage Spent Fuel), AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Pool Level), and AP/0/A/5500/033 (Damaged Tamper Seal on Special Nuclear Material Shipments).			X	X	
3	Explain the purpose of each of the Fuel Handling Crane Bridges.			X	X	
4	Describe the function and operation of the instrumentation and controls associated with the fuel handling bridges.			X	X	
5	Describe the interlocks associated with the fuel handling bridges. • List the requirements for bypassing fuel handling interlocks			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	
7	Describe operations of the Reactor Building Fuel Mast.			X	X	
8	Describe the design purposes and features of the Fuel Handling Auxiliaries. • New Fuel Elevator • Fuel Transfer Tube • Fuel Transfer Car • Upender • Fuel Handling Tools • Fuel Handling Accessories			X	X	
9	Describe the function and operation of the instrumentation and controls associated with the fuel handling auxiliaries.			X	X	

2.3 Fuel Handling Auxiliaries

A. The Catawba Nuclear Station is served with systems which support the overall refueling operation. These Fuel Handling Auxiliaries provide for:

1. Handling of New Fuel from receipt to deposit in New Fuel elevator. Refer to latest copy of AP/0/A/5500/33, (Damaged or Missing Tamper Seals on Special Nuclear Material Shipments) (Obj. #2))

2. Transfer of New Fuel from the New Fuel Storage Vault to the New Fuel elevator.

3. Transfer of assemblies from the Reactor Building to the Spent Fuel Pool and vice versa.

B. Components Description

1. New Fuel Elevator (Obj. #8)

a) Box shaped, with top open and able to hold one fuel assembly.

b) Used to lower New Fuel assemblies into SFP. (Refer to OP/1-2/A/6550/006) (Transferring Fuel with the Spent Fuel Manipulator Crane).

c) Control pendant on operating floor

1) Up/Down light

2) No-load light

(a) less than or equal to 330 lbs. light

3) Overload light

(a) Normal greater than 1200 lbs. (Can be bypassed)

(1) Prevents raising elevator with assembly in it unless key bypass switch is activated. (Prevents removing a Spent Assembly using this elevator).

(b) Overload greater than 2400 lbs. (No Bypass on this)

4) Up/Down pushbutton

d) Will not go up with high radiation alarm on EMF-15 <u>or</u> loss of power to EMF-15 (Spent Fuel Pool Building Refueling Bridge Monitor).

e) Will not go up with loss of power to SFP crane or crane over the elevator.

2. Transfer

a) Fuel Transfer Tube (Obj. #8)

1) Used for transferring fuel under water between containment and spent fuel pool.

2) Blank flange closes transfer tube on containment side.

Question: 05-57

1 Pt(s) Given the following conditions:

- Unit 1 is in Mode 3
- Auxiliary feedwater (CA) pumps are maintaining steam generators levels
- Condensate (CM) and main feedwater (CF) systems are in high pressure cleanup alignment with 1A Hotwell and 1A Condensate Booster pumps in service
- Steam generators are at no load level and 550 psig
- The CF system is aligned to the CA nozzle

The OATC inadvertently depresses the "CF NOZZL" pushbutton on the "S/G 1A NOZZLE SEL" switch.

Which one of the following correctly describes the CA and CF system alignments to S/G 1A?

A. CA flow remains aligned to the CA nozzle only.
CF flow can be established to S/G 1A by throttling open the "CF BYP CTRL" valve.

B. CA flow remains aligned to the CA nozzle only.
CF cannot be established to S/G 1A without a main feedwater pump in service.

C. CA flow is aligned to the CA and CF nozzles.
CF flow can be established to S/G 1A by throttling open the "CF BYP CTRL" valve.

D. CA flow is aligned to the CA and CF nozzles.
CF cannot be established to S/G 1A without a main feedwater pump in service.

Question: 05-57 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS035	Title	Steam Generator
	K1.01	Description	Knowledge of the physical connections and/or cause-effect relationships between the S/GS and the following systems: **(CFR: 41.2 to 41.9 / 45.7 to 45.8)** MFW/AFW systems
		Importance	4.2/4.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CF-CF revision 35
Objectives	4
REFERENCES	Lesson plan information
Author	RJK
Time	11/7/2005 8:49 AM

Distracter Analysis:

1. The CA flowpath is safety related and contains a dedicated flowpath to the steam generator.
   The CA flow cannot travel to the main CF nozzle due to a check valve.
   The CF NOZZLE pushbutton has no impact on CA system operation.

2. The high pressure cleanup path of the CM and CF systems does not include the CF connections to the S/G.
   CF system connections to the S/G are aligned to the CA nozzle with the CF containment isolation valves closed.

3. When the CF NOZZLE button is depressed, the CF alignment is opened to the main (CF) nozzle. There is sufficient pressure from the high pressure cleanup pumps to feed a S/G at the low pressure.

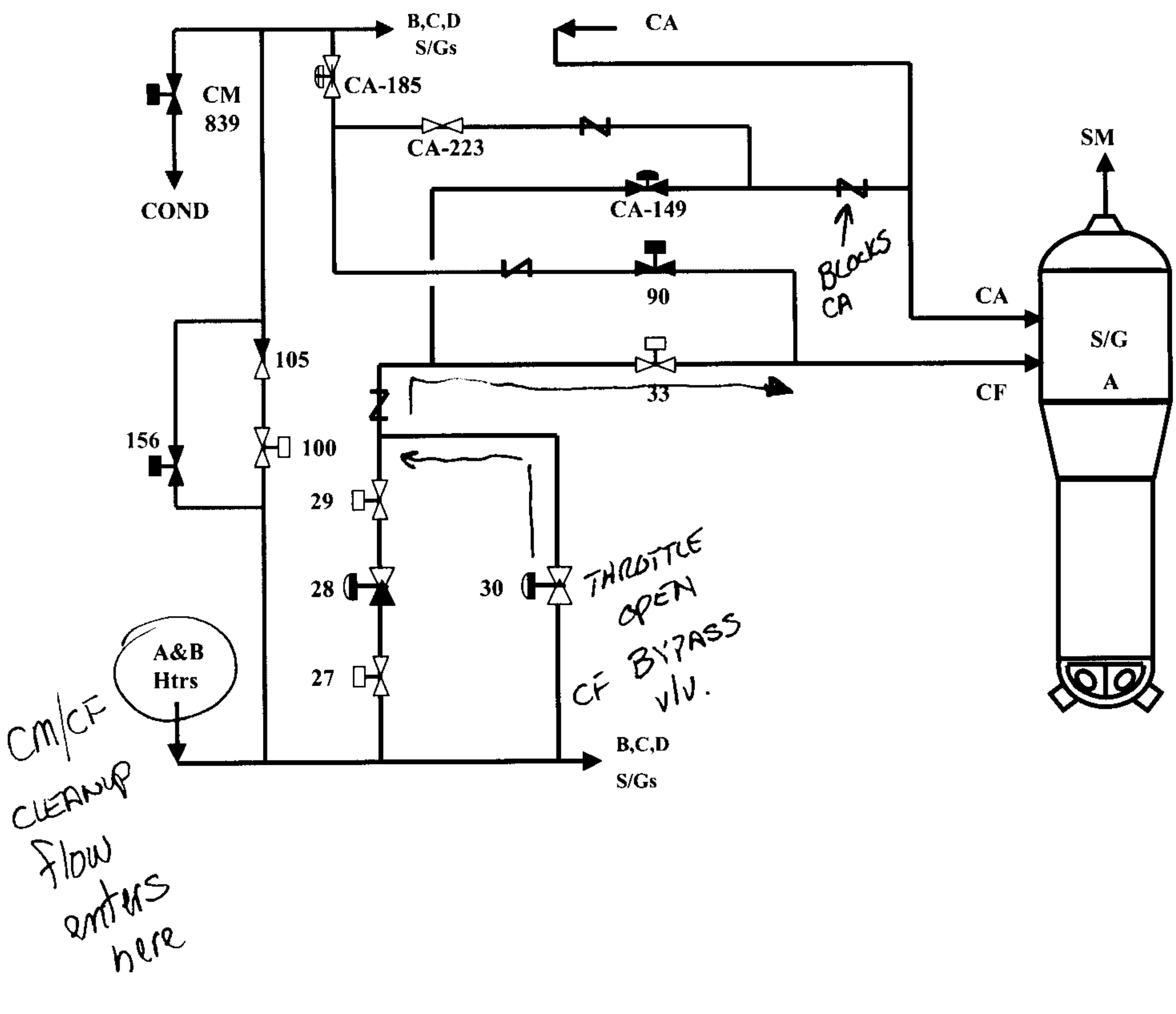
4. 550 psig was used because it is the pressure a S/G is depressurized to in order to establish flow from the CM/CF system in the FR-H.1 emergency procedures.

A. Correct for reasons 1 & 3
B. Incorrect for reasons 1 & 4
C. Incorrect for reasons 1 & 3
D. Incorrect for reasons 1 & 4

See CF lesson plan page 30 of 32 for CF/CA system drawing.

CF System
Equalization Header to S/Gs

Note: All valves CF System unless noted by system designation.



Question: 05-57

1 Pt(s) Recirculation flow from the Unit 1 steam generator steam separators is mixed with auxiliary feedwater in the ______ and with main feedwater in the ______.

A. area below the steam separators; downcomer region

B. tube bundle; area below the steam separators

C. downcomer region; preheater

D. preheater; tube bundle.

Question: 05-57 *Answer: A*

LEVEL:	RO/SRO

K/A	SYS035	Title	Steam Generator
	K1.01	Description	Knowledge of the physical connections and/or cause-effect relationships between the S/GS and the following systems: **(CFR: 41.2 to 41.9 / 45.7 to 45.8)** MFW/AFW systems
		Importance	4.2/4.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-STM-SG rev 32
Objectives	4
REFERENCES	Lesson plan information
Author	RJK
Time	7/27/2005 6:26 PM 36 minutes

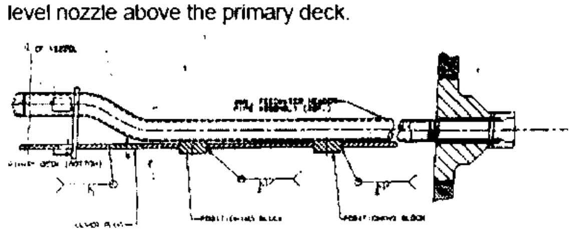
Distracter Analysis: -Main feed is combined with Recirc flow in downcomer
-Aux feed is mixed with Recirc flow up in the pan area at the outlet of the separators which is before the downcomer.

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

Lesson plan pages 10 and 11

Auxiliary Feedwater (CA) Nozzle

1) Enters above the tube bundle/shroud but below normal water level nozzle above the primary deck.

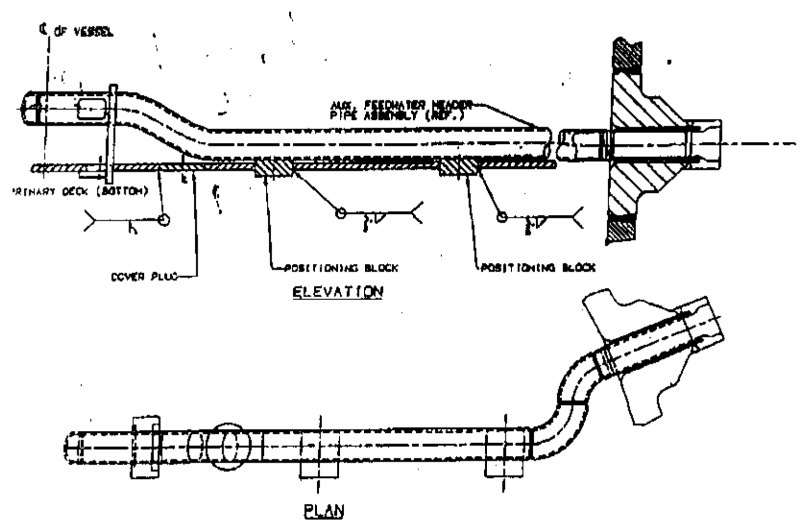


Main Feedring (CF)

1) Main Feedwater enters into the downcomer annulus outside the shroud via a feedwater distribution header (feedring).
2) The feedwater joins Recirculation flow in the downcomer, flowing down the outside and up under the shroud to enter the tube bundle region. (**Obj. #4**)

	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**
1	State the purpose of the Steam Generators.	X	X	X	X	
2	State the system designators and nomenclature for major components.	X				
3	Identify and describe the purpose and physical characteristics of the following Steam Generator features: • Tube Bundle • Bundle Shroud (Wrapper) and Downcomer Region • Primary and Secondary Decks • Auxiliary and Main Feedwater Inlets • Feedwater Preheating Systems • Steam Separation Components • Steam Outlet Nozzle • Blowdown Taps • Wet Layup Nozzle (Unit 1 Only)	X	X	X	X	X
4	Explain the Reactor Coolant, Feedwater, and Recirculation flowpaths inside the Steam Generators.	X	X	X	X	X
5	State the purpose for and describe the operation of Auxiliary Feedwater Nozzle Tempering Flow.		X	X	X	X
6	State the purpose for and describe the operation of Main Feedwater Reverse Purge Flow.		X	X	X	X
7	Describe the arrangement of Narrow and Wide Range level instrumentation and evaluate the effect of changing S/G temperature on indicated level.			X	X	X
8	Discuss the supplementary actions of AP/10 (Reactor Coolant Leak) Case 1 (Steam Generator Tube Leak).			X	X	X
9	Describe the operation of the S/G during power escalation between 0% to 15%, and 15% to 100%.			X	X	X

2. S/G Primary Side Flowpath - Reactor coolant leaving the reactor enters the S/G on the T-hot inlet. The water entering the S/G passes through the U-tubes giving up its heat to the secondary water in the S/G. The primary water exits on the T-cold outlet to the reactor coolant pumps. **(Obj. #4)**
3. The tube bundle is situated within a shroud (a.k.a. wrapper) which defines the secondary side flowpaths. The tube bundle is supported and constrained by the use of Lattice Grid Type tube supports in the straight portion of the tubes and flatbar U-bend restraints in the U-bend portion of the bundle.
4. Tubes
   a) There are 6633 tubes per Steam Generator.
   b) The average tube diameter is 0.685" OD.
   c) Total Heat Transfer Area is 79,800 sq. ft.
5. The Unit 1 Steam Generators have separate Main and Auxiliary feedwater inlets.
   a) Auxiliary Feedwater (CA) Nozzle
      1) Enters above the tube bundle/shroud but below normal water level nozzle above the primary deck.



AUXILIARY FEEDWATER NOZZLE & HEADER ASSEMBLY

      2) At low power levels, all feedwater is directed through the CA Nozzle. As power is increased, feedwater is aligned to the main feed ring.
      3) Tempering Flow (**Obj. #5 and #26**)
         (a) The purpose of Tempering Flow is to extend the operational life of the CA Nozzle by cooling it with a small amount of main feedwater.

(b) Normal steam generator internal temperature is ~ 550°F. Without flow through the CA Nozzle, its temperature will rise to equal this value.

(c) CA suction source temperature is ~ 100°F. Initiation of CA flow will result in significant thermal shock of the CA nozzle.

(d) Tempering flow is manually aligned to the CA Nozzles following transfer of feedwater to the main feed ring.

(e) A small amount of main feedwater (~450°F) is taken directly from the main feedwater header via a common supply line and power operated isolation valve (CF-100). Downstream of CF100, it is routed into the individual CA nozzles.

b) Main Feedring (CF)

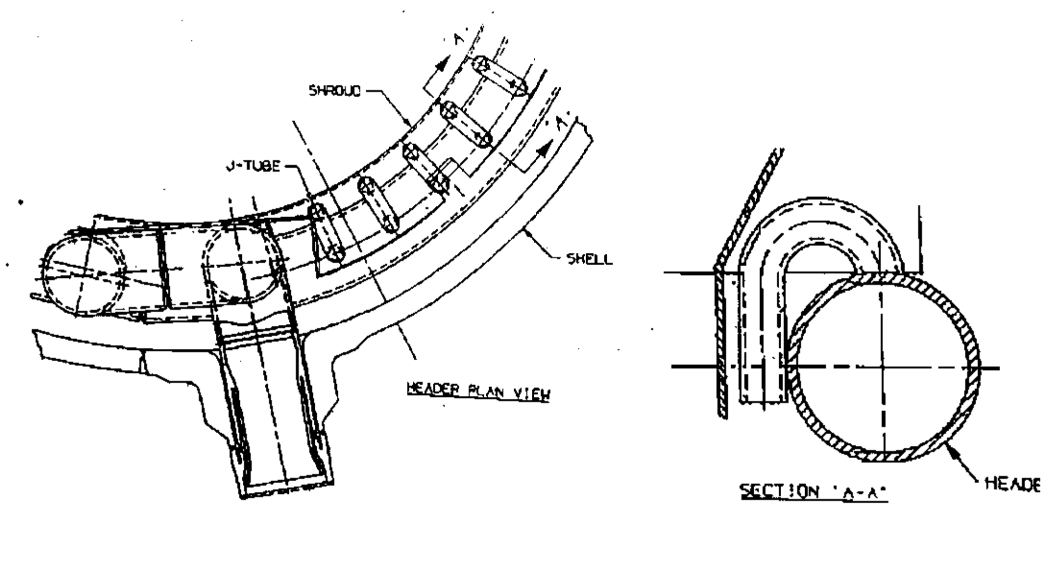
1) Main Feedwater enters into the downcomer annulus outside the shroud via a feedwater distribution header (feedring).

2) The feedwater joins Recirculation flow in the downcomer, flowing down the outside and up under the shroud to enter the tube bundle region. (**Obj. #4**)

3) Feedwater exits the main feedring via J-Tubes. The J-Tubes serve two important functions:

(a) The J-Tubes work to keep the feedring filled with water on short term transients that would uncover the feedring.

(b) The J-Tubes also serve to restrict reverse flow on a feedwater line break.



***Question*: 05-58**

1 Pt(s) Given:

- Unit 1 Reactor power is at 10%
- Main turbine is at 1800 RPM in preparation for paralleling to the grid.
- 1SA-22 (Main Steam To CSAE) fails closed.

Assuming no actions are taken to address 1SA-22, what other actions, if any, will be required?

A. The main turbine will automatically trip on loss of vacuum, the reactor will not trip, GO TO AP1/A/5500/006, Loss of S/G Feedwater.

B. The main turbine will automatically trip on loss of vacuum, the reactor will automatically trip. GO TO EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

C. 1AS-2 (Main Stm to Aux Steam) will modulate to maintain a steam supply to the Condensate Steam Air Ejector (CSAE), no additional operator action is required.

D. The main vacuum pumps will start automatically on decreasing vacuum to maintain vacuum above trip setpoints, no additional operator action is required.

NEW REPLACEMENT

Question: 05-58 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS055	**Title**	Condenser Air Removal
	K3.01	**Description**	Knowledge of the effect that a loss or malfunction of the CARS will have on the following: **(CFR: 41.7 / 45.6)** Main condenser
		Importance	2.5/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	ZM, AS
Objectives	
REFERENCES	AP/06
Author	JKS
Time	7/28/2005 12:16 PM 50 minutes

Distracter Analysis:

A. Correct:

B. Incorrect: At this power level the reactor will not trip automatically, but should be manually tripped as the CF Pumps are lost. CA cannot maintain S/G levels at this power level.

C. Incorrect: Many systems have more than one steam supply available to them. 1AS-2 is upstream of 1SA-22 and will be ineffective in providing steam to the CSAEs with 1SA-22 closed.

D. Incorrect: There is no auto-start feature for the ZM pumps, however, many systems have pumps that autostart on decreasing pressure.

Question: 05-58

---

1 Pt(s) Which one of the parameters measuring the conditions inside the main condenser will <u>decrease</u> if one of the condensate steam air ejectors is removed from service?

(Do <u>not</u> consider the effects on the hotwell water.)

Reference Provided

A. Temperature

B. Absolute pressure

C. Exhaust steam moisture

D. Exhaust steam enthalpy

Question*: 05-58** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS055	Title	Condenser Air Removal
	K3.01	Description	Knowledge of the effect that a loss or malfunction of the CARS will have on the following: **(CFR: 41.7 / 45.6)** Main condenser
		Importance	2.5/2.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	BNT-TH05 rev 2
Objectives	8D
REFERENCES	TH05 page 21 REFERENCE PROVIDED Steam Table Mollier Diagram
Author	RJK
Time	7/28/2005 12:16 PM 50 minutes

Distracter Analysis:

A. Incorrect: Temperature in a saturated environment tracks pressure, so temperature increases.

B. Incorrect: Absolute pressure increases (vacuum decreases). Operator may get confused through

C. Correct: If the steam exhausts to a higher back pressure, less work was done on the steam, therefore the steam contains less moisture.

D. Incorrect: Enthalpy is wasted, ie not used, so the exhaust steam still contains more than before at a lower vacuum.

SEQ	THERMODYNAMIC CYCLES ENABLING OBJECTIVES	BOT	GFES
1	Define thermodynamic cycle and identify the five (5) components necessary to a cycle. TH05001, TH05002	X	X
2	Explain the difference between a process and a cycle. TH05003	X	X
3	Define thermodynamic cycle efficiency (η) in terms of net work produced, heat supplied, and heat rejected. TH05004, TH05005	X	X
4	Describe the Carnot cycle and the relevancy of the Carnot cycle efficiency to power plant design and operation. TH05006, TH05007	X	X
5	Calculate the Carnot efficiency of a thermodynamic cycle when given heat source and heat sink temperature. TH05008	X	
6	Explain the impact that the Second Law of Thermodynamics has on power plant design and operation. TH05009	X	
7	Explain the differences between a Rankine steam cycle and a Carnot cycle. TH05010, TH05011	X	X
8	Describe how each of the following affects Rankine cycle efficiency:		
	A. Superheating TH05012, TH05024	X	X
	B. Moisture separators/reheaters TH05013, TH05018	X	X
	C. Feedwater heating TH05014, TH05020	X	X
	D. Condenser vacuum TH05015, TH05024	X	X
	E. Condensate subcooling TH05016, TH05021, TH05022, TH05023	X	X
	F. Steam pressure TH05017, TH05024	X	X
9	Describe the effects of moisture on turbine integrity and efficiency. TH05019		X
10	Define condensate depression. TH05021, TH05022	X	X
11	Explain methods of operation that aid in maintaining unit efficiency. TH05025	X	

5.1 FACTORS EFFECTING CYCLE EFFICIENCY

Plant operators must be aware of how changing plant parameters will affect plant efficiency. Any change in plant efficiency will cause a change in power output from the reactor to supply the same electrical power output. Let's first compare an "IDEAL" cycle to a "REAL" cycle to understand how they are different.

Two major differences exist when comparing ideal cycles to real cycles. Real cycles use real work processes and ideal cycles use ideal work processes. For a Rankine cycle, the work processes are the turbine (work by the working fluid) and the pump (work on the working fluid)

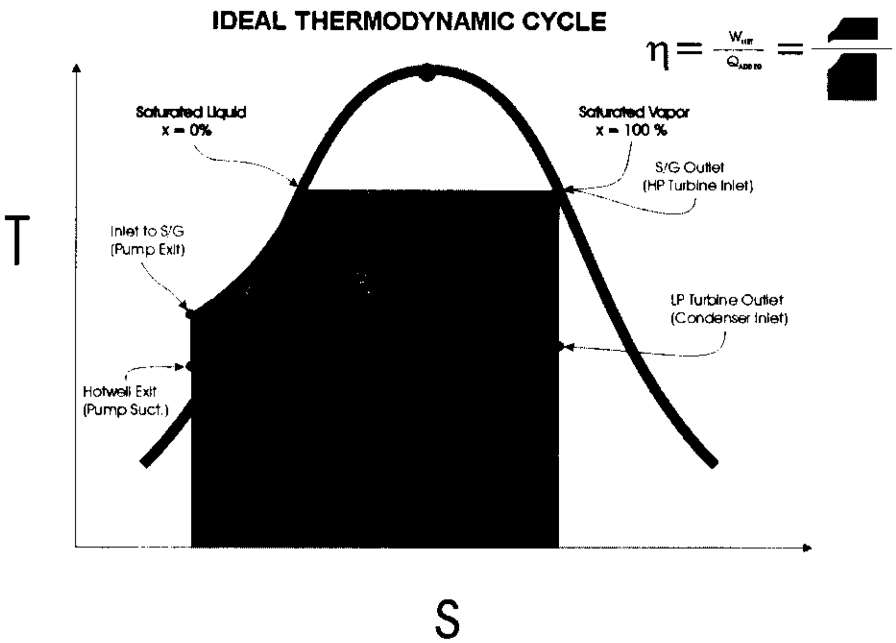


Figure 10 Ideal Thermodynamic Cycle

5.2 REAL TURBINE

If an "IDEAL" turbine were to suddenly become a "REAL" turbine, its output would decrease due to losses such as friction, windage, moisture, and tip leakage. To raise the turbine back to its original output, the turbine steam supply valves would open increasing the mass flow rate of the steam going to the turbine. The work of the turbine would increase to overcome the losses. Opening the steam supply valves decreases steam generator pressure and more heat would have to be added to raise steam generator pressure back to its original value. However, since the heat added is greater than the increase in work from the turbine, the cycle efficiency would decrease (Figure 11).

Entropy increases as a fluid passes through any "REAL" work process (such as a turbine). For a real turbine process, a higher quality (X) at the turbine outlet (more energy) is seen compared to a ideal turbine. If the turbine exhaust has more energy, then less energy was taken from the steam and converted into work by the turbine. Therefore, a real turbine is less efficient than an ideal turbine operating with the same steam supply conditions and exhausting to the same backpressure.

Question: 05-59

1 Pt(s) Which of the following automatic actions are designed to prevent contaminated liquids from reaching Lake Wylie without proper processing?

A. Liquid releases from the monitor tank building are terminated on low or loss of RL flow.

B. Auxiliary Building Floor Drain Tank discharge is directed to the monitor tank building on 1EMF-52 (Clean Area Floor Drain Monitor) Trip 2.

C. Turbine building sump pump flows are directed to the monitor tank building on EMF-31 (Turbine Building Sump) Trip 2.

D. Liquid releases from the auxiliary building are terminated on low or loss of RN flow.

Question: 05-59 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS068	**Title**	Liquid Radwaste System
	K4.01	**Description**	Knowledge of design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41.7)** Safety and environmental precautions for handling hot, acidic, and radioactive liquids
		Importance	3.4/4.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-WE-WL rev 15
Objectives	3
REFERENCES	WL lesson plan page 16
Author	RJK
Time	8/15/2005 9:50 AM 85 minutes

Distracter Analysis:

A. **Correct**: Release flow is diluted with the RL flow in the service building. On low flow in the RL system, 1WL-X28 trips closed.

B. **Incorrect**: This EMF directs flow to the ND/NS Sump, not the monitor tank building (partially correct).

C. **Incorrect**: This EMF terminates all sump pump actions. Operators actually manually align the flow to either the FDT system or the monitor tank building, but it not an automatic action.

D. **Incorrect**: Aux building releases are diluted with RN flow which in turn is diluted into the RL flow. There are only terminations on RL flow but an operator may not remember the difference.

***Question*: 05-59**

1 Pt(s) Which of the following automatic actions are designed to prevent contaminated liquids from reaching Lake Wylie without proper processing?

A. Liquid releases from the monitor tank building are terminated on low or loss of RL flow.

B. S/G blowdown flows are directed to the monitoring tank building on EMF-33 (Gas Exhaust) Trip 2.

C. Turbine building sump pump flows are directed to the monitor tank building on EMF-31 (Turbine Building Sump) Trip 2.

D. Liquid releases from the auxiliary building are terminated on low or loss of RN flow.

Question: 05-59 ***Answer: A***

LEVEL:	RO/SRO

K/A	SYS068	**Title**	Liquid Radwaste System
	K4.01	**Description**	Knowledge of design feature(s) and/or interlock(s) which provide for the following: **(CFR: 41.7)** Safety and environmental precautions for handling hot, acidic, and radioactive liquids
		Importance	3.4/4.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-WE-WL rev 15
Objectives	3
REFERENCES	WL lesson plan page 16
Author	RJK
Time	8/15/2005 9:50 AM 85 minutes

Distracter Analysis:

A. **Correct**: Release flow is diluted with the RL flow in the service building. On low flow in the RL system, 1WL-X28 trips closed.

B. **Incorrect**: This EMF does isolate blowdown flow from the S/Gs. An operator may think that the flow is diverted to the monitor tank building for storage.

C. **Incorrect**: This EMF terminates all sump pump actions. Operators actually manually align the flow to either the FDT system or the monitor tank building, but it not an automatic action.

D. **Incorrect**: Aux building releases are diluted with RN flow which in turn is diluted into the RL flow. There are only terminations on RL flow but an operator may not remember the difference.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Liquid Waste System	X	X	X	X	
	• State the purpose of each of the subsystems			X	X	
2	Describe the Reactor Coolant Drain Tank (NCDT) Subsystem.	X	X			
	• State the purpose of the NCDT	X	X			
	• State the purpose for using a cover gas in the NCDT	X	X			
	• State the normal discharge flow path and the refueling discharge flow path of the NCDT	X	X			
	• List the basic steps for placing a NCDT gas cylinder in service and removing it from service	X	X			
3	Discuss operation of the WL system for:	X	X	X	X	X
	• Normal Alignment	X	X	X	X	X
	• Performing a normal liquid waste release	X	X	X	X	X
	• Filling and Draining various components	X	X			
4	Describe the Automatic actions caused by an alarm on EMF-49 or EMF-57	X	X	X	X	X
5	State the system designator and nomenclature for major components	X				
6	Describe the categories of liquid waste			X	X	X
7	Explain how unidentified leakage inside containment is monitored			X	X	X
8	Discuss how VUCDT Contents can indicate a steam or NC System leak inside containment			X	X	X
9	Describe operation of the WL system during a Station blackout			X	X	
10	Summarize the Technical Specifications and Selected Licensee Commitments applicable to the WL system			X	X	
11	Explain how to respond to Liquid Waste System annunciator alarms			X	X	
12	Identify the information required to perform a release rate calculation			X	X	X
13	List and explain the process monitoring requirements for liquid waste releases			X	X	
14	Explain the hydrological effects on liquid effluent releases			X	X	

c) Powered from 600 VAC Unit Power (1MXM, 1MXN, 2MXM, 2MXN)

H. Steam Generator Drain Tank Subsystem (SGDT) (Obj. #1)

1. Originally designed to collect water generated by draining and flushing a S/G for maintenance, testing, and/or inspection.
2. Currently used as storage capacity for WEFT and FDT excess. The function of these tanks is to hold all WL water for processing, with the exception of LHST and VUCDT wastes, and to contain the waste from a primary to secondary leak.
3. Tanks – two shared tanks for the station
   a) 50,000 gallon, stainless steel lined tanks.
   b) Heat tracing on lines to and from SGDT's required for freeze protection.

NOTE: The nomenclature for the following two items is very similar. Please take notice of the difference between these components.

4. Steam Generator Drain Tank Pumps (two shared pumps) are used to transfer liquid waste from the tanks to the MTB for processing.
5. Steam Generator Drain Pumps (one pump per unit) are currently not used, but are available to take a suction from the low point of the BB (Steam Generator Blowdown) line from each steam generator to drain the generators to the SGDT.

I. Monitor Tank Building (MTB) (Obj. #1, 4)

1. The Monitor Tank Building was constructed to provide an additional facility with greater capacity to process liquid radwaste. It contains vendor supplied filters and demineralizers to process incoming waste water, which is then, directed to any one of three, 20,000 gallon Auxiliary Monitor Tanks (AMT's) until it is released.
   a) Inputs to the Monitor Tank Building are from the Steam Generator Drain Tanks or from either Turbine Building Sump if they become radioactively contaminated.
   b) Releases from the Monitor Tank Building must be a coordinated effort among RP, Radwaste Chemistry, and Operations.
   c) Water released from the Monitor Tank Building is released through an EMF (57), a control valve (1WL-X28), and then directly into the Low Pressure Service Water System (RL) discharge header at a point in Unit 2 Turbine Building basement near the KG skid.
   d) If EMF - 57's setpoint is exceeded during the release, it will close 1WL-X28 to terminate the release (Obj. #4).
   e) Atmosphere in the Monitor Tank Building is continuously monitored by EMF-58, which performs an alarm function only. Alarms on EMF-57 and EMF-58 are received at an alarm panel in the Control Room.

Question: 05-60

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1 Pt(s) Given the following information related to Waste Gas (WG) Decay Tank "C":

- H_2 concentration is 4.7%
- O_2 concentration is 5.3%

Which of the following actions is required to be performed per station Selected License Commitments (SLCs)?

A. Immediately suspend H_2 and O_2 additions to the WG decay tanks and begin a nitrogen purge to the hydrogen recombiner.

B. Immediately reduce H_2 concentration to less than 4% and O_2 concentration to less than 2%.

C. Immediately suspend all additions to the WG decay tanks and reduce O_2 concentration to less than 4%.

D. Immediately release all the contents of WG decay tank "C".

Question*: 05-60** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS071	Title	Waste Gas Disposal
	K5.04	Description	Knowledge of the operational implication of the following concepts as they apply to the Waste Gas Disposal System: **(CFR: 41.5 / 45.7)** Relationship of hydrogen/oxygen concentrations to flammability
		Importance	2.5/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-WE-WG rev 10
Objectives	6
REFERENCES	SLC-16.11-18
Author	RJK
Time	7/28/2005 2:33 PM 79 minutes

Distracter Analysis:

A. **Incorrect**: This would prevent any additional increases in O2 and H2 concentrations, and the N2 would be viewed as a way to prevent an explosion.

B. **Incorrect**: This would ensure that no explosion could occur.

C. **Correct**:

D. **Incorrect**: If all the contents are released, then the O2 and H2 concentration would also be eliminated, thus eliminating the possibility of an explosion..

SLC16.11-18 Immediate LCOs:

B.	Concentration of oxygen in the WASTE GAS HOLDUP SYSTEM > 4% by volume and hydrogen concentration > 4% by volume.	B.1	Suspend all additions of waste gases to the system. **AND**	Immediately
		B.2	Reduce the concentration of oxygen to ≤ 4% by volume. **AND**	Immediately
		B.3	Reduce oxygen concentration to within limits.	48 hours

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose(s) of the Waste Gas System.			X	X	
2	List the radioactive gas sources to the Waste Gas System.			X	X	X
3	Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X
4	Describe a waste gas release. • State EMF's required • Discuss selecting the controlling EMF on recorder • Describe taking WG EMF highest reading during release • Discuss "PRIOR TO RELEASE" and "AFTER RELEASE" sections of GWR Permit Report • Describe the automatic action associated with the following EMFs related to termination of a waste gas release: WG Disch Monitor (EMF 50) Unit Vent Particulate Monitor (EMF-35) Unit Vent Gaseous Monitor (EMF-36) Unit Vent Iodine Monitor (EMF-37)			X	X	X
5	Describe what information is needed to perform a release rate calculation.			X	X	X
6	State from memory all Tech Spec/SLC actions for the system, subsystem or components which require remedial action to be taken in less than one hour.			X	X	

16.11 RADIOLOGICAL EFFLUENTS CONTROLS

16.11-18 Explosive Gas Mixture

COMMITMENT: The concentration of oxygen in the WASTE GAS HOLDUP SYSTEM shall be limited to ≤ 2% by volume whenever the hydrogen concentration is > 4% by volume.

APPLICABILITY: At all times.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Concentration of oxygen in the WASTE GAS HOLDUP SYSTEM > 2% but ≤ 4% by volume and hydrogen concentration > 4% by volume.	A.1 Reduce oxygen concentration to within limits.	48 hours
B. Concentration of oxygen in the WASTE GAS HOLDUP SYSTEM > 4% by volume and hydrogen concentration > 4% by volume.	B.1 Suspend all additions of waste gases to the system.	Immediately
	<u>AND</u>	
	B.2 Reduce the concentration of oxygen to ≤ 4% by volume.	Immediately
	<u>AND</u>	
	B.3 Reduce oxygen concentration to within limits.	48 hours

Question: 05-61

1 Pt(s) Given the following:

- Both trains of SSPS are in "TEST"
- A spent fuel assembly has just been dropped in the refueling canal as it was being moved towards the transfer car
- Bubbles are noted breaking the surface

What affect will this accident have on 1EMF-17 (REACTOR BLDG REFUEL BRIDGE) and 1EMF-39L (CONTAINMENT GAS HI RAD), and what automatic action(s) will result?

A. 1EMF-17 and 1EMF-39L will alarm.
Containment evacuation alarm sounds; Sh signal is actuated.

B. 1EMF-17 will alarm, 1EMF-39L will not alarm.
Containment evacuation alarm sounds; Sh signal is actuated.

C. 1EMF-17 will alarm, 1EMF-39L will not alarm.
Containment evacuation alarm sounds; Sh signal is not actuated.

D. 1EMF-17 and 1EMF-39L will alarm.
Containment evacuation alarm sounds; Sh signal is not actuated.

Question*: 05-61** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS072	**Title**	Area Radiation Monitoring
	A1.01	**Description**	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ARM system controls including: **(CFR: 41.5 / 45.5)** Radiation levels
		Importance	3.4/3.6

SOURCE	New
LEVEL of KNOWLEDGE	Memory
Lesson	CNT lesson, FHS lesson
Objectives	CP02R 3 and 9
REFERENCES	
Author	JKS
Time	7/28/2005 4:27 PM 60 minutes

Distracter Analysis: **1EMF39 and 1EMF17 will alarm for this accident. With both trains of SSPS in test, Sh from 1EMF-39 will not actuate, but both EMFs cause a containment evacuation alarm. Students may think that all EMF functions of EMF 39 are blocked when SSPS is in test.**

A. **Incorrect**: Sh does not occur.
B. **Incorrect**: both EMFs will alarm, and no Sh.
C. **Incorrect**: both EMFs will alarm
D. **Correct**:

***Question*: 05-61**

1 Pt(s) Would radiography of a weld in the charging pump room cause an alarm on the area radiation monitor (ARM) located in the room?

A. No, the ARMs use Geiger-Mueller Tube detectors.

B. Yes, the ARMs use Geiger-Mueller Tube detectors.

C. No, the ARMs use Beta scintillation detectors.

D. Yes, the ARMs use Beta scintillation detectors.

Question*: 05-61** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS072	**Title**	Area Radiation Monitoring
	A1.01	**Description**	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ARM system controls including: **(CFR: 41.5 / 45.5)** Radiation levels
		Importance	3.4/3.6

SOURCE	New
LEVEL of KNOWLEDGE	Memory
Lesson	BNT Radiation Measurement rev 6 GET manual rev 10
Objectives	CP02R 3 and 9
REFERENCES	GET training manual page 95 BNT lesson CP02R page 23
Author	RJK
Time	7/28/2005 4:27 PM 60 minutes

Distracter Analysis: Welding is checked using gamma sources. ARMs use GM tubes to measure GAMMA radiation.

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

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

Radiography in Progress

Radiography uses highly penetrating gamma radiation to examine welds and components for structural integrity. Boundaries are established to prevent radiation exposures during radiography.

The majority of radiography incidents that have occurred at Duke have been radiography boundary violations. A radiography boundary violation occurs when any person makes an unauthorized entry into the radiation area boundary that is established and posted for radiographic operations (radiography).

The radiography boundary is established and posted for **YOUR PROTECTION**. Any unauthorized entry into a radiography boundary could potentially result in a person receiving a large dose of radiation in a very short period of time.

> **EXAMPLE:** A dose rate of **520 REM** per hour at 1 foot is possible. There is a 50% fatality rate for individuals receiving an immediate whole body dose of this magnitude.

The yellow and magenta rope and signs used to establish a radiation area boundary for the purpose of radiography are essentially the same as the ropes and signs that you as a Radiation Worker are accustomed to seeing while performing routine work activities.

However, the radiography boundary is easily recognized because it is posted with **RED STOP SIGNS** and the Radiation Area sign has a **FLASHING RED LIGHT** attached. A designated ENTRY/EXIT point is posted by the radiographers. The Radiation Area signs used to post a radiography boundary state:

CAUTION
RADIATION AREA
Radiography in Progress
KEEP OUT

Every employee should be **AWARE** that unauthorized entry into a radiography boundary will result in corrective disciplinary action(s) and could result in termination from employment.

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: 05-62

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

- A tornado completely destroys the switchyard
- 1A and 1B D/Gs failed to start due to fouled fuel oil
- The crew has implemented EP/1/A/5000/ECA-0.0, Loss of All AC power
- Controls have been transferred to the SSF
- UST level is 3%
- CACST level is 1%

What are the <u>minimum</u> actions required to maintain a suction source for the turbine driven auxiliary feedwater pump (CAPT)?

A. None, condenser circulating water was automatically aligned when low suction pressure was reached.

B. Defeat the low suction pressure trip, break vacuum, and manually align suction from the condenser hotwell.

C. Locally open nuclear service water assured supply valves.

D. None, condenser circulating water was automatically aligned when controls were transferred to the SSF.

Question: 05-62 **_Answer: A_**

LEVEL:	RO/SRO

K/A	SYS075	**Title**	Recirculating Water
	K4.01	**Description**	Knowledge of circulating water system design feature(s) and interlock(s) which provide for the following: **(CFR: 41.7)** Heat sink
		Importance	2.5/2.8

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CF-CA rev 048
Objectives	2
REFERENCES	Lesson plan information page 15, AP/06 rev 35
Author	RJK
Time	09/15/2005

Distracter Analysis: Upon a transfer to the SSF the control of 1(2)CA-174 and 175 are transferred to the SSF, however, positioning is controlled by suction pressure. The valves receive DC power from the SSF D/G and distribution system. Therefore no actions are required.

A. **Correct**:

B. **Incorrect**: These are actions that are taken in AP/06 to align the hotwell to CA suction.

C. **Incorrect**: The valves could be opened to supply RN since Unit 2 D/Gs are assumed to power some RN. But they are not the minimum actions necessary.

D. **Incorrect**: - Some alignments take place during transfer to the SSF but not these valves, however they are controlled from this location following the swap.

Question: 05-62

1 Pt(s) Unit 1 was operating at 100% when a Reactor Trip and subsequent entry into EP/1/A/5000/ECA-0.0, Loss of all AC power, occurs.

- The SSF has been manned and is operating
- The upper surge tank and CACST inventories have been depleted

What, if any, required actions are performed to maintain a suction source for the turbine driven auxiliary feedwater pump (CAPT) during the loss of all AC condition?

A. None, condenser circulating water is automatically aligned when low suction pressure is reached.

B. Defeat the low suction pressure trip, break vacuum, and manually align from the condenser hotwell.

C. Locally open nuclear service water assured supply valves.

D. None, condenser circulating water is automatically aligned when the SSF was manned.

Question*: 05-62** ***Answer: A

LEVEL:	RO/SRO

K/A	SYS075	**Title**	Recirculating Water
	K4.01	**Description**	Knowledge of circulating water system design feature(s) and interlock(s) which provide for the following: **(CFR: 41.7)** Heat sink
		Importance	2.5/2.8

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CF-CA rev 048
Objectives	2
REFERENCES	Lesson plan information page 15
Author	RJK
Time	09/15/2005

Distracter Analysis: Upon a transfer to the SSF the ties to the RC system are auto aligned. 1(2)CA-174 and 175 open. The valves receive DC power from the SSF D/G and distribution system.

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

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose of the CA System.	X	X	X	X	
2	List all of the sources of water available to the CA pumps, and the order of preference of each.	X	X	X	X	X
3	Explain the normal and recirculation flow paths associated with the CA System.	X	X	X	X	X
4	List the automatic start signals (including setpoint) for the motor driven and turbine driven CA pumps	X	X	X	X	X
5	Explain the trip and reset procedures for the CAPT Trip/Throttle valve.	X	X			
6	Explain CAPT local operation.	X	X			
7	Given appropriate plant conditions apply Limits and Precautions associated with related station procedures.	X	X	X	X	X
8	Draw the CA system per the Simplified Flow Diagram.	X	X			
9	Describe the use of the Auto Start Defeat circuitry.			X	X	X
10	Describe the operation of CA System Valve Control reset circuitry.			X	X	X
11	Discuss how to regain control of CA pumps following CA auto start coincident with sequencer actuation.			X	X	X
12	Explain CA pump low suction pressure protection.			X	X	X
13	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
14	State from memory all Technical Specification actions for the applicable systems, subsystems, and components which require remedial action to be taken in less than one hour.			X	X	
15	List the system designator and major component nomenclature.	X				

Time: 3 hours

b) RC System Loss of Normal Suction Source

1) The RC piping buried within the Turbine Building provides a separate, redundant Sabotage Proof source of Feed Water to the S/G's. This Source is a part of the SSF Complex and can supply the S/G's with enough feed to maintain the plant at Hot Standby Conditions for 3.5 days.

2) Three (3) pressure switches monitor suction pressure at the same location as the RN pressure switches. But these will supply ONLY THE TD CA PUMP upon reaching setpoint.

3) At 9.3 PSIG decreasing (2/3 coincidence) 1(2)CA174 and 1(2)CA175 WILL OPEN.

4) 1(2)AD-5 G4:"SSF CA XFER TO RC" indicates when SSF source lined up to CA system.

5) RC swapover is independent of an auto start signal.

c) Manual Start Low Suction Pressure Protection

1) Should the CA system be operating in MANUAL <u>or</u> "CA SYS VLV" be RESET, the auto open feature is blocked and the CA Pump that is running will trip.

2) This Trip feature operates on a time delay of five (5) seconds. The low pressure condition must exist continuously for 5 seconds to initiate a trip.

3) The Low Suction Pressure trips can be defeated by use of switches on the main control board. This action is done when aligning the CA suctions to the Hotwell per AP/06 (Loss of S/G Feedwater).

d) The CA pump trips on low suction pressure are blocked in Case II of AP/1/A/5500/006 (Loss of Normal CA Supply) so that the hotwell can be used as a CA suction source. The following switches are used to perform that function:

- CA TD PMP Lo Suct. Press Trip Block
- CA PMP 1A Lo Suct. Press Trip Block
- CA PMP 1B Lo Suct. Press Trip Block

D. Turbine Driven Auxiliary Feedwater Pump Overspeed Protection (Rated Speed 3800 RPM)

1. Electronic Overspeed

a) At 115% of Rated Speed, the T&T Valve trips Closed to stop the pump. The operator must REOPEN the valve by depressing the OPEN pushbutton on MC-10 or at the Local Panel to reset the pump.

Question: 05-63

1 Pt(s) Given the following conditions:

- Fire protection system malfunctions have allowed a fire, which started in Unit 1 cable room, to spread to the Unit 2 cable room and control room.
- Control room evacuation to the Auxiliary shutdown panels (ASP) was unsuccessful.
- Crews are transferring control the Safe Shutdown Facility (SSF) panels.

Which one of the following can be used to maintain the unit(s) in hot standby after the control room and ASPs controls have failed and are abandoned?

A. Supply electrical power to EMXA from the SSF diesel generator.

B. Increase pressurizer pressure with "D" pressurizer heater sub-banks.

C. Increase steam generator levels with water from the condenser hotwell.

D. Decrease pressurizer level using the reactor coolant pump seal return header.

Question: 05-63 ***Answer: B***

LEVEL:	RO/SRO

K/A	SYS086	**Title**	Fire Protection
	K3.01	**Description**	Knowledge of the effect that a loss or malfunction of the Fire Protection System will have on the following: **(CFR: 41.7 / 45.6)** Shutdown capability with redundant equipment
		Importance	2.7/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CP-AD rev 28
Objectives	2
REFERENCES	Lesson plan information pages 9 and 13
Author	RJK
Time	8/12/2005 4:28 PM 9 minutes

Distracter Analysis:

A. **Incorrect:** EMXA is the location where the operators transfer EMXS to the SSF power system.

B. **Correct**:

C. **Incorrect**: S/G level can be controlled with the turbine driven CA pump, but will not be using hotwell water.

D. **Incorrect**: This would lower level if there was a way to control the isolation valves.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	List the three events that would require the SSF to be manned.	X	X			
2	State the five major parameters controlled from the SSF and how each is controlled.	X	X	X	X	
3	State the purpose of the SSF Makeup pump.	X	X			
4	State the following associated with the Standby Makeup Pump. • suction source • design flowrate • time limit to start	X	X	X	X	
5	Provide the following associated with the SSF D/G. • State the SSF D/G purpose • Describe the function of the SSF D/G controls • Describe the SSF D/G protective relaying	X	X			
6	Describe the following associated with the SSF D/G auxiliaries. • Normal flow path • How makeup to each of the auxiliary systems is accomplished • Function of the fuel oil manual override knob	X	X			
7	List all the SSF D/G trips and trip bypasses. • State the action required if a non-emergency trip setpoint is exceeded while operating in the emergency mode	X	X			
8	Given a copy of OMP 2-26 SSF D/G Logbook, state the requirements for logging a run of the SSF D/G.	X	X	X	X	X
9	Given a copy of OMP 2-26 SSF D/G Logbook, classify a given SSF D/G start.	X	X	X	X	X
10	Given a copy of OMP 2-26 SSF D/G Logbook, state the correct SSF D/G Logbook entry for a given SSF D/G run.	X	X	X	X	X
11	Describe the normal and emergency alignment of the AC electrical power supplies to the SSF equipment.	X	X			
12	State the purpose of the DC portion of the SSF electrical supplies, including the batteries and battery chargers.	X	X			

41		Sequencer Corridor
26 & 42	556	1B D/G Room and Sequencer Corridor
27 & 43	556	2A D/G Room and Sequencer Corridor
28 & 44	556	2B D/G Room and Sequencer Corridor
29	600	Train A RN Pump Room
30	600	Train B RN Pump Room
38	631	U1 Fuel Building HVAC Room
45	574	U1 Cable Room Corridor
47	631	U2 Fuel Building HVAC Room
50	577	U2 Exterior Doghouse
51	577	U1 Exterior Doghouse

3. A fire event is not postulated concurrent with other non-fire-related failures in safety systems, plant accidents, or the most severe natural phenomena.
4. The design of the SSF is based on fire induced spurious operation of equipment not precluding the achievement of Hot Standby.

2.2 Controlled Parameters

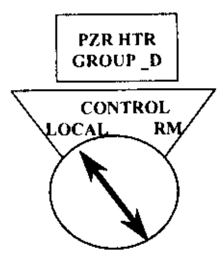
A. Functional Requirements

NOTE: There are sufficient controls and indications in the SSF to monitor natural circulation

1. The SSF provides an alternate and independent means to achieve and maintain hot standby condition by providing: (Obj. #2)
   a) Primary side volume control
   b) Primary side pressure control
   c) Secondary side volume control
   d) Secondary side pressure control
   e) Backup electrical power
2. The SSF must have the necessary instrumentation to monitor primary, secondary, and core parameters.

3. Primary Side Pressure Control (Obj. #2)
   a) Sub group of bank "D" heaters used for pressure control
   b) Must be energized within 15 hours (with VV in operation, or 50 hours with VV not in operation) to ensure PZR bubble remains in the PZR.
   c) Powered from SLXG
   d) Contain 70 KW of heat production
   e) Can be controlled from the SSF by selecting a heater control transfer switch (upper right) to the "LOCAL" (SSF) position and then placing the heaters in ON.
   f) Heaters will NOT de-energize if Pzr level decreases to <17%

PZR PRESSURE CONTROLS



4. Secondary Side Volume Control (Obj. #2)
   a) When control is shifted to the SSF (i.e. EMXS power supply swap and disconnects in the SSF receptacle), systems align to ensure the CAPT is able to maintain secondary inventory. The following valves will automatically close:
      1) S/G blowdown containment isolations
      2) Main steam isolations
      3) S/G PORVs
      4) CF containment isolation bypasses
      5) S/G tempering isolations

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a) When control is shifted to the SSF, systems align to limit the leakage from the NC System to allow the standby M/U pump to sufficiently maintain normal NCS inventory. The following valves will close:

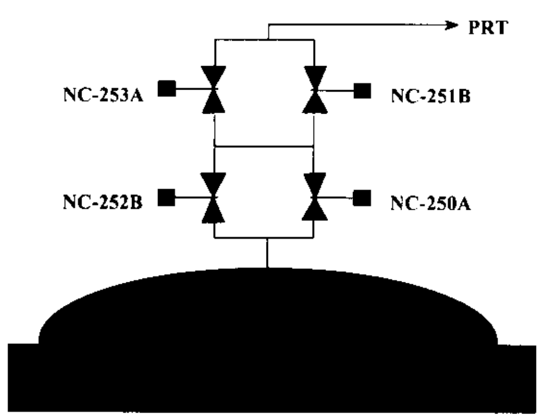
1) PZR PORVs
2) Letdown valves (normal and excess)
3) PZR spray valves
4) Sampling valves
5) NI-391 thru 398 as per NSM

b) Only 2 valves are available for letdown, Rx vessel head vent valves 1(2)NC-250A, 253A

Not seal return

1) Controlled from the SSF
2) Must have breaker on 1(2)EMXS closed when SSF is used
3) Open as necessary to maintain PZR level 25-92%
4) Head vents discharge to the PRT.

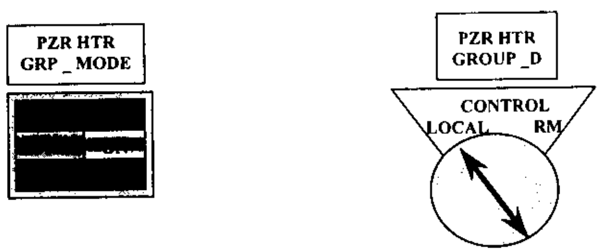
REACTOR VESSEL HEAD VENTS



5) Head Vents (1(2)NC-253A and 252B are normally closed with power removed, and 1(2)252B is checked to ensure power is removed when control is swapped to the SSF.

3. Primary Side Pressure Control (Obj. #2)
   a) Sub group of bank "D" heaters used for pressure control
   b) Must be energized within 15 hours (with VV in operation, or 50 hours with VV not in operation) to ensure PZR bubble remains in the PZR.
   c) Powered from SLXG
   d) Contain 70 KW of heat production
   e) Can be controlled from the SSF by selecting a heater control transfer switch (upper right) to the "LOCAL" (SSF) position and then placing the heaters in ON.
   f) Heaters will NOT de-energize if Pzr level decreases to <17%

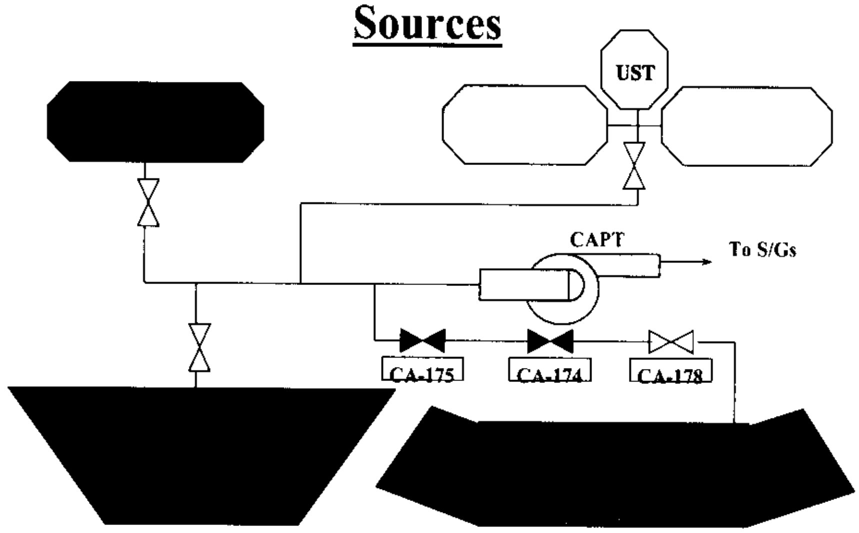
PZR PRESSURE CONTROLS



4. Secondary Side Volume Control (Obj. #2)
   a) When control is shifted to the SSF (i.e. EMXS power supply swap and disconnects in the SSF receptacle), systems align to ensure the CAPT is able to maintain secondary inventory. The following valves will automatically close:
      1) S/G blowdown containment isolations
      2) Main steam isolations
      3) S/G PORVs
      4) CF containment isolation bypasses
      5) S/G tempering isolations

NOTE: If the normal water sources are not available and all steaming is through the S/G safeties (inventory lost) there is enough water in the RC piping to keep the Rx cool for 3 1/2 days. This will ensure we will not exceed the 10 CFR100 dose rates to the public.

Turbine Driven CA Pump Suction Sources

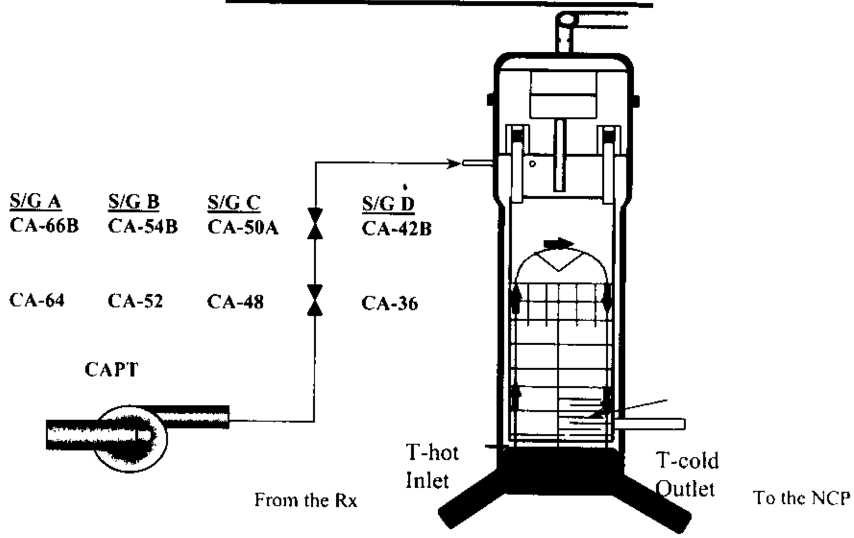


c) Flow Control Methods

1) The operator will use any of the following methods as necessary to maintain Unit 1 S/Gs from 55% to 60% wide range and 65% to 70% wide range on Unit 2.

Distractor → (a) CA flow control valves to all S/Gs (In Plant)

CAPT TO ALL' S/Gs



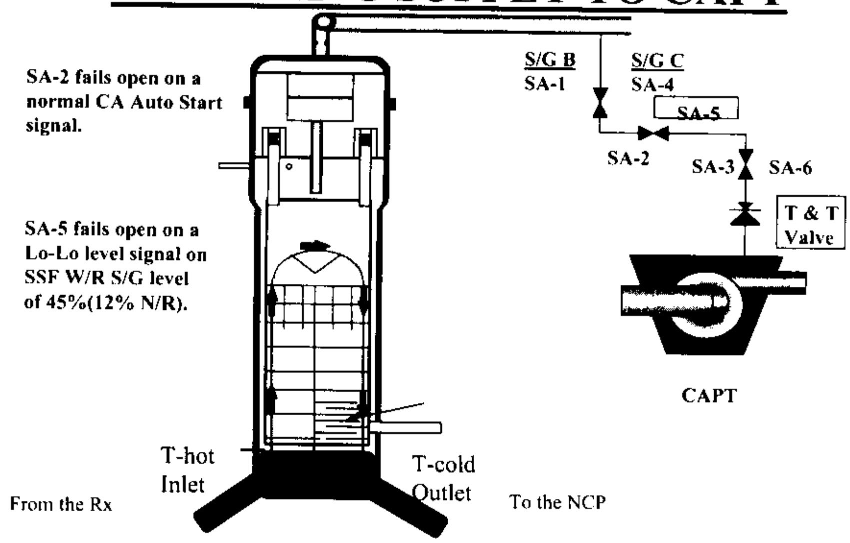
(b) Stop and start CAPT from SSF panel

(a) opening and closing 1(2)SA-5 (on SSF)

(b) start and stopping CAPT using the trip and throttle valve (on SSF)

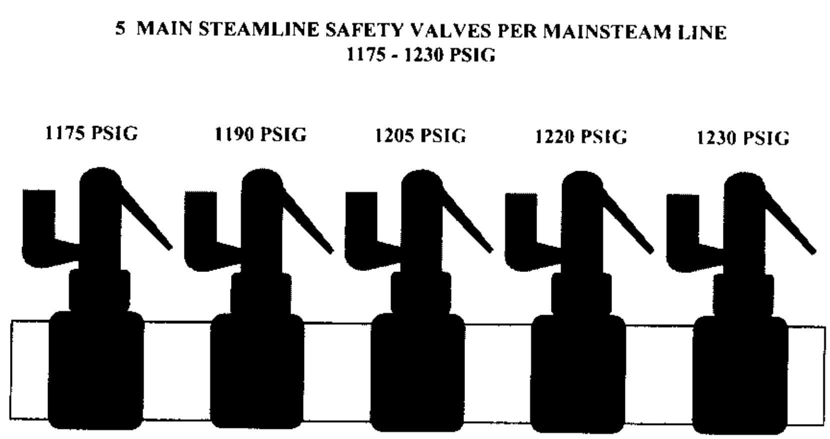
(c) Locally throttle 1(2)SA-3, 1(2)SA-6; S/G's "B" and "C" respectively

S/G B AND C SUPPLY TO CAPT



5. Secondary Side Pressure Control (Obj. #2)
   a) S/G safeties provide a steam relief path
   b) Lowest safety Psat-Tsat is 567°F (This is as low as Tc should be)

MAIN STEAMLINE SAFETY VALVES



***Question*: 05-64**

1 Pt(s) Given the following:

- NV-37A (Pressurizer Aux Spray) is failed open and cannot be closed
- Letdown has been isolated

Which of the following actions completes the isolation of auxiliary spray flow and how will this action impact pressurizer level and the NCP's?

A. Throttle 1NV-294 (NV PMPS 1A & 1B Discharge Control) to 47 gpm
Pressurizer level increases
NCP's continue to receive seal injection flow

B. Close 1NV-312A and 1NV-314B (Charging Line Containment Isolations)
Pressurizer level increases
NCP's continue to receive seal injection flow

C. Close 1NV-312A and 1NV-314B (Charging Line Containment Isolations)
Pressurizer level decreases
NCP's lose seal injection flow

D. Throttle 1NV-294 (NV PMPS 1A & 1B Discharge Control) to 32 gpm
Pressurizer level decreases
NCP's lose seal injection flow

Question: 05-64 *Answer: B*

LEVEL:	RO/SRO

K/A	SYS011	Title	Pressurizer Level Control
	A2.12	Description	Ability to (a) predict the impacts of the following malfunctions or operations on the PZR LCS; 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)** Operation of auxiliary spray
		Importance	3.3/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-PS-NV rev 44
Objectives	9
REFERENCES	EP/1/A/5000/FR-I.1 rev 11
Author	RJK
Time	8/12/2005 4:09 PM 42 minutes

Distracter Analysis: The level control is lost when charging header is isolated. Continued seal injection flow will increase PZR level when the only letdown is from seal leakoff. Until excess letdown is aligned there is only a level increase in the PZR. The NCP seals are still receiving 8 gpm each from 1NV-294 in manual at 32 gpm.

A. **Incorrect**: This will not isolate the spray flow. The operator may think that the reduced charging flow will stop spray flow.

B. **Correct**:

C. **Incorrect**: This will isolate the spray but the pressurizer level will INCREASE and not decrease due to continued seal injection flows and no letdown.

D. **Incorrect**: This will not isolate spray flow. The operator may think that the 32 gpm will stop the flow and keep the seal flow.

FR-I.1 step 11 b RNO page 15

2) **IF** 1NV-37A cannot be closed, **THEN**:
a) Isolate letdown.
b) Manually throttle charging flow to establish 8 GPM seal water flow to each NC pump with an open seal injection flowpath.
c) Close the following valves:
1NV-312A (Chrg Line Cont Isol)
1NV-314B (Chrg Line Cont Isol).
d) Establish excess letdown.
REFER TO Enclosure 2
(Establishing Excess Letdown).

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

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. **Verify Pzr spray valve status as follows:**	
__ a. Normal spray valves - CLOSED.	a. Perform the following: __ 1) Manually close spray valve(s). 2) <u>**IF**</u> spray valve(s) cannot be closed, <u>**THEN**</u>: __ a) Stop NC pumps 1A and 1B. __ b) <u>**IF**</u> NC pressure continues to decrease, <u>**THEN**</u> stop additional NC pumps as required.
__ b. 1NV-37A (NV Supply To Pzr Aux Spray) - CLOSED.	b. Perform the following: __ 1) Manually close 1NV-37A. 2) <u>**IF**</u> 1NV-37A cannot be closed, <u>**THEN**</u>: __ a) Isolate letdown. __ b) Manually throttle charging flow to establish 8 GPM seal water flow to each NC pump with an open seal injection flowpath. c) Close the following valves: __ • 1NV-312A (Chrg Line Cont Isol) __ • 1NV-314B (Chrg Line Cont Isol). __ d) Establish excess letdown. <u>**REFER TO**</u> Enclosure 2 (Establishing Excess Letdown).
__ 12. **Control charging and letdown flow as necessary to maintain NC pressure stable.**	
__ 13. **Verify Pzr level - LESS THAN 92%.**	__ <u>**RETURN TO**</u> **Step 12.**

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ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. **Verify Pzr spray valve status as follows:**	
__ a. Normal spray valves - CLOSED.	a. Perform the following: __ 1) Manually close spray valve(s). 2) **<u>IF</u>** spray valve(s) cannot be closed, **<u>THEN</u>**: __ a) Stop NC pumps 1A and 1B. __ b) **<u>IF</u>** NC pressure continues to decrease, **<u>THEN</u>** stop additional NC pumps as required.
__ b. 1NV-37A (NV Supply To Pzr Aux Spray) - CLOSED.	b. Perform the following: __ 1) Manually close 1NV-37A. 2) **<u>IF</u>** 1NV-37A cannot be closed, **<u>THEN</u>**: __ a) Isolate letdown. __ b) Manually throttle charging flow to establish 8 GPM seal water flow to each NC pump with an open seal injection flowpath. c) Close the following valves: __ • 1NV-312A (Chrg Line Cont Isol) __ • 1NV-314B (Chrg Line Cont Isol). __ d) Establish excess letdown. **<u>REFER</u> <u>TO</u>** Enclosure 2 (Establishing Excess Letdown).
__ 12. **Control charging and letdown flow as necessary to maintain NC pressure stable.**	
__ 13. **Verify Pzr level - LESS THAN 92%.**	__ **<u>RETURN</u> <u>TO</u> Step 12.**

b) Channel 3 performs functions previously selected Channel 2 performed.

4. Position 3-2 selected if Channel 1 fails.

   a) Channel 3 performs previously selected Channel 1 functions.

   b) Channel 2 resumes normal functions.

E. Level Master Controller

1. Input error signal is L-ACT minus L-REF.

2. Output Signal Controls

   a) Positive displacement charging pump speed. (Pump abandoned in place)

   b) Centrifugal charging pump discharge flow control valve NV294.

3. Signal Characteristic

   a) Rate sensitive to provide increase output for changing input error signal.

4. PZR Level Master Man-Auto Station

   a) AUTO - allows input error signal to vary the controller output.

   b) MAN - allows manual control of controller output.

   c) Pot setting controls minimum flow position of NV-294 when NV-294 and the PZR Level Master are in "automatic".

5. The NV-294 controller also receives a charging flow feedback signal

   a) Charging flow input from NVFT 5630

   b) NV-294 adjusts position to match actual charging flow to charging flow requested by the PZR Level Master.

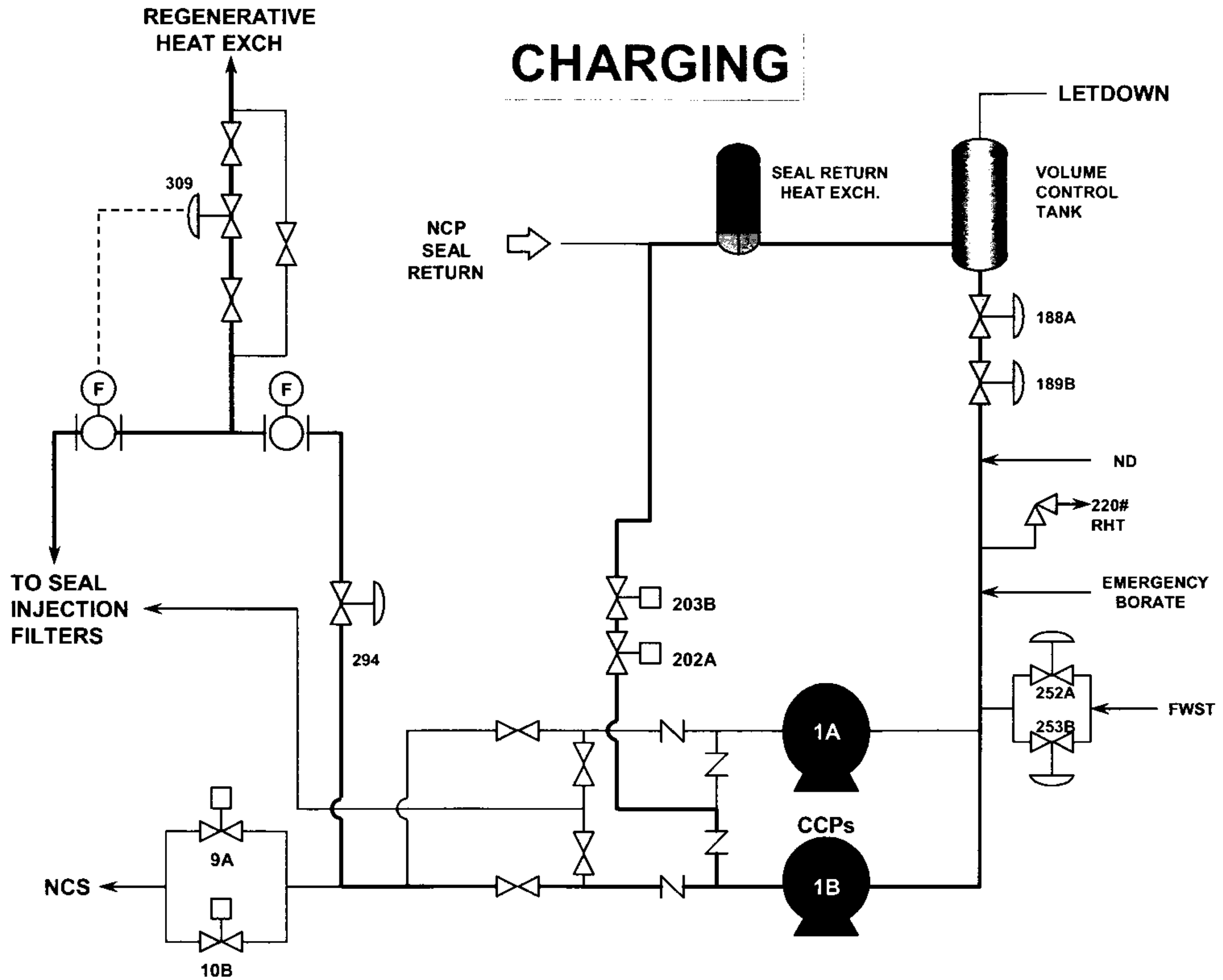
   c) NV-294 will maintain a minimum flow while in AUTO of 47 gpm (32gpm for seal injection flow and 15gpm for cooling flow through the regenerative heat exchanger).

   d) Due to the above, a failure of Charging Line Flow will have a dramatic effect on NV-294:

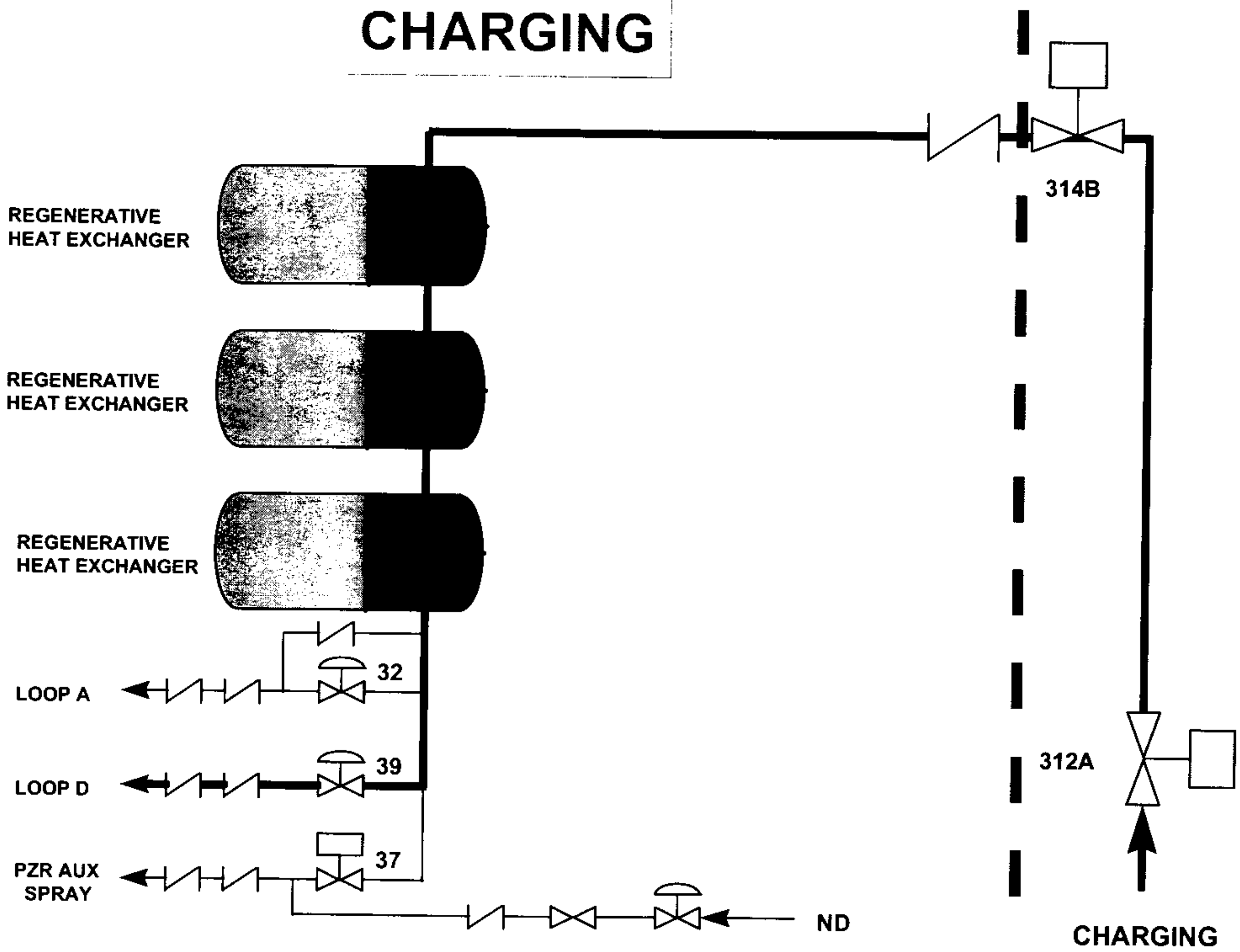
      1) Charging Flow fails High - NV-294 will "see" that 1) it meets the minimum required flow (47 gpm) and 2) charging flow is greater than required by the PZR Level Master. End result of this will be NV-294 will be fully closed in AUTO.

      2) Charging Flow fails Lo - NV-294 will "see" that 1) it does not meet minimum required flow (47 gpm) and 2) charging flow is less than required by the PZR Level Master. End result of this will be NV-294 will be fully opened in AUTO.

CHARGING


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

CHARGING


REGENERATIVE HEAT EXCHANGER
REGENERATIVE HEAT EXCHANGER
REGENERATIVE HEAT EXCHANGER
LOOP A
32
LOOP D
39
PZR AUX SPRAY
37
ND
314B
312A
CHARGING

Question: 05-65

1 Pt(s) A condensate system startup is in progress per OP/1/A/6250/001, Condensate and Feedwater. 1CM-887 (CM Slow Fill Isol Valve) is opened until the "CM SYS FILL LEVEL HI" status light on 1SI-17 is lit. What is the significance of this indication and how was the fill accomplished?

A. The condensate system has been filled between the hotwell and the inlet of the main feed pumps.
Fill was completed using gravity; no hotwell pump was necessary.

B. The condensate system has been filled between the hotwell and the inlet of the main feed pumps.
Fill was completed using gravity and a hotwell pump.

C. The condensate system has been filled between the hotwell and the inlet of the upper surge tank dome.
Fill was completed using gravity; no hotwell pump was necessary.

D. The condensate system has been filled between the hotwell and the inlet of the upper surge tank dome.
Fill was completed using gravity and a hotwell pump.

Question: 05-65 **Answer: D**

LEVEL:	RO/SRO

K/A	SYS056	Title	Condensate
	G2.1.23	Description	Ability to perform specific system and integrated plant procedures during all modes of plant operation **(CFR: 45.2 / 45.6)**
		Importance	3.9/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CF-CM
Objectives	5
REFERENCES	CM lesson plan pgs 20-21 rev 33
Author	RJK
Time	8/2/2005 10:41 AM 64 minutes

Distracter Analysis:

Various portions of the CM/CF system are filled following outages. The piping between the hotwell and the CF pump suction is filled using gravity. Then a pump is started to fill the remaining piping up to the UST dome.

A. **Incorrect**: This doesn't cause the light to be lit.
B. **Incorrect**: This doesn't cause the light to be lit and pumps are not used
C. **Incorrect** The piping is filled using a combination of hotwell pump and gravity.
D. **Correct:**

Question: 05-65

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1 Pt(s) A condensate system startup is in progress per OP/1/A/6250/001, Condensate and Feedwater. 1CM-887 (CM Slow Fill Isol Valve) is opened until the "CM SYS FILL LEVEL HI" status light on 1SI-17 is lit. What is the significance of this indication?

A. The hotwell has been filled to greater than normal level.

B. The condensate system has been filled from the hotwell up to the polishing demineralizer outlet valves.

C. The condensate system has been filled from the hotwell up to main feed water pump suction valves.

D. The condensate system has been filled from the hotwell up to the inlet of the upper surge tank dome.

Question: 05-65 ***Answer: D***

LEVEL:	RO/SRO

K/A	SYS056	Title	Condensate
	G2.1.23	Description	Ability to perform specific system and integrated plant procedures during all modes of plant operation **(CFR: 45.2 / 45.6)**
		Importance	3.9/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-CF-CM
Objectives	5
REFERENCES	CM lesson plan pgs 20-21 rev 33
Author	RJK
Time	8/2/2005 10:41 AM 64 minutes

Distracter Analysis:

Various portions of the CM/CF system are filled following outages. The other choices are plausible due to their inclusion in the fill process. Hotwell is gravity filled. The remaining piping cannot be gravity filled and is filled using a hotwell pump through 1CM-887.

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

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
4	State the interlocks, controls, trip signals and protection features associated with these condensate and condensate storage system components: • Hotwell and Hotwell level control • Hotwell Pumps • Hotwell High Level Control (CM33) • Generator Load Rejection Bypass (CM83) • Polishing Demineralizers • F and G Low Pressure Heaters • Condensate Booster Pumps • 'C' Heater Drain Tank Pumps • Condensate Storage Tank (CST) and Pumps • Low and High pressure cleanup flowpath valves: CM-123, CM-127, and CF-26	X	X	X	X	X
5	For each of the following evolutions describe the basic sequence to place the condensate and condensate storage system components in operation. • Filling the condensate system. • First hotwell pump start • Low and High pressure cleanup/recirculation • Normal operation supplying condensate to the suction of the feedwater pumps	X	X	X	X	X
6	For either a Full Load Rejection or a Loss of Feedwater Pump, state how the following components operate to ensure the condensate system continues to operate and supply condensate water to the feedwater (CF) system. • Hotwell Pumps • Generator Load Rejection Bypass (CM83) • Condensate Booster Pumps • 'C' Heater Drain Tank Pumps	X	X	X	X	X

3. After the pump is started, the "slow fill valve", CM-877, is opened to fill the CM system up to the upper surge tank dome. Pump pressure is employed to completely fill the CM to the dome. A flow orifice in the slow fill line limits water hammers. When actual level reaches the UST dome, a level switch located at CM-127 will light a status light on MC-13, "CM SYS FILL LEVEL HI" to signal that the system is full.
4. Refer to procedure guidelines for setting the amount of bypass flow around the polishing demineralizers. (See section 2.1.G.2 for summary)

D. Low Pressure cleanup (Obj. #5)

1. When "CM SYS FILL LEVEL HI" status light on MC-13 is lit the process to recirculate the condensate water through the upper surge tank dome can begin. CM-127 is setup in AUTO to control condensate system flow at 5500 gpm. This flow is measured at the booster pump discharge.
2. Anytime the steam generators are being used for heat removal in Modes 3 and 4; certain conditions must be met to allow CM-127 to be used.
   a) Heating steam to “C” heaters is isolated
   b) “C” heater outlet temperature less than 120 °F
   c) UST “TOP and BOTTOM” temperatures less than 134 °F
3. At all times in Modes 1 and 2, CM-127 is isolated.
4. CM-127 (CM-CF Cleanup Flow Control) Process Controller operation
   a) Indications
      1) Two vertical scales (GPM x 1000) 14000 GPM is maximum indicated setpoint or actual flowrate.
         (a) Left one for setpoint
         (b) Condensate system flow transmitter located on the Booster pump discharge is the input to this Moore controller.
      2) Three horizontal displays
         (a) Top scale will display flow setpoint if selected to “S” and actual flow if selected to “P”. If selected to “V”, valve position in % is displayed.
         (b) Small digital scale for control function made and troubleshooting, etc (I&E use)
         (c) Bottom digital scale will ALWAYS display actual valve position.
      3) Three lettered lights
         (a) P - Process which means actual flowrate
         (b) S - Setpoint which means controlling setpoint in GPM

***Question*: 05-66**

1 Pt(s) To use an operating procedure that is normally stored in a location outside the control room, the operator ________________.

A. verifies the field copy against the control room control copy prior to use.

B. makes a working copy to use from the field copy which is a control copy.

C. ensures the verification of documents outside the control room PT is current.

D. uses the field copy which is a control copy.

Question: 05-66 ***Answer: D***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Conduct of Operations
	2.1.21	**Description**	Ability to obtain and verify controlled procedure copy **(CFR: 45.10 / 45.13)**
		Importance	3.1/3.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-ADM-OP rev 20
Objectives	10, 18
REFERENCES	OMP 1-4 rev 72
Author	RJK
Time	8/2/2005 12:18 PM 35 minutes

Distracter Analysis:

A. **Incorrect**: That is the controlled copy, no verification is required. Though an operator may think there is an additional copy in the control room.

B. **Incorrect**: The intention of placing the procedures locally is so there is no need to do anything prior to use, no copy is required. But this is the method from using a control copy from the control room i.e. makes a working copy.

C. **Incorrect**: This is something you would have no way of knowing. But these local procedures are verified monthly per the PT.

D. **Correct**:

OMP 1-4 quote: page 3

"Control copies in locations other than the control room are used to respond to an emergency or to respond to local annunciator alarms and are not required to be re-verified prior to use."

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Describe the general philosophy and intent of procedures.	X	X	X	X	
2	Describe when a procedure is required.	X	X	X	X	
3	Describe how a procedure is revised for Permanent major changes with normal approval.	X	X	X	X	
4	Describe how a procedure is revised for Major changes with temporary approval.	X	X	X	X	
5	Describe how a procedure is revised for Restricted major changes.	X	X	X	X	
6	Describe how a procedure is revised for Minor procedure changes.	X	X	X	X	
7	Define the term - Qualified Individual.	X	X	X	X	X
8	Explain when IV is required.	X	X	X	X	X
9	Describe the responsibilities for use of procedures.	X	X	X	X	X
10	Describe "working copy", control copy (outside Control Room), and "control copy".	X	X	X	X	
11	List the actions to take prior to the use of a procedure.	X	X	X	X	
12	Describe when a procedure is required to be in the possession of the user.	X	X	X	X	
13	Explain when sign off/initials are required in a procedure.	X	X	X	X	
14	Describe the action taken for incomplete and completed procedures.	X	X	X	X	X
15	Describe the requirements necessary to depart from a procedure.	X	X	X	X	X
16	Describe the action necessary to resolve a given discrepancy.	X	X	X	X	
17	Describe how procedures are verified correct.	X	X	X	X	
18	Describe how control copy (outside the Control Room) procedures are maintained current.	X	X	X	X	
19	Describe the use and purpose of the "Revised Data Book".	X	X	X	X	
20	Explain the format used in the EP's and AP's.	X	X	X	X	
21	Describe the use of constrained language and the meaning of any word from the constrained language list.	X	X	X	X	X
22	Describe the difference between "A" and "B" procedures.	X	X	X	X	
23	Describe the transfer of initials in a procedure.	X	X	X	X	X

6. Control of Approved Procedures

6.1. Operations Control Copy Procedures:

A. Control copies in the control room:

- A control copy of all Operations approved procedures shall be kept in the control room.
- Control copy procedures shall not be removed from their authorized location except to make copies or for use during emergencies and procedures can not be printed from NEDL or copied.
- When a control copy is used to photocopy working copies, the "CONTROL COPY" stamp mark shall be covered so that it does not show on the working copy.

B. Control copies in locations other than the control room:

- The procedures to be designated Control Copy in locations other than the control room shall be authorized by the Ops Support Manager and listed in PT/1(2)/A/4700/008 (Verification of Documents Outside the Control Room).
- Control copies in locations other than the control room are used to respond to an emergency or to respond to local annunciator alarms and are not required to be re-verified prior to use.
- Control copies in locations other than the control room containing signoffs should only be used in an emergency and are not to be used as a convenience.
- If a control copy containing signoffs is used, it shall be replaced with a new control copy as soon as possible.

***Question*: 05-67**

1 Pt(s) Under which of the following conditions can the Control Room Supervisor waive the requirement to announce alarms to the control room team?

A. The same annunciator(s) repeatedly alarming during surveillance testing.

B. Expected annunciators during the immediate actions of a safety injection emergency.

C. Status of a local annunciator panel alarm reported to the control room.

D. Priority and non-priority OAC alarms.

Question: 05-67 ***Answer: A***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Conduct of Operations
	2.1.14	**Description**	Knowledge of system status criteria which require the notification of plant personnel. **(CFR: 43.5 / 45.12)**
		Importance	2.5/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	comprehension
Lesson	OP-CN-ADM-NSO1 rev 11
Objectives	12
REFERENCES	NSD 509 rev 4 pages 3 and 4
Author	RJK
Time	8/2/2005 1:11 PM 45 minutes

Distracter Analysis:

A. **Correct**: CRS is authorized to waive the requirement.
B. **Incorrect**: These alarms must be announced and discussed ASAP after the immediate actions are completed. A operator may think that this could be waived due to the emergency to allow for crew concentration on the accident.
C. **Incorrect**: This must be treated as any unexpected alarm. The operator will converse with the operator and could think this is all that is required.
D. **Incorrect**: The priority alarms are the same as any unexpected annunciator. But an operator may think that all the OAC device is a monitor for his/her use only.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Describe each step of the S.T.A.R. Self Checking process	X	X	X	X	X
2	State the purpose for performing "Independent Verification".	X	X	X	X	X
3	Describe the qualifications of the "Verifier".	X	X			
4	Describe the process of Separate Verification and state when it is used.	X	X			
5	Describe the process of Double verification and state when it is used.	X	X			
6	Describe the process of Independent Verification of locked components.	X	X			
7	State the conditions that may allow IV to be waived.	X	X			
8	Describe the action required when a component is found out of the required position.	X	X			
9	Describe the process of performing a Pre-Job Briefing and state when it is used per CNS S.D 3.0.21.	X	X	X	X	X
10	Explain what items must always be addressed in all Pre-Job Briefings per CNS S.D. 3.0.21.	X	X	X	X	X
11	Assess when and what type of Pre-Job Briefing should be conducted per CNS S.D. 3.0.21.				X	X
12	Explain and apply NSD 509 "Communication Standards" and OMP 2-21 "Rules of Conduct", use of phones, and two-way radios.	X	X	X	X	X
13	Illustrate the application of: • Use of Names • Three Way Communications • Use of Phonetic Alphabet • Providing specific Information, for the Communications Standards as stated in NSD 509 and OMP 2-21	X	X	X	X	X
14	Know SRO Responsibilities for Work Preparation as defined by OPS. Mgt.				X	X
15	Know SRO Responsibilities for Team Interface as defined by OPS. Mgt.				X	X
16	Describe the "Peer Checking" Process and when it is required.			X	X	X

12. **Control Room and Control Room Area Informational Notes:** Informational notes shall only be used on control panels in the Control Room and Control Room area when authorized by and signed by designated Operations Supervision. Informational notes shall be for information only and shall never be used to circumvent or supplement approved procedures. However, place-keeping aids may be placed on instrumentation and procedures in accordance with OMP guidance
13. **Eating Meals in the Control Room:** Only personnel assigned to the Control Room will be allowed to eat meals there.(normally the Control Room SRO and Reactor Operators). The Control Room SRO can authorize other individuals to eat in the control room when necessary. (for example: Reactor Engineers during zero power physics testing) Food and drink shall be kept away from the control panels.
14. **Control Room Professionalism Criteria Evaluation:** Evaluation of Control Room professional standards shall be part of the Management/Supervisory Observation Program.

509.3 NUCLEAR SITE COMMUNICATION STANDARDS

509.3.1 COMMUNICATION STANDARDS

Use phonetics on the following systems, channels, and trains at all times and in any conversation;

- N-Charlie, N-Delta, and N-Victor systems – (MNS / CNS only)
- "A" Alpha, "B" Bravo, "C" Charlie, and "D" Delta channels
- "A" Alpha, "B" Bravo trains.

Use three-way communications when you are;

- Directing the manipulation of plant equipment
- Communicating the status of plant equipment directed to an individual.

Refer to Appendix A (Nuclear Site Communication Standard Examples) for examples of phonetic alphabet and 3-way communications use at MNS / CNS.

Refer to Appendix B (Nuclear Site Communications Standard Examples) for examples of phonetic alphabet and 3-way communications use at ONS.

509.4 ALARM MANAGEMENT STANDARD

509.4.1 CONTROL ROOM ALARM MANAGEMENT STANDARD

This standard applies to all alarms received in the Operations main Control Rooms (CR), including annunciators and computer alarms.

The Control Room SRO, Reactor Operator at the Controls (ROATC), and Balance of Plant Operator (BOP) are the Control Room crew members responsible for operating the plant and responding to emergencies and it is imperative that these crew members operate as a team. These team members must keep each other adequately informed of plant status at all times. Three-way communications must be used to communicate all expected and unexpected alarms.

When announcing alarms the operator shall call out either the name of the alarm or the activity causing multiple alarms.(examples: "reflash panel testing", "swapping RN pumps") When announcing an individual alarm paraphrasing of the alarm nomenclature is allowed. However, the exact nature of the alarm must be clearly conveyed.

The Operator at the controls is responsible for ensuring that the appropriate follow-up action is taken for all alarms. Alarms shall be considered valid until determined otherwise.

509.4.1.1 Expected Annunciators

1. Annunciators that are a direct result of surveillance testing or plant manipulations AND are caused by manipulations in the procedures governing those activities are considered expected alarms. Reference to the associated annunciator response is not required when expected alarms are identified to the Control Room crew prior to the activity being performed. (i.e. pre-job brief, notified by procedure step)
2. The Control Room crew MUST be notified prior to performance of all work activities that will actuate Control Room annunciators. The Control Room SRO is responsible to ensure that the Reactor Operators are aware of all expected annunciators.
3. All expected annunciators caused by routine operator rounds MUST be identified and the Reactor Operator notified prior to the manipulation that causes the annunciator to alarm. Three way communications of these alarms may occur at the time of, or just prior to the annunciator being received.
4. Expected annunciators are acknowledged by one of the Reactor Operators. The Reactor Operator announces the alarm to the Control Room SRO and conveys that it is expected. The Control Room SRO repeats back the alarm and the acknowledging RO completes the third leg of the communication.
5. If the expected annunciator is due to surveillance or maintenance activity and it is expected to annunciate more than one time, the Control Room SRO can authorize not announcing this annunciator to the crew repeatedly. When the activity causing the alarm is completed, a member of Control Room crew shall announce to the crew that the activity is complete and all further alarms will be unexpected.

509.4.1.2 Unexpected Annunciators

1. Unexpected annunciators are acknowledged by one of the Reactor Operators. The reactor Operator announces the annunciator to the Control Room. The RO gives the noun description. The Control Room SRO repeats back the alarm and the acknowledging RO completes the third leg of the communication. The Control Room SRO is responsible for assuring the other RO on the unit is aware of significant unexpected annunciators.
2. The associated annunciator response shall be referenced for all unexpected alarms during normal operations.

509.4.1.3 Annunciator Response During Abnormal and Emergency Conditions

Abnormal and emergency conditions are defined as entry into any EP or AP, and any unplanned, rapid load reduction or plant shutdown.

1. Control Room SRO permission is required for reset of first-out annunciators.
2. When several simultaneous annunciators come in during abnormal / emergency operations, the operators scan the annunciators and announce any that are unexpected or unexplained for the existing off normal/emergency condition.
3. Annunciator response procedures shall be utilized on unexpected or unexplained annunciators to ensure all necessary actions are taken. The timing of reference to the annunciator response procedures may vary depending on control room crew priorities.
4. On a plant trip, multiple alarms will be received; immediate actions are taken in response to the trip. When plant conditions allow, the annunciators are acknowledged. The Control Room crew discuss/review the status of annunciators, and evaluate whether all are expected or unexpected for the existing plant conditions and refer to the applicable alarm response as necessary.

Question: 05-68

1 Pt(s)

Given the following:

- Unit 1 is in Mode 3.
- Reactor coolant system (NCS) pressure is 2750 psig.

What is the required Tech Spec action for this condition?

A. Reduce NCS pressure to less than 2485 psig within 5 minutes.

B. Reduce NCS pressure to less than 2735 psig within 5 minutes.

C. Reduce NCS pressure to less than 2485 within 1 hour.

D. Restore NCS pressure to less than 2735 within 1 hour.

Question: 05-68 ***Answer: B***

LEVEL:	RO/SRO

K/A	Generic	Title	Conduct of Operations
	2.1.33	**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	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	
Objectives	
REFERENCES	REFERENCE T.S. 2.0 safety limits.
Author	JKS
Time	11/8/2005 1:23 PM

Distracter Analysis:

The actual requirements is within 5 minutes in MODE 3,4,5 and within 1 hour in Modes 1, 2. 2485 is the highest "normal" type setpoint (lift setpoint of the safety reliefs)

A. Incorrect: Right action time, wrong pressure
B. Correct
C. Incorrect: wrong pressure , and wrong time frame this would be ok for mode 1 or 2.
D. Incorrect: right pressure wrong time frame (see above)

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

In MODES 1 and 2, the combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature, and pressurizer pressure shall not exceed the limits specified in the COLR for four loop operation; and the following SLs shall not be exceeded:

2.1.1.1 The departure from nucleate boiling ratio (DNBR) shall be maintained ≥ 1.14 for the WRB-2M CHF correlation.

2.1.1.2 The peak fuel centerline temperature shall be maintained < 5080 degrees F, decreasing 58 degrees F for every 10,000 MWd/mtU of fuel burnup.

2.1.2 RCS Pressure SL

In MODES 1, 2, 3, 4, and 5, the RCS pressure shall be maintained ≤ 2735 psig.

2.2 SL Violations

2.2.1 If SL 2.1.1 is violated, restore compliance and be in MODE 3 within 1 hour.

2.2.2 If SL 2.1.2 is violated:

2.2.2.1 In MODE 1 or 2, restore compliance and be in MODE 3 within 1 hour.

2.2.2.2 In MODE 3, 4, or 5, restore compliance within 5 minutes.

Question: 05-68

1 Pt(s) Given the following conditions:

- Unit 1 preparing to perform a reactor startup
- All shutdown banks fully withdrawn
- All control banks fully inserted

The following milestone times are noted:

December 6

0100 Estimated Critical Position approved for the startup
0300 Began control bank withdrawal to bring the reactor critical
0400 Reactor critical
1200 Reactor power is 1%

December 7

1000 Reactor power is 100%

From 0100 on December 6th to 1000 on December 7th what are the minimum number of surveillances that will satisfy the technical specification requirements for Shutdown and Control Rod Bank insertion limits?

References Provided

	Shutdown Banks	Control Banks
A.	2	2
B.	2	3
C.	3	3
D.	3	4

Question: 05-68 *Answer: B*

LEVEL:	RO/SRO

K/A	Generic	Title	Conduct of Operations
	2.1.33	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	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-IC-IRE rev 30
Objectives	19
REFERENCES	REFERENCE Provided: T.S. 3.1.5, T.S. 3.1.6
Author	RJK
Time	8/12/2005 3:15 PM 65 minutes

Distracter Analysis:

Shutdown banks begin when the first control bank is not fully inserted (0300) then the frequency is every 12 hours. The minimum would be 0300 + 12 = **1500** +12 = **0300** +12 = 1500. Two times during the first 24 hours after 12/6 0300. A third one is NOT required until 12/7 1500.

Control Banks begin within the 4 hours before the reactor is critical. Added to the first surveillance would be 0400 +12 = **1600** +12 = **0400** +12 = 1600. Two additional times in the first 24 hours after 12/6 0400. A fourth one is NOT required until 12/7 1600.

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

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
14	State the number and arrangement of Control Banks and Shutdown Banks in the core.			X	X	
15	State the rod speeds for various modes of operation			X	X	X
16	Describe the basic operation of IRE during startup and shutdown			X	X	
17	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	
18	State from memory, the immediate actions required per AP/1/A/5500/015 Rod Control Malfunction			X	X	X
19	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
20	State from memory, the immediate actions required per AP/1/A/5500/014 Control Rod Misalignment			X	X	X
21	Given a set of specific plant conditions and all required procedures, use the rules of usage and outstanding PPRBs to identify the correct procedure flow path			X	X	X
22	Explain the reason for immediately tripping the reactor on multiple dropped rods			X	X	X
23	Describe the operation of the Motor Generator (MG) Sets during startup, shutdown, and parallel operations including the electrical relationships between the MG sets and the Reactor Trip Breakers, and the purpose of the MG set overcurrent relays.	X	X			

Hour: 3 Hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Shutdown Bank Insertion Limits

LCO 3.1.5 Each shutdown bank shall be within insertion limits specified in the COLR.

APPLICABILITY: MODE 1,
MODE 2 with any control bank not fully inserted.

------------------------------NOTE------------------------------
This LCO is not applicable while performing SR 3.1.4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within limits.	A.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Restore shutdown banks to within limits.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	Verify each shutdown bank is within the limits specified in the COLR.	12 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Control Bank Insertion Limits

LCO 3.1.6 Control banks shall be within the insertion, sequence, and overlap limits specified in the COLR.

APPLICABILITY: MODE 1,
MODE 2 with $k_{eff} \geq 1.0$.

--------------------------------NOTE--------------------------------
This LCO is not applicable while performing SR 3.1.4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank insertion limits not met.	A.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	OR	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.2 Restore control bank(s) to within limits.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Control bank sequence or overlap limits not met.	B.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	OR	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.2 Restore control bank sequence and overlap to within limits.	2 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.6.1	Verify estimated critical control bank position is within the limits specified in the COLR.	Within 4 hours prior to achieving criticality

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.6.2	Verify each control bank insertion is within the limits specified in the COLR.	12 hours <u>AND</u> Once within 4 hours and every 4 hours thereafter when the rod insertion limit monitor is inoperable
SR 3.1.6.3	Verify sequence and overlap limits specified in the COLR are met for control banks not fully withdrawn from the core.	12 hours

1. Procedure

1.1 Within four hours prior to going critical verify estimated control bank position is within the limits specified in the COLR by verifying the following have been completed: (SR 3.1.6.1)

_____ 1.1.1 A predicted critical rod position has been determined by one of the following:

☐ OP/0/A/6100/006 (Reactivity Balance Calculation)

OR

☐ PT/0/A/4150/019 (1/M Approach To Criticality)

_____ 1.1.2 A copy of the REACTBAL PC program or manual ECP calculation has been attached to this enclosure.

_____ 1.1.3 The predicted critical rod position is within the control bank insertion limit specified in the CORE OPERATING LIMITS REPORT. (TS 3.1.6)

_____ 1.1.4 The predicted critical rod position is within the administrative control bank withdrawal limits to maintain MTC within limits. (TS 3.1.3)

_____ 1.2 Verify all shutdown banks (A, B, C, D and E) are within the limits specified in the COLR prior to the withdrawal of any control rods. (SR 3.1.5.1)

***Question*: 05-69**

1 Pt(s) Given the following:

- Unit 1 and 2 are operating at 100%
- One single steam generator tube fully shears on each unit
- The crews are responding per EP/1(2)/A/5000/E-3, Steam Generator Tube Rupture, preparing to perform the initial reactor coolant system cooldown to the required core exit thermocouple temperature using steam dumps.

Based on the differences between Unit 1 and Unit 2 steam generator design, which unit would have a lower leakage rate and which unit would reach the target temperature first?

(Assume identical cores and steam dump performance.)

A. Unit 1 would have less leakage and Unit 1 would reach required core exit temperature first.

B. Unit 1 would have less leakage and Unit 2 would reach required core exit temperature first.

C. Unit 2 would have less leakage and Unit 1 would reach required core exit temperature first.

D. Unit 2 would have less leakage and Unit 2 would reach required core exit temperature first.

Question: 05-69 ***Answer: A***

LEVEL:	RO/SRO

K/A	Generic	Title	Equipment Control
	2.2.3	Description	(multi-unit) Knowledge of the design, procedural, and operational differences between units. **(CFR: 41 / 43 / 45)**
		Importance	3.1/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-STM-SG rev 32 pg 35
Objectives	10
REFERENCES	Lesson plan
Author	RJK
Time	8/3/2005 10:33 AM 23 minutes

Distracter Analysis: Unit 1 has smaller tubes and larger surface area, therefore the leakage would be less and assuming dumps are fully opened for the initial NC cooldown, Unit 1 would cooldown faster.

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

Question: 05-69

1 Pt(s) What is the approximate difference between Unit 1 and Unit 2 average reactor coolant temperature (Tavg) at 100% power?

A. 0.5

B. 1.5

C. 2.5

D. 3.5

Question: 05-69 ***Answer: C***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Equipment Control
	2.2.3	**Description**	(multi-unit) Knowledge of the design, procedural, and operational differences between units. **(CFR: 41 / 43 / 45)**
		Importance	3.1/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-IC-IRX rev 22
Objectives	3
REFERENCES	Lesson plan
Author	RJK
Time	8/3/2005 10:33 AM 23 minutes

Distracter Analysis: Due to the S/G changes, Unit 1 and 2 operate with different final 100% power Tavgs. The Tref program is established by a linear increase with turbine impulse pressure. Unit 1 is 557 – 585 Unit 2 is 557 – 587.5.

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

Lesson plan page 8

C. Tref Program Circuit

1. Generates T_{ref} signal proportional to turbine load (programmed linearly with impulse pressure) from 557°F to 585°F for Unit 1 and 557 to 587.5 for Unit 2.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of IRX.			X	X	X
2	Describe the purpose and interconnections of the functional blocks of IRX per the training handout.			X	X	X
3	List the inputs to IRX and explain where each is used, including inputs to other systems.			X	X	X
4	List and describe the interlocks associated with IRX.			X	X	X
5	Given the direction of failure of any input signal, predict the resulting direction of rod motion.			X	X	X

9. The Compensated T_{avg} signal is then compared toT_{ref} to give a Temperature Error signal. This signal goes to indication (Temp Error meter on MC-1) and rod control system (tells how fast and in what direction to move the rods).

B. Turbine Impulse Pressure (**OBJ 3**)

1. Measured at first stage impulse chamber. Impulse pressure is nearly linear with power, so it provides a good indication of how much heat the turbine is demanding. This tells how much heat the core should be producing.
2. Directly proportional to turbine load
3. Channel I used for turbine power input to reactor control system and for protection system input (P-13).
4. Signal goes to the following thru an isolation amp for reactor control:
   a) Plant Computer for indication.
   b) MCB Indication: on MC-1.
   c) Reactor Control System receives filtered signal for:
      1) T_{ref} Program
      2) Power Mismatch Circuit
5. Filter
   a) Noise filtration
   b) Keeps short pressure transients from generating a rod motion signal.

C. Tref Program Circuit

1. Generates T_{ref} signal proportional to turbine load (programmed linearly with impulse pressure) from 557°F to 585°F for Unit 1 and 557 to 587.5 for Unit 2.
2. T_{ref} output signal
   a) Plant Computer for indication.
   b) Steam Dump Control - load rejection controller where it is compared to Auct High Tavg.
   c) T_{avg}/T_{ref} Recorder on MC-1.
   d) Tref/Tauct Hi/Lo Alarm - Alarm at <u>plus or minus</u> 3°F difference (AD2, A-4).
3. T_{ref} Filter - Acts as Lag circuit for transient suppression. Has a 30 sec lag.

4. Purpose of heatup and cooldown curves is to prevent non-ductile failure of the vessel.
5. Curves based on RT_{NDT}.

   RT_{NDT} Reference Temperature (nil-ductility temperature).

   a) Items considered in curves.
      1) Limiting RT_{NDT}
      2) Delta RT_{NDT}
         (a) Radiation exposure
         (b) Copper Content
      3) Instrument Errors
   b) Delta RT_{NDT} updated by surveillance program.

4.2 System Description and Operation (Refer to Figure 2)

A. Equipment Description

1. System Parameters (Obj. #2)
   a) 40 year design life
   b) System pressure
      1) Normal - 2235 psig
      2) Design - 2485 psig
      3) Safety Limit - 2735 psig
   c) System Temperatures
      1) At 100% power

	Unit 1	Unit 2
T-Hot	614.2°F	616.7°F
T-Cold	556.3°F	558.3°F
T-Avg	585.1°F	587.5°F
Core ΔT	57.9°F	58.4°F

      2) At Hot Zero Power (HZP)

         T-Avg = T-Hot = T-Cold = 557°F (Both Units)
   d) Other Information
      1) Flow Design Flow - 101,000 gpm per pump

         Total flow - 195.5 X 10^6 lbm/hr

Question: 05-70

1 Pt(s) Unit 2 is in Mode 3 preparing for startup per OP/2/A/6100/001 (Controlling Procedure for Unit Startup) with the following:

- Current reactor coolant (NC) boron concentration = 1600 ppm
- Estimated Critical Boron concentration = 1275 ppm

A reactor makeup water pump flow test is about to be commenced which is expected to reduce boron concentration to approximately 1580 ppm. Which one of the following requirements <u>must</u> be satisfied <u>prior</u> to the test?

A. All four reactor coolant pumps are in service.

B. Pressurizer boron concentration is within 50 ppm with the NC system concentration.

C. Verify final boron concentration after the test remains greater than 100 ppm above the required shutdown margin concentration.

D. All shutdown banks fully withdrawn.

Question: 05-70 *Answer: D*

LEVEL:	RO/SRO

K/A	Generic	Title	Equipment Control
	2.2.1	Description	Ability to perform pre-startup procedures for the facility, including operating those controls associated with plant equipment that could affect reactivity. **(CFR: 45.1)**
		Importance	3.7/3.6

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	
Objectives	
REFERENCES	OP/1/A/6100/001 rev 210
Author	RJK
Time	8/3/2005 11:04 AM 28 minutes

Distracter Analysis: per the procedure L&Ps, the only requirement is to ensure all SD banks are withdrawn.

A. **Incorrect**: There is no requirement for this, but sounds like a requirement to avoid possible mixing issues with NC Boron concentration.
B. **Incorrect**: This can be waived in Mode 3 per L&P #5 see below.
C. **Incorrect**: No such requirement but it does seem reasonable that you would not want to dilute below SDM requirements. (ECB is still above SDM)
D. **Correct**:

Limits and precautions

2.5 During Modes 1 & 2 and prior to diluting for ECB, the PZR boron concentration should be within ± 50 ppm of the NC System boron concentration. During Modes 3, 4, 5, 6, or No Mode, PZR boron concentration is <u>NOT</u> required to be maintained relative to the NC System provided the following conditions are met:

- PZR outflow can be verified
- NC System boron concentration > 100 ppm over the required SDM

2.13 During any planned boron dilution operations in Mode 3, all shutdown banks shall be fully withdrawn. After refueling, the startup will be controlled by procedures PT/0/A/4150/001 (Controlling Procedure for Startup Physics Testing) and PT/0/A/4150/001J (Zero Power Physics Testing).

Controlling Procedure For Unit Startup

1. Purpose

1.1 To outline the steps necessary to take the plant from cold shutdown to 15% full power.

1.2 To provide a procedure for startup from any shutdown condition.

2. Limits and Precautions

2.1 NC System heatup rate of 50°F in any one hour period is the heatup rate limit for normal operation. Under abnormal or emergency conditions, the Tech Spec NC System heatup limit of 60°F in any one hour period shall **NOT** be exceeded.

2.2 Heatup rate of the PZR should **NOT** exceed 80°F in any one hour period. SLC 16.5-4 heatup limit of 100°F in any one hour period shall **NOT** be exceeded.

2.3 A stable startup rate of 0.5 dpm is administratively recommended. Do **NOT** exceed a stable startup rate of 1 dpm. When approaching the POAH, a startup rate of < 0.2 dpm is recommended; this rate should **NOT** be exceeded until the turbine is placed on line.

2.4 Overlap between the source and intermediate ranges and between intermediate and the power ranges shall **NOT** be less than 1 decade.

2.5 During Modes 1 & 2 and prior to diluting for ECB, the PZR boron concentration should be within ± 50 ppm of the NC System boron concentration. During Modes 3, 4, 5, 6, or No Mode, PZR boron concentration is **NOT** required to be maintained relative to the NC System provided the following conditions are met:

- PZR outflow can be verified
- NC System boron concentration > 100 ppm over the required SDM

2.6 With the reactor critical at low power, steam withdrawal from the S/Gs may be used only for auxiliary uses (i.e., warm steam lines, operate air ejectors, supply gland steam) or for controlling heatup rate via the steam dumping system. Caution should be used to ensure the steam drain is slow.

2.7 Ensure reactivity management guidance outlined in OMP 1-20 (Reactivity Management) is followed during reactor startup and power operation.

2.8 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.

2.9 If the temperature difference between the PZR and the spray fluid is greater than 260°F, spray should **NOT** be initiated. A ΔT of 320°F shall **NOT** be exceeded. The following control room indications may be used to determine the ΔT between the PZR steam space and the PZR spray fluid:

- OAC C1P1360 (PZR STM TEMP - PZR SPRAY A TEMP D/T)
- OAC C1P1361 (PZR STM TEMP - PZR SPRAY B TEMP D/T)
- OAC C1P1362 (PZR STM TEMP - HX Charging TEMP D/T)
- OAC C1P1363 (PZR STM TEMP - ND PMP B Discharge TEMP D/T)
- OAC C1P1364 (PZR STM TEMP - ND PMP A Discharge TEMP D/T)
- 1NCP5380 (Pressurizer Vapor TEMP) (1MC10)
- 1NCP5390 (PRESS Spray Line Temp Loop A) (1MC10)
- 1NCP5400 (PRESS Spray Line Temp Loop B) (1MC10)
- 1NVP5100 (Regen HX Chrg TEMP) (1MC5)
- 1NDCR5070 (ND HX 1B Inlet & Outlet TEMP) (1MC7)
- 1NDCR5060 (ND HX 1A Inlet & Outlet TEMP) (1MC7)

2.10 Observe the limitations of TS Table 3.4.12-1 (Reactor Coolant Pump Operating Restrictions For Low Temperature Overpressure Protection) for NC pump operation during LTOP conditions.

2.11 The NC System temperature should **NOT** exceed 160°F until at least one NC pump is in service during solid operation of the NC System.

2.12 The Shutdown Margin Monitor/Boron Dilution Mitigation System should be monitored during heatup and/or when reactivity changes cause the count rate to increase. Failure to reset the "ALARM SETPOINT" prior to the count rate exceeding this setpoint will result in a system activation causing borated water from the FWST to be injected into the NC System.

2.13 During any planned boron dilution operations in Mode 3, all shutdown banks shall be fully withdrawn. After refueling, the startup will be controlled by procedures PT/0/A/4150/001 (Controlling Procedure for Startup Physics Testing) and PT/0/A/4150/001J (Zero Power Physics Testing).

2.14 During heatup in Mode 3 the ΔT between the PZR and the NC loops should be maintained approximately 100°F to provide adequate subcooling while minimizing PZR and spray fluid ΔT.

2.15 When changing reactor power, refer to Unit One R.O.D Section 2.4 (Fuel Maneuvering Limits) for allowable rate changes.

***Question*: 05-71**

1 Pt(s) Given the following:

- Unit 1 is operating at 100%
- The feedwater temperature input to the thermal power best estimate (TPBE) was incorrectly calibrated to 7°F less than actual feedwater temperature
- Calibration of the power range nuclear instruments (NIs) are being performed

How will TPBE power compare to actual thermal power and how will adjustment of the NIs be affected using the calculated value of TPBE?

A. TPBE is lower than actual power.
NI adjustment will be less conservative.

B. TPBE is higher than actual power.
NI adjustment will be less conservative.

C. TPBE is lower than actual power.
NI adjustment will be more conservative.

D. TPBE is higher than actual power.
NI adjustment will be more conservative.

Question: 05-71 ***Answer: D***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Equipment control
	2.2.34	**Description**	Knowledge of the process for determining the internal and external effects on core reactivity. **(CFR: 43.6)**
		Importance	2.8/3.2

SOURCE	Bank
LEVEL of KNOWLEDGE	Comprehension
Lesson	TPBE
Objectives	3
REFERENCES	
Author	JKS
Time	

Distracter Analysis: Due to FFW temperature being 7 degrees higher than indicated/calibrated, TPBE calculation will indicate higher than actual thermal power. This will cause NI calibration to result in setpoints that are more conservative (i.e. closer to the trip setpoint).

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

***Question*: 05-71**

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1 Pt(s) After a core reload, what evolution is completed to ensure <u>actual</u> core reactivity is known?

A. Boron diluted to the estimated critical boron prior to initial criticality.

B. Reaching criticality within the allowable window of the estimated critical position.

C. Post criticality zero power physics testing.

D. Power increased to the point of adding heat.

Question: 05-71 *Answer: C*

LEVEL:	RO/SRO

K/A	Generic	Title	Equipment control
	2.2.34	Description	Knowledge of the process for determining the internal and external effects on core reactivity. **(CFR: 43.6)**
		Importance	2.8/3.2

SOURCE	New
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-ADM-RXM
Objectives	6
REFERENCES	NSD 304 rev 013
Author	RJK
Time	8/3/2005 12:16 PM 59 minutes

Distracter Analysis: Per the statements in the shutdown area of operations in NSD 304, the specific measurements of the reactivity effects on the core are made using the Zero Power Physics Testing procedure.

A. **Incorrect**: The word "ESTIMATE" should give you a clue that this is not the time. But the dilution does give the control room a specific reactivity point per the procedure.
B. **Incorrect**: While we hope the critical point is made, there is a large window within which we hope to go critical.
C. **Correct**:
D. **Incorrect**: Too late.

Shutdown Operations

Scope: The following controls encompass all plant operations with reactor coolant system temperatures and pressures below "No Load" (i.e., hot zero power) with the reactor subcritical.

New Cores:

During core reload, special controls are in place in accordance with 304.6.6.1. After core reload, actual core reactivity is unknown prior to Zero Power Physics Testing. New cores have high "excess reactivity" and would be critical at relatively high boron concentrations, even with all rods inserted.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Define Reactivity Management per NSD 304 (Reactivity Management).	X	X	X	X	X
2	State the roles and responsibilities of the following personnel concerning reactivity management. 1. Operations Shift Manager 2. Nuclear Shift Supervisor 3. Reactor Operator 4. Non-Licensed Operator 5. Shift Work Manager/STA	X	X			
3	State the roles and responsibilities for the following personnel concerning reactivity management. 1. Operations Shift Manager 2. Nuclear Shift Supervisor 3. Reactor Operator 4. Shift Work Manager/STA			X	X	X
4	State the importance of effective communications between work groups for activities affecting core reactivity.	X	X	X	X	X
5	Identify reactivity controls applicable to the NLO.	X	X			
6	Identify special reactivity controls as described in NSD 304 for the following plant evolutions. 1. Start-up Operations 2. Power Operation 3. Shutdown Operations 4. Zero Power Physics Testing 5. Fuel Handling Activities			X	X	X
7	Evaluate lessons learned from industry events concerning reactivity management	X	X	X	X	X
8	Identify the available instrumentation and computer displays used to assess reactor status.			X	X	X

Verify cycle specific constants are incorporated into applicable software for the particular stage in core life.

- Power Ascension/Power Reduction:
  1. The effects of a positive moderator temperature coefficient (MTC) shall be communicated by a Reactor Engineer to the Operations shift personnel. Simulator training shall be used to prepare the crew for operation with a positive MTC.
  2. All power maneuvers shall be executed per approved procedures.
  3. All operating limits (fuel maneuvering limits, rod insertion limits, rod withdrawal limits, etc.) shall be observed.
  4. Indication of reactor power using neutron monitoring system shall be compared to alternate indications to verify consistency. If unexplained discrepancies exist between reactor power level indications, power ascension shall cease until the situation is investigated and resolved. Approval of the Station Manager/designee or PORC (see NSD 308) is required to resume power ascension.
  5. In the event of an unexplained change in reactivity, power ascension shall cease. Limitations on continued operation shall be based upon Technical Specifications and approval of the Station Manager or designee is required to resume power ascension.
- Steady State Operations:
  1. Core thermal power shall be monitored to ensure that it does not exceed limits.
  2. Core power shall be checked by independent indications (i.e., reactor power, electrical output, thermal power indication). If an unexplained discrepancy exists between power level indications the discrepancy shall be investigated. In the event of an anomalous reactivity indication, the reactor power level shall be maintained or reduced as directed by the Operations Shift Manager or Shift Supervisor until the situation is investigated and resolved. The Operations Shift Manager should seek the assistance of a Reactor Engineer or Shift Technical Advisor (STA) for recommendations concerning the anomalous indication.

Deleted:

Deleted: d

Deleted: Work

Deleted: Manager

304.6.6.4 Shutdown Operations

Scope: The following controls encompass all plant operations with reactor coolant system temperatures and pressures below "No Load" (i.e., hot zero power) with the reactor subcritical.

Special attention should be given to control of and the effects of "locked out" or "out of service" computer points.

Verify cycle specific constants are incorporated into applicable software for the particular stage in core life.

- Shutdown Margin as defined by Technical Specifications shall be maintained at all times. Procedural controls shall be in place to provide guidance on control rod position and boron concentration in the event of an unexplained change in reactivity or shutdown margin.
- Operators shall make only one positive reactivity addition at a time. This applies to:
  - Control rod withdrawal,
  - RCS deboration, and
  - RCS temperature changes made with the intention of adding reactivity.

  This does not preclude testing or other activities which have the potential to cause small changes in temperature or boron concentration where the resultant positive reactivity change would be small in relation to the shutdown margin.
- Increased monitoring of the source range instrumentation shall be conducted during conditions or evolutions affecting reactivity.

New Cores:

During core reload, special controls are in place in accordance with 304.6.6.1. After core reload, actual core reactivity is unknown prior to Zero Power Physics Testing. New cores have high "excess reactivity" and would be critical at relatively high boron concentrations, even with all rods inserted.

- Licensed Operators and all plant employees are to place special emphasis upon practices designed to prevent reactivity excursions for new cores, including:

  Controls to ensure that the new core is loaded as designed

  Controls to ensure required nuclear instrumentation is in place

  Controls to ensure that required boron concentration is maintained in the core and adjoining systems

  Controls to prevent potential "slugs" of unborated water from entering the core and to prevent boron dilution (ref. SOER 94-02_.

- Applicable management, outage managers, maintenance personnel, engineers, and Licensed Operators are to ensure effective evaluation of situations which could increase the risks or consequences of reactivity excursions for new cores, such as:

  Changes in LPI/ND restoration, filling, and alignment

  Changes in mid-loop operations

  Activities in or above the Refueling/Fuel Transfer Canal when the reactor head is off

  Situations which reduce the number of fission product barriers with the new core in place (e.g., an open containment equipment hatch with the reactor vessel head removed)

  Other changes potentially affecting the "Reactivity Control" Key Safety Function for Shutdown Risk Management (ref. NSD 403)."

The primary focus of these controls is a new, beginning-of-cycle (BOC) reload core. However, any forced outage during a cycle may still involve the potential for a reactivity excursion, therefore, these controls shall still be addressed, as applicable.

Reduced Inventory:

- Every group is responsible for being familiar with the possible effects of their activities on reactivity. If the effects are unknown or if questions arise concerning the activity, then work shall not be performed until all problems are resolved and effects are known.
- Licensed Operators shall be briefed about reactivity management concerns during periods of reduced inventory prior to entering reduced inventory conditions.
- Licensed Operators shall be aware of all activities that may affect reactivity and the consequences of these affects. Consideration should be given to increased use of pre-job briefings during periods of reduced inventory.

304.6.6.5 Zero Power Physics Testing

- ZPPT shall be treated as Infrequently Performed Test Evolutions (IPTE) and controlled as such. (see NSD 213)
- One SRO and one RO shall be dedicated to ZPPT, with no concurrent responsibilities.
- A Qualified Reactor Engineer shall be the Test Coordinator during the ZPPT.
- There shall be at least one (1) "data analyst" on each shift of ZPPT to assist the test coordinator.
- The Test Coordinator should be located in the control room with direct line-of-sight and unaided voice communications with the dedicated SRO and RO.

Question: 05-72

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1 Pt(s) A Duke Energy radiation worker current year Total Effective Dose Equivalent (TEDE) is 1700 mrem. If he is expected to receive 50 mrem per hour during a repair job, how many hours can he work before reaching the Duke Basic Administrative Control limit? (Assume all appropriate extensions have been approved)

A. 2 hours

B. 4 hours

C. 6 hours

D. 8 hours

Question: 05-72 ***Answer: C***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Radiation Control
	2.3.1	**Description**	Knowledge of 10 CFR: 20 and related facility radiation control requirements **(CFR: 41.12 / 43.4 / 45.9 / 45.10)**
		Importance	2.6/3.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-RAD-HP rev 20
Objectives	2
REFERENCES	Duke GET study material for Radiation worker training
Author	RJK
Time	8/3/2005 12:57 PM 19 minutes

Distracter Analysis: Straight from the

A. **Incorrect**: This brings it to the Duke Alert level only. But a confused person may ignore the extensions. 1800 mrem

B. **Incorrect**: This brings it to the Duke Exclude level only. But the same confused person may ignore the extensions. 1900 mrem

C. **Correct**: 1700 + (50 X 6) = 2000

D. **Incorrect**: You are too high and it is not allowed. 2100 mrem

Conditions of Exposure	NRC(10CFR20) Limits	DE Basic Administrative Control	DE Maximum Administrative Control
Adult Total Effective Dose Equivalent (TEDE)	5.0 rem/year	2.0 rem/year	5.0 rem/year

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Define the following terms: Deep Dose Equivalent (DDE) Committed Dose Equivalent (CDE) Committed Effective Dose Equivalent (CEDE) Total Effective Dose Equivalent (TEDE) Shallow Dose Equivalent (SDE) Lens Dose Equivalent (LDE)			X	X	
2	List the 10CFR20 and Duke Energy Administrative External and Internal Dose Limits for the following: TEDE Individual Organ or Tissue Lens of the Eye Skin or any Extremity Declared Pregnant Woman Minors Public Planned Special Exposures (PSE)			X	X	
3	State the type of exposure each of the following terms relates to: Annual Limit on Intake (ALI) Derived Air Concentration (DAC)			X	X	
4	List the mathematical relationship between DAC-hours and ALI, and between ALI and TEDE.			X	X	
5	Describe how internal dose can occur.			X	X	

10CFR20 Limits / Duke Energy Limits (Obj. #2)

Conditions of Exposure	NRC(10CFR20) Limits	DE Basic Administrative Control	DE Maximum Administrative Control
Adult Total Effective Dose Equivalent (TEDE)	5.0 rem/year	2.0 rem/year	5.0 rem/year
Adult Lens Dose Equivalent (LDE) (Lens of Eye)	15.0 rem/year		15.0 rem/year
Adult Shallow-Dose Equivalent (SDE) 1. Skin 2. Extremities	50 rem/year		50 rem/year
Any Internal Organ (for example, thyroid)	50 rem/year		50 rem/year
Minors	10% of Adult and may not enter High Rad Area		10% of Adult and may not enter High Rad Area
Public	100 mrem		
Declared Pregnant Woman (TEDE)	500 mrem /pregnancy	50 mrem/month	500 mrem /pregnancy
If the radiation worker is found to have exceeded, or is within 50 mrem of the 500 mrem allowed by the time the pregnancy is declared, a limit of 50 mrem for the remainder of the pregnancy will be applied.			
Planned Special Exposure	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.

***Question*: 05-73**

1 Pt(s) Which of these Catawba dose reduction practices is effective in reducing the "Source Term" for radiation workers?

A. Minimize the workers time on the job site.

B. Reduce the size of primary system filters.

C. Install temporary shielding around the job site.

D. Use low exposure waiting areas to stage equipment.

Question: 05-73 *Answer: B*

LEVEL:	RO/SRO

K/A	Generic	Title	Radiation Control
	2.3.10	Description	Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure. **(CFR: 43.4 / 45.10)**
		Importance	2.9/3.3

SOURCE	BANK (GET CBP questions)
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-RAD-HP rev 20
Objectives	10
REFERENCES	GET exam bank
Author	RJK
Time	8/3/2005 1:26 PM 19 minutes

Distracter Analysis: All these are admirable efforts to reduce worker dose, but the SOURCE of the radiation is reduced by the use of better filters.

A. **Incorrect**: Time is reduced not the source.
B. **Correct**:
C. **Incorrect**: It's a shield reduction not a source.
D. **Incorrect**: It's a shield/distance reduction not a source.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
10	Describe how the ALARA concept is maintained at CNS. Summarize the specific responsibilities outlined in the System ALARA Manual Section II. A. Describe the ALARA philosophy and goals. B. Summarize the concepts of ALARA. Summarize the operational ALARA Program per System ALARA Manual Section III. A. Summarize the responsibility of the station personnel. • Sr. Vice-President NGD • Site Vice-President and Staff • Station Radiation Protection Manager • System Radiation Protection Manager • System ALARA Coordinator • Radiation Protection Technicians • ALARA Group • Section Managers • Job Sponsors • Supervision • Individual Employees B. Explain the purpose of the ALARA Planning Component. C. Explain the purpose of the Radiation Field Reduction Component and evaluate the importance of each of the five elements of the "Source Term Reduction Element". • Hot Spot Identification, Tracking & Elimination • Primary Chemistry Controls • Primary System Filtration Downsizing • Cobalt Reduction • Fuel Reliability			X X	X X	

5.5 Source Term Reduction

The phrase "source term reduction" means the removal or reduction of area dose rates by actions such as:

- Removing the component that is the source of radiation
- Reducing primary system filter sizes
- Flushing and purging
- Using controls to minimize input of debris into piping during maintenance
- Maintaining proper chemistry in the primary systems

Source term reduction is being used in the plant and is a very efficient means of helping to maintain dose ALARA.

Even when all of the methods of dose reduction we have discussed are in use, you must be alert to changing radiological conditions.

Things that can cause these changes are radiography (testing of pipes or welds with radioactive sources), changes in reactor power level, and changes in system lineups. If abnormally high radiation levels are noticed, you should leave the area immediately and notify RP.

It is important to note that the primary root cause for most overexposures in U.S. utilities is individuals not being aware of initial and/or changing radiological conditions. (SOER 85-03 and SOER 01-1)

As a result of lessons learned from industry events, certain tasks require a more comprehensive pre-job planning as part of the overall ALARA effort. An ALARA pre-job planning meeting should include representatives from all parties that will be involved with the job. The purpose of the meeting is to ensure the scope of the job is clearly understood and to identify potential dose reduction opportunities.

The meeting should be scheduled well in advance of the job to ensure there is sufficient time to evaluate and act on dose reduction opportunities identified.

1. Initial Conditions

_____ 1.1 Review the Limits and Precautions.

_____ 1.2 Verify normal letdown has been secured per OP/1/A/6200/004 (Residual Heat Removal System).

_____ 1.3 Verify letdown is in service from ND per OP/1/A/6200/004 (Residual Heat Removal System).

2. Procedure

NOTE:
1. Performance of this enclosure should be coordinated with the draining of penetration M-347 per OP/1/A/6200/020 (Unit 1 Venting and Draining Procedure For Type "C" Leak Rate Tests). Flushing of the letdown line should occur prior to the penetration being drained.
2. Steps 2.1 through 2.8 may be performed in any order.

_____ 2.1 Notify Radwaste Chemistry that the Letdown line and the Regenerative Heat Exchanger are to be flushed and drained to the Containment Floor & Equipment sump.
Person notified ______________________________

_____ 2.2 Notify RP ALARA group to establish flush termination criteria.
Person notified ______________________________

_____ 2.3 Coordinate the flushing and draining with Radiation Protection.
Person notified ______________________________

_____ 2.4 Verify 1NV-2A (NC Letdn To Regen Hx Isol) (1MC10) is closed.

_____ 2.5 Place the RMWST in recirc per OP/1/A/6200/012 (Reactor Makeup Water).

_____ 2.6 Open 1NB-459 (RMWST Pmps Disch To Aux Bldg Flush Hdr) (AB-550, KK-50, Rm 217).

_____ 2.7 Close 1NB-460 (RMWST To Aux Bldg Flush Hdr) (AB-550, KK-50, Rm 217).

_____ 2.8 Close 1NV-17 (Letdown Hx Inlet Isol) (AB-585, JJ-52, Rm 419).

2.23 After 30 minutes, or as directed by Radiation Protection, close the following valves:

_____ _____ • 1NV-836 (Norm Letdn Test Vent)
_____ • 1NV-7 (Regen Hx Shell Side Flush Supply)
_____ • 1NV-9 (Regen Hx Shell Side Flush & Vent Isol)

2.24 Perform one of the following as directed by Radiation Protection:

_____ • **IF** previous flushing was adequate to reduce area dose rates, proceed to Step 2.38.

_____ • **IF** previous flushing was **NOT** adequate to reduce area dose rates, proceed to the following step.

_____ _____ 2.25 Ensure the pipe cap at 1NV-836 (Norm Letdn Test Vent) (CV-587, 44'-236°, PCHA) has been removed.

CAUTION: Connections made in the next two steps must be able to withstand 100 psig. {PIP 02-2120}

_____ 2.26 Installed a non-contaminated hose on the vent at 1NV-836 (Norm Letdn Test Vnt). (pipe is 3/4 inch)

_____ 2.27 Connect the opposite end of the hose to 1YM-122 (YM Hdr Test Vent) (CV-575, 41'-231°, LC).

_____ 2.28 Ensure the connections made in the previous two steps are secure.

2.29 Open the following valves to align YM water to the letdown lines and the Regenerative Hx:

_____ _____ • 1NV-836 (Norm Letdn Test Vnt)
_____ • 1YM-122 (YM Hdr Test Vent)

_____ 2.30 Open 1NV-837 (Regen Hx Letdn Drn) (CV-552, 48'-121°, PCHA) to begin flushing the letdown piping.

NOTE: For the following step, cycling is defined as closing 1YM-122, waiting one minute, then re-opening 1YM-122.

2.31 Cycle 1YM-122 (YM Hdr Test Vent) as needed to induce flow transients in the letdown line.

_____ 2.32 After 15 minutes, or as directed by Radiation Protection, close 1NV-837 (Regen Hx Letdn Drn).

***Question*: 05-74**

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1 Pt(s) Unit 1 is at 100% power with an active fire located in an area designated "SSF Dedicated Fire Area" per AP/0/A/5500/045, Plant Fire. Which one action is initially required for the affected unit?

A. Partial transfer to the auxiliary shutdown panels.

B. Partial transfer to the standby shutdown facility.

C. Complete transfer to the auxiliary shutdown panels.

D. Complete transfer to the standby shutdown facility.

Question: 05-74 ***Answer: B***

LEVEL:	RO/SRO

K/A	Generic	**Title**	Emergency Procedures/Plan
	2.4.27	**Description**	Knowledge of fire in the plant procedure. **(CFR: 41.10 / 43.5 / 45.13)**
		Importance	3.0/3.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-EI-AP45
Objectives	4 & 5
REFERENCES	AP/0/A/5500/045 rev 001
Author	RJK
Time	8/3/2005 2:01 PM 36 minutes

Distracter Analysis: Per the AP, the initial action in response to the active fire in a Unit 1 dedicated SSF area is to dispatch an operator for the Time Critical act of partially transferring to the SSF controls.

A. **Incorrect**: Only on a loss of control room
B. **Correct**:
C. **Incorrect**: Only on a fire in both control rooms
D. **Incorrect**: It would have to be a bigger problem than just a dedicated area fire, ASPs would also be affected.

	Objectives	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of AP/0/A/5500/045 (Plant Fire)			X	X	X
2	Determine if entry into AP/0/A/5500/045 (Plant Fire) is required as defined by an "active" fire in the AP.			X	X	X
3	Using the proper enclosures of AP/0/A/5500/045 (Plant Fire) determine the "affected area" and "affected unit" involved with an "active" fire.			X	X	X
4	Explain how a "partial transfer to the SSF" is accomplished as performed in AP/0/A/5500/045 (Plant Fire)			X	X	X
5	Determine the proper entry requirements into AP/1/A/5500/017 (Loss of Control Room) due to the Control Room becoming uninhabitable caused by a fire in the plant.			X	X	X

Time: 1.0 Hour

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
- Partial transfer to the SSF is time critical.
- Partial transfer isolates S/G blowdown which may affect reactor power.
- **IF** a security event is in progress, ensure the operators dispatched to the SSF use the SSF security fence.

4. **IF only Unit 1 affected, THEN perform the following:**

__ a. Dispatch operator with radio to 1ETA switchgear room to perform partial transfer to SSF. **REFER TO** AP/0/A/5500/045 (Plant Fire), Enclosure 4 (Unit 1 Partial Transfer to SSF).

__ b. Dispatch operator to SSF to standby for further instructions.

__ c. **REFER TO** Enclosure 6 (Unit 1 Equipment Affected on Transfer).

__ d. **IF** fire in the CA Pump Room, **THEN GO TO** Enclosure 18 (Response to Fire in Unit 1 CA Pump Room).

CAUTION **Failure to restore NC pump seal cooling via thermal barrier cooling or NV seal injection within ten minutes will cause damage to NC pump seals resulting in NC System inventory loss.**

__ e. **IF AT ANY TIME** KC **AND** NV seal cooling for any Unit 1 NC pump is lost, **THEN** notify operator at SSF (Ext. 5251 or 5212) to align seal injection to Unit 1. **REFER TO** AP/0/A/5500/020 (Loss Of Nuclear Service Water), Enclosure 5 (Establishing NC Makeup/Seal Injection From The SSF).

Question*: *05-75

---

1 Pt(s) Given the following events:

- Unit 2 Alert declared
- ENS sheet signed and handed to you for transmittal
- Selective Signaling and the Bell telephone lines are not functioning

Which of the following is the <u>next</u> <u>preferred</u> method for completing the initial notification to the states and county agencies?

A. TSC satellite phone

B. Control room dedicated fax

C. A company cell phone

D. State radios

Question: 05-75 *Answer: A*

LEVEL:	RO/SRO

K/A	Generic	Title	Emergency Procedures/Plan
	2.4.39	Description	Knowledge of the RO's responsibilities in emergency plan implementation. **(CFR: 45.11)**
		Importance	3.3/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	
Objectives	
REFERENCES	RP/0/A/5000/06A rev19
Author	RJK
Time	8/4/2005 8:42 AM 56 minutes

Distracter Analysis: This is a list of acceptable alternate methods to communicate with offsite agencies.

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

RP/0/A/5000/06A Enclosure 4.2 page 1of 3

NOTE:
1. The Selective Signal phone is the primary communication device. The Bell line (regular telephone) is the first back-up, the TSC Satellite Phone is the second back-up, the State Radios are the third Backup and the Briefcase Satellite Phone is the fourth back-up.
2. Information regarding back-up communication devices is located in the CNS Emergency Phone Directory (EP Group Manual Section 5.3.6).
3. Selective Signaling is an open line that is capable of connecting all agencies together at the same time. The line is always active (no dial tone). The handset has a "push to talk" button which must be pressed in order for the parties on the other end to hear you. To use the headset instead of the handset, the switch on the headset controller must be set to "headset" and the handset removed from the phone cradle.
4. Although the official transmittal time is designated as the time the first agency answers the call, it is important to assure that every effort is made to communicate to all of the agencies at the same time.
5. Authentication is not required when using the Selective Signaling phone unless requested by an Off-site Agency.

NOTE:
1. The Selective Signal phone is the primary communication device. The Bell line (regular telephone) is the first back-up, the TSC Satellite Phone is the second back-up, the State Radios are the third Backup and the Briefcase Satellite Phone is the fourth back-up.
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4. Although the official transmittal time is designated as the time the first agency answers the call, it is important to assure that every effort is made to communicate to all of the agencies at the same time.
5. Authentication is not required when using the Selective Signaling phone unless requested by an Off-site Agency.

1. Emergency Notification Transmission

☐ 1.1 Fax the notification form to the various locations using Enclosure 4.4 allowing sufficient time for the agencies to receive the fax.

☐ 1.2 Establish communications with Off-site Agencies using the Selective Signaling phone:

☐ 1.2.1 Use *5 to call all primary agencies simultaneously or each agency may be dialed individually.

☐ 1.2.2 As each agency answers, say: ***"This is Catawba Nuclear Station, Hold Please."***

	SELECTIVE SIGNAL			BELL LINE
Time	**Selective Signal #**	Agency		Individual phone numbers OR one touch dial button
	513	York County (WP/EOC)		1-803-329-1110
	116	Mecklenburg County (WP/EOC)		1-704-943-6200
	112	Gaston County (WP/EOC)		1-704-866-3300
	518	S.C. (WP/EOC)		1-803-737-8500
	314	N.C. (WP/EOC)		1-919-733-3300

☐ 1.3 **Document the time the first agency** answers the call as the Notification Time on line 2 (Notification Time & Date) of Emergency Notification Form.

☐ 1.3.1 Perform a roll call to verify that all agencies are on the line.

Question: 05-76

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1 Pt(s) The first charging pump (NV) is shutdown during safety injection termination following a small break LOCA. The following parameter trends are noted:

- Subcooling is +4 °F and slowly decreasing
- Pressurizer level is 25% and slowly decreasing
- NC pressure is 1680 psig and slowly decreasing

As control room supervisor (CRS), which of the following describes the plants response to the charging pump shutdown and your course of action to complete the safety injection termination?

A. Lower injection flow is causing pressure to decrease. Go to EP/1/A/5000/ES-1.2, Post LOCA Cooldown and Depressurization, and initiate a cooldown to maintain subcooling while continuing to terminate SI flow.

B. Lower injection flow is causing pressure to decrease. Continue in EP/1/A/5000/ES-1.1, SI Termination, and restart all ECCS pumps if subcooling is lost.

C. Lower injection flow is causing temperature to increase. Go to EP/1/A/5000/ES-1.2, Post LOCA Cooldown and Depressurization, and initiate a cooldown to maintain subcooling while continuing to terminate SI flow.

D. Lower injection flow is causing temperature to increase. Continue in EP/1/A/5000/ES-1.1, SI Termination, and restart all ECCS pumps if subcooling is lost.

Question*: *05-76 ***Answer: A***

LEVEL:	SRO

K/A	EPE009	**Title**	Small Break LOCA
	G.2.4.6	**Description**	Knowledge symptom base EOP mitigation strategies (CFR: 41.10 / 43.5 / 45.13)
		Importance	3.1/4.0

SOURCE	New
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-EP-EP2
Objectives	10
REFERENCES	EP/1/A/5000/ES-1.1 rev 20
Author	RJK
Time	6/23/2005 8:10 AM 80 minutes

Distracter Analysis:

A. Correct: If pressure continues to decrease, the crew must transfer to ES-1.2 and conduct a cooldown and continue to terminate.

B. Incorrect: Pressure will stabilize at some point, but since it is decreasing now, the RNO requires a transfer to the ES-1.2 procedure.

C. Incorrect: A small break LOCA will not affect temperatures at a scale enough to cause an increase. Also, E-0 Enclosure 4 is in effect and the OATC is to control temperatures. Again an operator might think that a cooldown is a good answer to maintaining desirable conditions.

D. Incorrect: A small break LOCA will not affect temperatures at a scale enough to cause an increase. Also, E-0 Enclosure 4 is in effect and the OATC is to control temperatures.

CNS EP/1/A/5000/ES-1.1	SAFETY INJECTION TERMINATION	PAGE NO. 3 of 63 Revision 20

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Verify NC pressure - STABLE OR INCREASING.**	**Perform the following:** __ a. Ensure Pzr spray valves - CLOSED. __ b. <u>IF</u> NC pressure continues to decrease, <u>**THEN**</u> <u>GO</u> <u>TO</u> EP/1/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization).

LP OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the Purpose of EP/1/A/5000/E-1 (Loss of Reactor or Secondary Coolant)			X	X	X
2	State the Purpose of EP/1/A/5000/ES-1.1 (SI Termination)			X	X	X
3	State the Purpose of EP/1/A/5000/ES-1.2 (Post LOCA Cooldown and Depressurization)			X	X	X
4	State the Purpose of EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation)			X	X	X
5	State the Purpose of EP/1/A/5000/ES-1.4 (Transfer to Hot Leg Recirculation)			X	X	X
6	State the Purpose of EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation)			X	X	X
7	State the Purpose of EP/1/A/5000/ECA-1.2 (LOCA Outside Containment)			X	X	X
8	State the Purpose of EP/1/A/5000/ECA-1.3 (Containment Sump Blockage)					
9	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/E-1 (Loss of Reactor or Secondary Coolant)			X	X	X
10	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-1.1 (SI Termination)			X	X	X
11	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-1.2 (Post LOCA Cooldown and Depressurization)			X	X	X
12	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation)			X	X	X
13	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation)			X	X	X
14	Explain Enclosure 1 (Foldout Page) actions of EP/1/A/5000/ECA-1.3 (Containment Sump Blockage)					
15	Explain the Bases, including any identified knowledges/abilities, for all of the steps, notes, and cautions in EP/1/A/5000/E-1 (Loss of Reactor or Secondary Coolant)			X	X	X

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Verify NC pressure - STABLE OR INCREASING.**	**Perform the following:** __ a. Ensure Pzr spray valves - CLOSED. __ b. <u>**IF**</u> NC pressure continues to decrease, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> EP/1/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization).
__ 7. **Verify VI pressure - GREATER THAN 50 PSIG.**	**In subsequent steps, control room control is lost for the following valves and local operation will be required:** __ • 1NV-294 (NV Pmps A&B Disch Flow Ctrl) __ • 1NV-309 (Seal Water Injection Flow).
8. **Isolate NV S/I flowpath as follows:**	
a. Verify the following valves - OPEN: __ • 1NV-252A (NV Pumps Suct From FWST) __ • 1NV-253B (NV Pumps Suct From FWST).	a. <u>**IF**</u> NV pump suctions are aligned for Cold Leg Recirc, <u>**THEN**</u>: __ 1) Close 1NV-309 (Seal Water Injection Flow). 2) <u>**IF**</u> control of 1NV-309 is lost from the control room, <u>**THEN**</u> dispatch operator with radio to perform the following: __ a) Close 1NV-308 (Seal Wtr Inj Flow Ctrl Isol) (AB-554, JJ-54, Rm 233) (Ladder needed). __ b) Throttle 1NV-311 (Seal Wtr Inj Flow Ctrl Byp) (AB-555, JJ-54, Rm 233) to control seal injection flow as required in subsequent steps. 3) Open the following valves: __ • 1NV-312A (Chrg Line Cont Isol) __ • 1NV-314B (Chrg Line Cont Isol). (RNO continued on next page)

***Question*: 05-77**

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

- Unit 1 is at 100% power.
- 1NV-294 (NV Pmps A&B Disch Flow Ctrl) failed to mid position and flow cannot be adjusted.
- Total charging flow is 60 gpm.
- Letdown flow has been adjusted to maintain pressurizer level constant.

Current conditions:

- Pressurizer level is 55%.
- Unit 1 is being shutdown to hot standby

Which of the following describes the pressurizer level change and your method to maintain pressurizer level at programmed level as power is decreased.

A. Pressurizer level will decrease much faster than programmed level. Enter AP/1/A/5500/012 Case II, Loss of Letdown, when level reaches 17%.

B. Pressurizer level will decrease much slower than programmed level. Use annunciator response procedures to manually decrease pressurizer level.

C. Pressurizer level will decrease much faster than programmed level. Enter OP/1/A/6200/001, Chemical and Volume Control System, to manually increase pressurizer level.

D. Pressurizer level will decrease approximately the same as programmed level. Use annunciator response procedures to correct minor differences in level.

Question*: 05-77** ***Answer: D

LEVEL:	SRO

K/A	APE022	Title	Loss of Reactor Coolant Makeup
	AA2.04	Description	Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Pump Makeup: **(CFR: 43.5 / 45.13)** How long PZR level can be maintained within limits
		Importance	2.9/3.8

SOURCE	NEW
LEVEL of KNOWLEDGE	analysis
Lesson	OP-CN-PS-ILE rev 23
Objective(s)	9
REFERENCES	Lesson plan information.
Author	RJK
Time	29 minutes plus 2 hours

Distracter Analysis: Pressurizer level changes as T-Avg changes. With minor fluctuations, the need for additional NV flow is minimized. Only occasional adjustments by the crew are required.

A. **Incorrect**: With flow matched, PZR level will decrease with programmed level.
B. **Incorrect**: With flow matched, PZR level will decrease with programmed level.
C. **Incorrect**: With flow matched, PZR level will decrease with programmed level,
D. **Correct**:

Lesson plan page 7: 2.1.A.4

c) A program level is selected to match as nearly as possible, the level changes that would occur as coolant temperature changes from no-load (557°F) to full load (585°F/587°F). This results in no significant charging requirement changes as power level is varied.

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

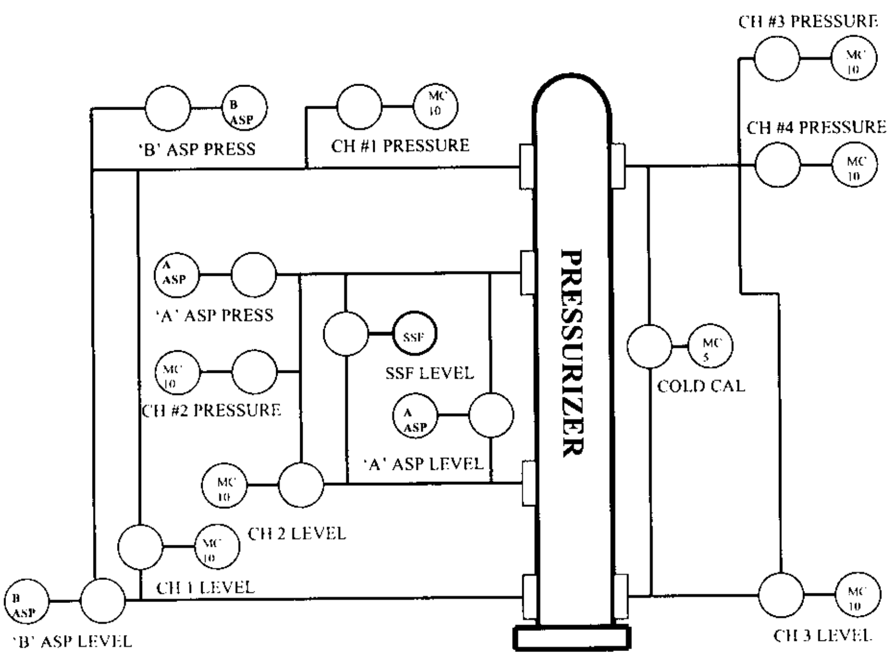
TIME: 2.0 HOURS

b) Program level follows normal expansion/contraction of NC System volume as load increases/decreases to maintain a constant mass of water in the NC System.

c) A program level is selected to match as nearly as possible, the level changes that would occur as coolant temperature changes from no-load (557°F) to full load (585°F/587°F). This results in no significant charging requirement changes as power level is varied.

1) Any deviation in level from the program will result in a signal to adjust charging flow via NV 294. (**OBJ. #4**)

2.2 Control and Instrumentation (**OBJ. #5**)



A. PZR Level Channels

1. Channel 1, 2, 3

a) Calibrated at normal PZR temp. (653°F).

1) Indicated level will differ from actual level when Pzr temp. is less than 653°F.

2) Consult Revised Unit 1(2) Data Book curves for actual VS indicated level differences.

b) Used during normal operation for protection, control and indication.

***Question*: 05-78**

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1 Pt(s) Given the following conditions:

- Unit 1 in Mode 6
- Refueling cavity is filled to 23 feet.
- Core reload is in progress
- NC temperature is 145°F
- 1A residual heat removal (ND) train is in operation

The ND train must be shutdown and declared inoperable to repair a leak on the pump motor cooler. The pump will be shutdown for less than one hour.

What is the major heat transfer mechanism and what affect (if any) does this have on refueling activities?

A. Core heat transfer is primarily through convection.
Stop the core reload.

B. Core heat transfer is primarily through subcooled nucleate boiling.
Stop the core reload.

C. Core heat transfer is primarily through convection.
Core reload may continue provided no operations are permitted that would dilute the refueling cavity boron concentration.

D. Core heat transfer is primarily through subcooled nucleate boiling.
Core reload may continue provided no operations are permitted that would dilute the refueling cavity boron concentration.

***Question*: 05-78** ***Answer:* A**

LEVEL:	SRO

K/A	APE025	**Title**	Loss of RHR System
	G2.2.25	**Description**	Knowledge of bases in technical specifications for limiting conditions for operations and safety limits. (CFR 43.2)
		Importance	2.5/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PS-ND
Objectives	11
REFERENCES	T.S. 3.9.4 and Bases
Author	RJK
Time	10/17/2005 12:51:27 PM 122 minutes

Distracter Analysis: Because the pump is stated as inoperable, core loading must stop. If the pump were not inoperable, core loading is allowed to continue without ND for up to one hour provided no change in [B]. This allows loading near the edges of the core where flow may interfere with setting fuel assemblies. The Tech Spec basis states that core cooling occurs by convection. Subcooled nucleate boiling is a term familiar to the operators and is the normal method of heat removal during normal power operations.

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

TS 3.9.4 Bases
The LCO is modified by a Note that allows the required operating RHR loop to be removed from service for up to 1 hour per 8 hour period, provided no operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to meet the minimum boron concentration of LCO 3.9.1. Boron concentration reduction with coolant at boron concentrations less than required to assure the minimum required RCS boron concentration is maintained is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot leg nozzles and RCS to RHR isolation valve testing. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity

	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	

3.9 REFUELING OPERATIONS

3.9.4 Residual Heat Removal (RHR) and Coolant Circulation — High Water Level

LCO 3.9.4 One RHR loop shall be OPERABLE and in operation.

-----NOTE-----
The required RHR loop may be removed from operation for ≤ 1 hour per 8 hour period, provided no operations are permitted that would cause introduction of coolant into the Reactor Coolant System with boron concentration less than required to meet the minimum required boron concentration of LCO 3.9.1.

APPLICABILITY: MODE 6 with the water level ≥ 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RHR loop requirements not met.	A.1 Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet the boron concentration of LCO 3.9.1.	Immediately
	AND	
	A.2 Suspend loading irradiated fuel assemblies in the core.	Immediately
	AND	
	A.3 Initiate action to satisfy RHR loop requirements.	Immediately
	AND	
		(continued)

B 3.9 REFUELING OPERATIONS

B 3.9.4 Residual Heat Removal (RHR) and Coolant Circulation—High Water Level

BASES

BACKGROUND

The purpose of the RHR System in MODE 6 is to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34, to provide mixing of borated coolant and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the RHR heat exchanger(s), where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown or decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant and component cooling water through the RHR heat exchanger(s). Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

APPLICABLE SAFETY ANALYSES

If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. One train of the RHR System is required to be operational in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to prevent this challenge. The LCO does permit de-energizing the RHR pump for short durations, under the condition that the boron concentration is not diluted. This conditional de-energizing of the RHR pump does not result in a challenge to the fission product barrier.

The RHR System satisfies Criterion 4 of 10 CFR 50.36 (Ref. 2).

LCO

Only one RHR loop is required for decay heat removal in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange. Only one RHR loop is required to be OPERABLE, because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one RHR loop must be OPERABLE and in operation to provide:

BASES

LCO (continued)

a. Removal of decay heat;

b. Mixing of borated coolant to minimize the possibility of criticality; and

c. Indication of reactor coolant temperature.

An OPERABLE RHR loop includes an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. The operability of the operating RHR train and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature. If not in its normal RHR alignment from the RCS hot leg and returning to the RCS cold legs, the required RHR loop is OPERABLE provided the system may be placed in service from the control room, or may be placed in service in a short period of time by actions outside the control room and there are no restraints to placing the equipment in service.

The LCO is modified by a Note that allows the required operating RHR loop to be removed from service for up to 1 hour per 8 hour period, provided no operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to meet the minimum boron concentration of LCO 3.9.1. Boron concentration reduction with coolant at boron concentrations less than required to assure the minimum required RCS boron concentration is maintained is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot leg nozzles and RCS to RHR isolation valve testing. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity.

The acceptability of the LCO and the LCO Note is based on preventing boiling in the core in the event of the loss of RHR cooling. However, it has been determined that when the upper internals are in place in the reactor vessel there is insufficient communication with the water above the core for adequate decay heat removal by natural circulation. As a result, boiling in the core could occur in a relatively short time if RHR cooling is lost. Therefore, during the short period of time that the upper internals are installed, administrative processes are implemented to reduce the risk of core boiling. The availability of additional cooling equipment, including equipment not required to be OPERABLE by the Technical Specifications, contributes to this risk reduction. The plant staff assesses these cooling sources to assure that the desired minimal level of risk is maintained. This is commonly referred to as defense-in-depth. This strategy is

BASES

LCO (continued)

consistent with NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management" (Ref. 3).

APPLICABILITY

One RHR loop must be OPERABLE and in operation in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to provide decay heat removal. The 23 ft water level was selected because it corresponds to the 23 ft requirement established for fuel movement in LCO 3.9.6, "Refueling Cavity Water Level." Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS), and Section 3.5, Emergency Core Cooling Systems (ECCS). RHR loop requirements in MODE 6 with the water level < 23 ft are located in LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation—Low Water Level."

ACTIONS

RHR loop requirements are met by having one RHR loop OPERABLE and in operation, except as permitted in the Note to the LCO.

A.1

If RHR loop requirements are not met, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation.

A.2

If RHR loop requirements are not met, actions shall be taken immediately to suspend loading of irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural convection to the heat sink provided by the water above the core. A minimum refueling water level of 23 ft above the reactor vessel flange provides an adequate available heat sink. Suspending any operation that would increase decay heat load, such as loading a fuel assembly, is a prudent action under this condition.

BASES

ACTIONS (continued)

A.3

If RHR loop requirements are not met, actions shall be initiated and continued in order to satisfy RHR loop requirements. With the unit in MODE 6 and the refueling water level ≥ 23 ft above the top of the reactor vessel flange, corrective actions shall be initiated immediately.

A.4

If RHR loop requirements are not met, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures dose limits are not exceeded.

The Completion Time of 4 hours is reasonable, based on the low probability of the coolant boiling in that time.

SURVEILLANCE REQUIREMENTS

SR 3.9.4.1

This Surveillance demonstrates that the RHR loop is in operation and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. The RCS temperature is determined to ensure the appropriate decay heat removal is maintained. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator in the control room for monitoring the RHR System.

REFERENCES

1. UFSAR, Section 5.5.7.
2. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).
3. NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

Question: 05-79

1 Pt(s) Unit 1 is operating at 100% with 1A RN pump in service when the following alarms are received:

- 1AD-12, A/1 "RN PUMP A FLOW HI/LO"
- 1AD-12, A/2 "RN ESSENTIAL HDR A PRESSURE - LO"
- 1AD-12, A/5 "RN ESSENTIAL HDR B PRESSURE - LO"
- 1AD-12, B/1 "RN PUMP INTAKE PIT A LEVEL-LO"
- 1AD-12, B/2 "RN PIT A SCREEN HI D/P"

Which of the following describes the event that occurred and your actions to restore proper RN system conditions?

A. "A" Train RN Screens are clogged.
Enter AP/0/A/5500/020, Case II, Loss of RN Pit Level, swap to the pond and start 2A RN Pump.

B. "A" Train RN Screens are clogged.
Enter AP/0/A/5500/020, Case II, Loss of RN Pit Level, swap to the pond and start a "B" Train RN Pump.

C. 1A RN Pump has tripped.
Enter AP/0/A/5500/020, Case I, Loss of RN Train, start 2A RN Pump.

D. 1A RN Pump has tripped.
Enter AP/0/A/5500/020, Case I, Loss of RN Train, start a "B" Train RN Pump.

Question: 05-79 ***Answer: B***

LEVEL:	SRO

K/A	APE062	**Title**	Loss of Nuclear Service Water
	G2.4.6	**Description**	Knowledge of symptom based EOP mitigation strategies. **(CFR 43.5)**
		Importance	3.1/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PSS-RN
Objectives	11 & 17
REFERENCES	AP/0/A/5500/020 rev 35 page 10
Author	RJK
Time	6/22/2005 12:36 PM 181 minutes

Distracter Analysis:

A. **Incorrect**: This action by itself will do nothing for the "A" train RN. If the operator thinks that the level transients could be corrected by an additional pump start.

B. **Correct**: Per actions of AP-20 attached.

C. **Incorrect**: If an operator thinks the alarms are only due to a pump trip then this would be the appropriate action.

D. **Incorrect**: Same issue, the alarms are from clogged strainers, additional pumps are appropriate from the other train.

Case II actions for clogged screens.

1 **Verify the following alarms - DARK:** __ • 1AD-12, B/2 "RN PIT A SCREEN HI D/P" __ • 1AD-12, B/5 "RN PIT B SCREEN HI D/P".	__ **IF the operating RN pump is on the affected pit with high D/P, THEN align RN to SNSWP. REFER TO Enclosure 2 (RN Valve Alignment for RN Swap to SNSWP).**
__ 2 **Start idle RN pump(s) on the unaffected train.**	
3 **Verify affected pit level adequate as follows:** __ • 1AD-12, B/1 "RN PUMP INTAKE PIT A LEVEL-LO" - DARK	__ **Align RN to the SNSWP. REFER TO Enclosure 2 (RN Valve Alignment for RN Swap to SNSWP).**

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	X	X	X	X	X
	• An Emergency Low Pit Level	X	X	X	X	X
	• A Safety Injection signal	X	X	X	X	X
	• An Sp signal	X	X	X	X	X
	• ASP to local			X	X	X

	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	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. **Verify the following alarms - DARK:** __ • 1AD-12, B/2 "RN PIT A SCREEN HI D/P" __ • 1AD-12, B/5 "RN PIT B SCREEN HI D/P".	__ **IF the operating RN pump is on the affected pit with high D/P, THEN align RN to SNSWP. REFER TO Enclosure 2 (RN Valve Alignment for RN Swap to SNSWP).**

NOTE
- Isolating the Unit 1 or 2 non-essential header will result in loss of cooling supply to the following unit related equipment:
  - VA Supply Vent Units
  - VF Supply Vent Unit.
- Automatic swapover to the SNSWP on emergency-low RN pit level, prevents Control Room operation of RN pumps and affected valves for 2 minutes following swapover.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 2. **Start idle RN pump(s) on the unaffected train.**	
3. **Verify affected pit level adequate as follows:** __ • 1AD-12, B/1 "RN PUMP INTAKE PIT A LEVEL-LO" - DARK __ • 1AD-12, B/4 "RN PUMP INTAKE PIT B LEVEL-LO" - DARK __ • 2AD-12, B/1 "RN PUMP INTAKE PIT A LEVEL-LO" - DARK __ • 2AD-12, B/4 "RN PUMP INTAKE PIT B LEVEL-LO" - DARK __ • Affected pit level indication - STABLE OR INCREASING.	__ **Align RN to the SNSWP. REFER TO Enclosure 2 (RN Valve Alignment for RN Swap to SNSWP).**
__ 4. **Verify each operating RN pump discharge flow - LESS THAN 23,000 GPM.**	__ **IF the operating train pit levels are normal, THEN REFER TO Case I (Loss of RN Train).**

Question: 05-80

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

- Feed and Bleed was initiated per EP/1/A/5000/FR-H.1 (Response to Loss of Secondary Heat Sink).
- 15 minutes later, the turbine driven CA pump is started and available to provide feed flow to the S/Gs.

Which one of the following describes the minimum requirement and procedure used to terminate the feed and bleed lineup?

A. Remain in EP/1/A/5000/FR-H.1 until greater than 11% NR level is reached in one S/G and then secure bleed and feed.

B. Remain in EP/1/A/5000/FR-H.1 until greater than 450 gpm total CA flow is established then enter EP/1/A/5000/ES-1.1, Safety Injection Termination, to secure bleed and feed.

C. Remain in EP/1/A/5000/FR-H.1 until greater than 450 gpm total CA flow is established and then secure bleed and feed.

D. Remain in EP/1/A/5000/FR-H.1 until greater than 11% NR level is reached in one S/G then enter EP/1/A/5000/ES-1.1, Safety Injection Termination, to secure bleed and feed.

Question*: *05-80 ***Answer: A***

LEVEL:	SRO

K/A	WE05	Title	Loss of Secondary Heat Sink
	EA2.2	Description	Ability to determine and interpret the following as they apply to the (Loss of Secondary Heat Sink) (CFR: 43.5 / 45.13) Adherence to appropriate procedures and operation within the limitations in the facilities license and amendments
		Importance	3.7/4.3

SOURCE	Modified: Turkey Point 3 2003 Exam
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-EP-FRH
Objectives	3
REFERENCES	EP/1/A/5000/FR-H.1 rev 025
Author	RJK
Time	7/1/2005 12:54 PM 102 minutes

Distracter Analysis:

A. Correct:

B. Incorrect: Since Bleed and feed is established (step 19), there are no more exits from this procedure until SI is terminated. . If the operator knows that greater than 450 gpm is adequate CA flow under other conditions.

C. Incorrect: Since Bleed and feed is established (step 19), there are no more exits from this procedure until SI is terminated. If the operator knows that greater than 450 gpm is adequate CA flow under other conditions.

D. Incorrect: Since Bleed and feed is established (step 19), there are no more exits from this procedure until SI is terminated. Note that an operator knows that 11% in one S/G is a 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

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
33. **Align CA to establish control of S/G feed as follows:**	
__ a. Ensure CA System valve control - RESET.	
__ b. Close CA flow control valves on S/Gs not presently being fed.	
34. **Continue attempts to establish secondary heat sink in at least one S/G as follows:**	
__ • CA. **REFER TO** Steps 6 through 7	
__ • CF or CM. **REFER TO** Steps 9 through 16.	
__ 35. **Verify N/R level in at least one S/G - GREATER THAN 11% (29% ACC).**	__ **RETURN TO Step 34.**
36. **Verify NC System temperatures as follows:**	__ **RETURN TO Step 34.**
__ • Core exit T/Cs - DECREASING __ • All NC T-Hots - DECREASING.	
37. **Verify all of the following reactor vessel head vent valves - CLOSED:**	__ **Manually close affected valve(s).**
__ • 1NC-250A (Rx Head Vent Block) __ • 1NC-251B (Rx Head Vent) __ • 1NC-252B (Rx Head Vent Block) __ • 1NC-253A (Rx Head Vent).	
38. **Verify S/I termination criteria as follows:**	
__ a. NC subcooling based on core exit T/Cs - GREATER THAN 50°F.	__ a. **GO TO** Step 39.
__ b. "REACTOR VESSEL LR LEVEL" - GREATER THAN 61%.	__ b. **GO TO** Step 39.
__ c. **GO TO** Step 40.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
39. **Verify NC System bleed path status as follows:**	
__ a. Any Pzr PORV and associated isolation valve - OPEN.	__ a. **GO TO** EP/1/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).
__ b. Close one Pzr PORV and place it in "AUTO".	b. Perform the following: __ 1) Close the associated Pzr PORV isolation valve. __ 2) **IF** the Pzr PORV isolation valve cannot be closed, **THEN GO TO** EP/1/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).
__ c. After closing a Pzr PORV, allow NC pressure to increase to restore subcooling and RVLIS level.	
__ d. **RETURN TO** Step 38.	
40. **Stop S/I pumps as follows:** __ • Both NI pumps __ • All but one NV pump.	
41. **Verify NC System bleed path status as follows:**	
__ a. Any Pzr PORV and associated isolation valve - OPEN.	__ a. **GO TO** Step 42.
__ b. Close all but one Pzr PORV.	b. Perform the following: __ 1) Close the associated Pzr PORV isolation valve. __ 2) **IF** the Pzr PORV isolation valve cannot be closed, **THEN GO TO** EP/1/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).
__ c. Place closed Pzr PORV in "AUTO".	

Question*: *05-81

1 Pt(s) Unit 1 is operating at 55% power when the following indications are noted:

- Turbine megawatt load is increasing.
- Reactor power is increasing.
- Annunciator 1AD-2 A/4 "T-REF/T-AUCT HI-LO" is lit.

Which of the following describes the event that occurred and actions to address these indications?

A. A steam leak has occurred. Enter AP/1/A/5500/028, Steam Leak, and decrease turbine load to stop the power increase.

B. Channel 1 impulse pressure has failed low. Place control rod bank select switch to manual and enter AP/1/A/5500/015, Case II, Continuous Rod Movement.

C. Loop D narrow range T-cold has failed high. Place T-Avg Defeat switch to loop D per the 1AD-2 A/4 annunciator response.

D. A continuous rod withdrawal has occurred. Place control rod bank select switch to manual and enter AP/1/A/5500/015, Case II, Continuous Rod Movement.

Question*: 05-81** ***Answer: D

LEVEL:	SRO

K/A	APE001	**Title**	Continuous Rod Withdrawal
	AA2.05	**Description**	Ability to determine and interpret the following as they apply to the Continuous Rod Withdrawal: (CFR: 43.5 / 45.13) Uncontrolled rod withdrawal, from available indications
		Importance	4.4/4.6

SOURCE	MODIFIED: North Anna 2002 RO exam
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-IC-IRX
Objectives	5
REFERENCES	AP/1/A/5500/015 rev 010
Author	RJK
Time	7/1/2005 1:02 PM 55 minutes

Distracter Analysis: The power level chosen was picked to ensure auto rod withdrawal is still available.

A. **Incorrect**: Turbine load would decrease as Tavg and steam pressure drops. An operator may think that turbine control would compensate.

B. **Incorrect**: This would cause a rod insertion. An operator could get the effects of this backwards and think a turbine or reactor response would occur.

C. **Incorrect**: Causes a rod insertion. An operator mistakenly thinks this is what occurs.

D. **Correct**:

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of IRX.			x	x	x
2	Describe the purpose and interconnections of the functional blocks of IRX per the training handout.			x	x	x
3	List the inputs to IRX and explain where each is used, including inputs to other systems.			x	x	x
4	List and describe the interlocks associated with IRX.			x	x	x
5	Given the direction of failure of any input signal, predict the resulting direction of rod motion.			x	x	x

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

__ 1. **Ensure "CRD BANK SELECT" switch - IN MANUAL.**

__ 2. **Verify all rod motion - STOPS.**

Perform the following:

__ a. Manually trip reactor.

__ b. **GO TO** EP/1/A/5000/E-0 (Reactor Trip Or Safety Injection).

__ 3. **Manually adjust control rods as necessary to maintain T-Avg within 1°F of T-Ref.**

Adjust the following as necessary to maintain T-Avg within 1°F of T-Ref:

__ • Turbine load
__ • NC System boron concentration.

__ 4. **Determine and correct cause of continuous rod movement.**

5. **Ensure compliance with appropriate Tech Specs:**

__ • 3.1.1 (Shutdown Margin (SDM))

__ • 3.1.4 (Rod Group Alignment Limits)

__ • 3.1.5 (Shutdown Bank Insertion Limits)

__ • 3.1.6 (Control Bank Insertion Limits)

__ • 3.3.2 (ESFAS Instrumentation).

6. **Determine required notifications:**

__ • **REFER TO** RP/0/A/5000/001 (Classification Of Emergency)

__ • **REFER TO** RP/0/B/5000/013 (NRC Notification Requirements).

Question: 05-82

1 Pt(s) Refueling operations are in progress when the following alarms are received:

- 1RAD-2, B-1 "1EMF-42 FUEL BLDG VENT HI RAD"
- 1RAD-3, C-5 "1EMF-15 SPENT FUEL BLDG REFUEL BRIDGE"
- 1RAD-2, D-2 "1EMF-17 REACTOR BLDG REFUEL BRIDGE"

What accident explains these indications and what procedure should be entered?

A. Inventory is being lost from the refueling cavity/spent fuel pool
Enter AP/1/A/5500/027 (Shutdown LOCA)
Increase charging flow to restore level

B. Inventory is being lost from the refueling cavity/spent fuel pool
Enter AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Level)
Ensure KF-122 (KF Fuel Transfer Canal Isol) is closed

C. A fuel assembly has been damaged in the reactor building
Enter AP/1/A/5500/025 (Case I Damaged Fuel in Reactor Building)
Move the fuel transfer car to the spent fuel (pit) side

D. A fuel assembly has been damaged in the spent fuel pool
Enter AP/1/A/5500/025 (Case II Damaged Fuel in Spent Fuel Pool Area)
Ensure the fuel transfer car is on the spent fuel (pit) side

Question*: 05-82** ***Answer: B

LEVEL:	SRO

K/A	APE036	Title	Fuel Handling Accidents
	G2.4.4	Description	Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures. **(CFR: 41.10 / 43.2 / 45.6)**
		Importance	4.0/4.3

SOURCE	NEW	
LEVEL of KNOWLEDGE	Comprehension	
Lesson	OP-CN-FH-FHS	
Objectives	2	
REFERENCES	AP/1/A/5500/026 rev 011	
Author	RJK	
Time	7/1/2005 1:20 PM	13 minutes, plus 65 from other version.

Distracter Analysis:

A. **Incorrect**: This AP responds to loss of coolant accidents in the shutdown modes. If an operator thinks that the radiation is due to a loss of level and injection could solve the problem.

B. **Correct**:

C. **Incorrect**: Not all the entry conditions are relevant to this cause and AP to enter, but the operator might think that both areas are affected.

D. **Incorrect**: Not all the entry conditions are relevant to this cause and AP to enter, but the operator might think that both areas are affected.

AP-26

- 1RAD-3, D/2 "1EMF 17 REACTOR BLDG REFUEL BRIDGE" - LIT
- 1RAD-3, C/5 "1EMF 15 SPENT FUEL BLDG REFUEL BRIDGE" - LIT
- 1RAD-2, B/1 "1EMF 42 FUEL BLDG VENT HI RAD" - LIT.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Explain the purpose and design features of the Fuel Handling System: • Fuel transfer canal • Spent fuel pool • Cask area • Transfer tube associated with fuel handling operations • New fuel storage vault			X	X	
2	Describe in general terms the actions required per AP/1/A/5500/025 (Damage Spent Fuel), AP/1/A/5500/026 (Loss of Refueling Canal or Spent Fuel Pool Level), and AP/0/A/5500/033 (Damaged Tamper Seal on Special Nuclear Material Shipments).			X	X	
3	Explain the purpose of each of the Fuel Handling Crane Bridges.			X	X	
4	Describe the function and operation of the instrumentation and controls associated with the fuel handling bridges.			X	X	
5	Describe the interlocks associated with the fuel handling bridges. • List the requirements for bypassing fuel handling interlocks			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	
7	Describe operations of the Reactor Building Fuel Mast.			X	X	
8	Describe the design purposes and features of the Fuel Handling Auxiliaries. • New Fuel Elevator • Fuel Transfer Tube • Fuel Transfer Car • Upender • Fuel Handling Tools • Fuel Handling Accessories			X	X	
9	Describe the function and operation of the instrumentation and controls associated with the fuel handling auxiliaries.			X	X	

A. Purpose

- To verify proper response in the event of loss of water level in the refueling canal or spent fuel pool.

B. Symptoms

- Visual evidence of low water level
- 1AD-13, E/2 "SPENT FUEL POOL LEVEL HI/LO" - LIT
- OAC point C1D2638 (Incore Inst Sump Level) - HI HI
- OAC point C1D1579 (Spent Fuel Pool Level) - LO
- 1RAD-3, D/2 "1EMF 17 REACTOR BLDG REFUEL BRIDGE" - LIT
- 1RAD-3, C/5 "1EMF 15 SPENT FUEL BLDG REFUEL BRIDGE" - LIT
- 1RAD-2, B/1 "1EMF 42 FUEL BLDG VENT HI RAD" - LIT.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

__ 1. **Verify fuel movement - IN PROGRESS.**

__ **GO TO Step 3.**

2. **Ensure all fuel assemblies are placed in safe position as follows:**

   __ • Lower any fuel assembly in either upender to fully down.

   __ • Lower any fuel assembly in the reactor building manipulator crane to fully down in the core or the deep end of the canal.

   __ • Lower any fuel assembly in the spent fuel manipulator crane to fully down.

   __ • Move fuel transfer car to spent fuel (pit) side.

__ 3. **Dispatch operator to ensure 1KF-122 (KF Fuel Transfer Canal Isol) (AB-610, KK-49, Rm 600) (Key #633) - CLOSED.**

__ 4. **Notify RP of level loss.**

__ 5. **Monitor symptoms requiring entry to AP/1/A/5500/19 (Loss Of Residual Heat Removal System).**

__ 6. **Evacuate non-essential personnel from containment and the spent fuel pool bldg.**

__ 7. **Verify proper VC/YC system operation. REFER TO Enclosure 4 (Control Room Ventilation System Verification).**

***Question*: 05-83**

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1 Pt(s) Which of the following is designed to limit exposures to both the public and station personnel caused by the storage of or accidental release of gaseous effluents from the Waste Gas (WG) system?

A. Curie content of the storage tanks.

B. Normal gaseous effluent release rates.

C. Concentration limits for iodine, tritium and radiation in particulate form.

D. Hydrogen and oxygen concentration limits during gas treatment and storage.

Question: 05-83 **Answer: A**

LEVEL:	SRO

K/A	APE060	**Title**	Accidental Gaseous Radwaste Release
	G2.2.25	**Description**	Knowledge of bases in technical specifications for limiting conditions for operations and safety limits. **(CFR: 43.2)**
		Importance	2.5/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-WE-WG
Objectives	3 and 6
REFERENCES	SLC 16.11-19 Bases
Author	RJK
Time	7/1/2005 1:22 PM 73 minutes

Distracter Analysis:

A. Correct: See SLC bases.

B. Incorrect: This is not associated with accidental releases but an operator might think that we limit normal releases to reduce the risk when an accident occurs.

C. Incorrect: This is a commitment for all releases; an operator might think that since we limit these isotopes, they are also the bases of the accidental releases.

D. Incorrect: These are general limits to ensure there is no explosive mixture released, an operator might agree that we limit these so that thee is no way to accidentally cause an explosion and accidental release.

SLC 16.11-19 (Limits on Tank Curie Content) Immediate LCO Bases: uncontrolled release of the tank's contents, the resulting whole body exposure to a MEMBER OF THE PUBLIC at the nearest SITE BOUNDARY will not exceed 0.5 rem

SLC 16.11-18 (Gaseous Effluents (Explosive Gas Limits)) Bases: Maintaining the concentration of hydrogen and oxygen below their flammability limits provides assurance that the releases of radioactive materials will be controlled in conformance with the requirements of General Design Criterion 60 of Appendix A to 10 CFR Part 50

SLC 16.11-9 (Dose from Iodine, Tritium, and Rad in Particulate Form) Bases: The release rate COMMITMENTS for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of the calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

SLC 16.11-6 (Gaseous Effluents Dose Rates) Bases: The basic requirements for SLCs concerning effluents from nuclear power reactors are stated in 10 CFR 50.36a. These requirements indicate that compliance with effluent SLCs will keep average annual releases of radioactive material in effluents to small percentages of the limits specified in the old 10 CFR 20.106 (new 10 CFR 20.1301).

	Objective	I S S	N L O	L P R O	L P S O	P T R Q
1	State the purpose(s) of the Waste Gas System.			X	X	
2	List the radioactive gas sources to the Waste Gas System.			X	X	X
3	Given a set of plant conditions and access to reference materials, determine the actions necessary to comply with Tech Specs/SLCs.			X	X	X
4	Describe a waste gas release. • State EMF's required • Discuss selecting the controlling EMF on recorder • Describe taking WG EMF highest reading during release • Discuss "PRIOR TO RELEASE" and "AFTER RELEASE" sections of GWR Permit Report • Describe the automatic action associated with the following EMFs related to termination of a waste gas release: WG Disch Monitor (EMF 50) Unit Vent Particulate Monitor (EMF-35) Unit Vent Gaseous Monitor (EMF-36) Unit Vent Iodine Monitor (EMF-37)			X	X	X
5	Describe what information is needed to perform a release rate calculation.			X	X	X
6	State from memory all Tech Spec/SLC actions for the system, subsystem or components which require remedial action to be taken in less than one hour.			X	X	

16.11 RADIOLOGICAL EFFLUENTS CONTROLS

16.11-9 Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form

COMMITMENT The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives > 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 16.11-16-1 in SLC 16.11-16) shall be limited to the following:

a. During any calendar quarter: $\leq$ 7.5 mrem to any organ, and

b. During any calendar year: $\leq$ 15 mrem to any organ.

APPLICABILITY: At all times.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Calculated dose from the release of Iodine-131, Iodine-133, tritium, and radioactive material in particulate form with half-lives > 8 days in gaseous effluents exceeding any of above limits.	A.1 Prepare and submit a Special Report to the NRC which identifies the causes for exceeding the limits, corrective actions taken to reduce releases, and actions taken to ensure that subsequent releases are within limits.	30 days

TESTING REQUIREMENTS

TEST	FREQUENCY
TR 16.11-9-1 Determine cumulative dose contributions from Iodine-131, Iodine-133, tritium, and radioactive material in particulate form with half-lives > 8 days in gaseous effluents for current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM.	31 days

BASES

This SLC is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50, and are the guides set forth in Section II.C of Appendix I. The REMEDIAL ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable". The ODCM calculational methods specified in the TESTING REQUIREMENTS implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate COMMITMENTS for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of the calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

This commitment applies to the release of radioactive materials in gaseous effluents from each unit at the site. When shared radwaste treatment systems are used by more than one unit on a site, the wastes from all units are mixed for shared treatment; by such mixing, the effluent releases cannot accurately be ascribed to a specific unit. An estimate should be made of the contributions from each unit based on input conditions, e.g., flow rates and radioactivity concentrations, or, if not practicable, the treated effluent releases may be allocated equally to each of the radioactive waste producing units sharing the radwaste treatment system. For determining conformance to COMMITMENTS, these allocations from shared radwaste treatment systems are to be added to the releases specifically attributed to each unit to obtain the total releases per unit.

REFERENCES

1. Catawba Offsite Dose Calculation Manual.
2. 10 CFR Part 50, Appendix I.

16.11 RADIOLOGICAL EFFLUENTS CONTROLS

16.11-19 Gas Storage Tanks

COMMITMENT: The quantity of radioactivity contained in each gas storage tank shall be limited to ≤ 97,000 Curies of noble gases (considered as Xe-133 equivalent).

APPLICABILITY: At all times.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Quantity of radioactive material in tank(s) exceeding limit.	A.1 Suspend all additions of radioactive material to the tank(s).	Immediately
	AND	
	A.2 Reduce tank(s) contents to within limit.	48 hours
	AND	
	A.3 Describe the events leading to this condition in the Radioactive Effluent Release Report.	In the next scheduled Radioactive Effluent Release Report pursuant to Technical Specification 5.6.3

TESTING REQUIREMENTS

TEST	FREQUENCY
TR 16.11-19-1 Verify that the quantity of radioactive material contained in each tank is within limits when radioactive materials are being added to the tank(s).	24 hours

BASES

The tanks included in this SLC are those tanks for which the quantity of radioactivity contained is not limited directly or indirectly by another SLC. Restricting the quantity of radioactivity contained in each gas storage tank provides assurance that in the event of an uncontrolled release of the tank's contents, the resulting whole body exposure to a MEMBER OF THE PUBLIC at the nearest SITE BOUNDARY will not exceed 0.5 rem. This is consistent with Standard Review Plan 11.3, Branch Technical Position ETSB 11-5, "Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure," in NUREG-0800, July 1981.

REFERENCES

1. Letter from NRC to Gary R. Peterson, Duke, Issuance of Improved Technical Specifications Amendments for Catawba, September 30, 1998.

2. Technical Specification 5.5.12, Explosive Gas and Storage Tank Radioactivity Monitoring Program.

Question: 05-84

1 Pt(s) A manual makeup to the volume control tank (VCT) has increased level from 35% to 80% causing a reactor coolant pump seal leakoff flow alarm.

Which of the following is the correct seal leakoff flow alarm and what is your response to this situation?

A. "NCP #1 SEAL LEAKOFF HI FLOW"
Enter AP/1/A/5500/008, Case I, NC Pump Seal Malfunction and decrease VCT pressure.

B. "NCP #1 SEAL LEAKOFF HI FLOW"
Refer to OP/1/A/6250/002A, Reactor Coolant Pump Operations and increase VCT pressure.

C. "NCP #1 SEAL LEAKOFF LO FLOW"
Refer to OP/1/A/6250/002A, Reactor Coolant Pump Operations and decrease VCT pressure.

D. "NCP #1 SEAL LEAKOFF LO FLOW"
Enter AP/1/A/5500/008, Case I, NC Pump Seal Malfunction and increase VCT pressure.

***Question*: 05-84** ***Answer:* C**

LEVEL:	SRO

K/A	SYS003	Title	Reactor Coolant Pump
	A2.05	Description	Ability to (a) predict the impacts of the following malfunctions or operations on the RCPS; 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)** Effects of VCT pressure on RCP seal leakoff flows
		Importance	2.5/2.8

SOURCE	New
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-PS-NCP
Objectives	3
REFERENCES	OP/1/A/6150/002A Enclosure 4.4 rev 053
Author	RJK
Time	7/1/2005 1:26 PM 17 minutes, plus 70 minutes

Distracter Analysis: As level increases, VCT pressure will always increase. This will decrease seal leakoff. The OP has guidance to restore the correct value.

A. **Incorrect**: An operator may mistake the level change as an increase in seal leakoff and think that venting will restore initial conditions.

B. **Incorrect**: If the operator thinks that the level increase increases seal leakoff, then decreasing level is the correct action.

C. **Correct**:

D. **Incorrect:** If the operator thinks that increasing pressure somehow forces more leakoff.

	Objective	I S S	N L O	L P R O	L P S O	P T R Q
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

C/1

NCP #1 SEAL LEAKOFF HI FLOW

SETPOINT: 5.0 GPM

ORIGIN:
1. NC Pump A - 1NVFT5151
2. NC Pump B - 1NVFT5141
3. NC Pump C - 1NVFT5131
4. NC Pump D - 1NVFT5121

PROBABLE CAUSE:
1. Damaged #1 Seal
2. Cocked #1 Seal
3. Loss of injection water followed by high seal temp
4. Hi temperature of injection water

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS:
1. Dispatch an operator to 1RFM-12 on 1RFMP1 (Cable Spreading Room, AB-574) to identify the affected pump(s) and acknowledge the alarm.
2. Refer to AP/1/A/5500/08 (Malfunction of Reactor Coolant Pump).
3. Verify total NC leakage is less than 20 gpm to ensure operability of the standby makeup pump per PT/1/A/4150/001D (NC System Leakage Calculation).

NOTE: The SSF is conservatively declared inoperable due to the potential for exceeding the NC Pump seal cooling capacity of the Standby Makeup Pump. {PIP 96-1910}

SUPPLEMENTARY ACTIONS:
1. Declare the SSF inoperable. {PIP 96-1910}
2. Notify Engineering to issue an Operability Notification Form. {PIP 96-1910}

REFERENCES:
1. CN-1499-NV-3
2. CNM-1201.01-157

PANEL: 1AD-7

NCP #1 SEAL LEAKOFF LO FLOW

C/2

SETPOINT: .8 GPM

ORIGIN:
1. NC Pump A - 1NVFT5150
2. NC Pump B - 1NVFT5140
3. NC Pump C - 1NVFT5130
4. NC Pump D - 1NVFT5120

PROBABLE CAUSE:
1. #1 seal damage
2. #2 seal excessive leakage
3. Low D/P
4. NC Coolant low pressure

AUTOMATIC ACTIONS: None

IMMEDIATE ACTIONS:
1. Dispatch an operator to 1RFM-13 on 1RFMP1 (Cable Spreading Room, AB-574) to identify the affected pump(s) and acknowledge the alarm.
2. Refer to AP/1/A/5500/08 (Malfunction of Reactor Coolant Pump).

SUPPLEMENTARY ACTIONS: Verify that the affected pumps #1 seal leakoff rate is within limits per the Unit One Revised Data Book, Figure 26 and adjust as necessary.

REFERENCES:
1. CN-1499-NV-3
2. CNM-1201.01-157 (Tech Manual)

1. Initial Conditions

____ 1.1 Review the Limits and Precautions.

____ 1.2 Verify indicated #1 Seal Leakoff Flow is less than required per Step 2.7 of Enclosure 4.1 (Startup and Operation of the NC Pumps).

2. Procedure

NOTE: The following items may help to increase #1 Seal Leakoff Flow:

a. Lower VCT Pressures.
b. Higher ΔP across the pump.
c. Ensuring proper seal return valve lineup, the seal return lines have been properly vented and the seal return filter differential pressure is normal.
d. Jogging an NC Pump Oil Lift Pump.

2.1 The following steps will isolate the Seal Return lines and monitor the time it takes for the standpipe to fill to ensure #1 Seal Leakoff as required per Enclosure 4.1 (Startup and Operation of the NC Pumps).

____ 2.1.1 Close <u>one</u> of the following valves for the appropriate pump:

- ☐ 1NV-52A (NC Pump 1A Seal Return)
- ☐ 1NV-63B (NC Pump 1B Seal Return)
- ☐ 1NV-74A (NC Pump 1C Seal Return)
- ☐ 1NV-85B (NC Pump 1D Seal Return)

____ 2.1.2 Drain the appropriate standpipe per Enclosure 4.3 (Filling and Draining of the NC Pump Standpipes) of this procedure until the low level alarm is obtained.

NOTE: In the following step, the time it takes for the low level alarm to clear until the high level alarm is received should be monitored.

____ 2.1.3 Monitor time it takes for the standpipe high level alarm to be received once the low level alarm has cleared and calculate the #1 Seal Leakoff as follows:

$$\frac{0.82 \text{ gal.}}{\text{(recorded time in minutes)}} = \_\_\_\_\_\_\_\_ \text{ gpm}$$

____ 2.1.4 Monitor NC Pump #1 Seal Leakoff Lo Range to verify ≥ the required Seal Leakoff Flow per Step 2.7 of Enclosure 4.1 (Startup and Operation of the NC Pumps).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor Enclosure 1 (Foldout Page).**	
__ 2 **Verify proper containment isolation and VX operation. REFER TO Enclosure 3 (Containment Isolation VX System Verification).**	
3. **Verify proper NS operation as follows:**	
a. IF EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation) is in effect, THEN:	
__ 1) Operate NS as directed by EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).	
__ 2) GO TO Step 4.	
__ b. Verify NS pumps - ON.	b. Perform the following for affected train(s): __ 1) Reset ECCS. __ 2) Reset D/G load sequencer. __ 3) Manually start affected pump. __ 4) IF AT ANY TIME a B/O occurs, THEN restart S/I equipment previously on.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7 **Determine NS requirements as follows:**	
a. Verify following NS pump suction valves - OPEN:	__ a. **GO TO** Step 10.
__ • 1NS-20A (NS Pump 1A Suct From FWST)	
__ • 1NS-3B (NS Pump 1B Suct From FWST).	
__ b. Determine number of NS pumps required from the following table:	

FWST LEVEL	CONTAINMENT PRESSURE (PSIG)	NS PUMPS REQUIRED
GREATER THAN 5%	GREATER THAN 15	2
	BETWEEN 10 AND 15	1
	LESS THAN 10	0
LESS THAN 5%	N/A	0

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ c. Verify the number of NS pumps on - EQUAL TO NUMBER REQUIRED.	__ c. Manually operate NS pumps as required by table above.
8. **Verify criteria to align NS for recirc as follows:**	
__ a. Any NS pump - ON.	__ a. **GO TO** Step 9.
__ b. Containment sump level - GREATER THAN 3.5 FT.	b. Perform the following: __ 1) **WHEN** containment sump level greater than 3.5 ft, **THEN** perform Step 8.c. __ 2) **GO TO** Step 9.
__ c. Align NS for recirc. **REFER TO** Enclosure 3 (Aligning NS for Recirculation).	

***Question*: 05-85**

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1 Pt(s) The crew is currently implementing EP/1/A/5000/FR-Z.1 (Response to High Containment Pressure) on a red path due to a failure of both NS pumps. Prior to the completion of FR-Z.1, the following occurred:

- 1AD-9 D/8 FWST 2/4 LO LEVEL annunciator was LIT.
- Crew transitioned to EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation).
- 1NI-185A (ND Pump 1A Cont Sump Suct) and 1NI-184B (ND Pump 1B Cont Sump Suct) failed to open automatically. All additional efforts to open the valves have failed.
- An orange path has been validated by the STA on Core Cooling.

Based on the current conditions, what is the immediate correct course of action?

A. Go to EP/1/A/5000/FR-C.2 (Response to Degraded Core Cooling)

B. Return to EP/1/A/5000/FR-Z.1.

C. Go to EP/1/A/5000/ECA-1.1 (Loss of Emergency Coolant Recirculation)

D. Continue in EP/1/A/5000/ES-1.3.

Question*: 05-85** ***Answer: B

LEVEL:	SRO

K/A	SYS026	**Title**	Containment Spray
	A2.02	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Failure of automatic recirculation transfer
		Importance	4.2/4.4

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-EP-CSF
Objectives	1
REFERENCES	EP/1/A/5000/FR-Z.1 rev 010 pages 2 and 19
Author	RJK
Time	7/1/2005 1:48 PM 301 minutes

Distracter Analysis:

A. Incorrect: Student may think that core cooling is a higher priority in this condition since you are not in the Z.1 but the RED path still exists.

B. Correct:

C. Incorrect: This would be correct if no valid red or orange paths were in effect.

D. Incorrect: If student thinks that additional steps in ES-1.3 may provide guidance to get the valves open or that swap to CLR would help NS per enclosure 2.

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

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. <u>Operator Actions</u>

__ 1. **Monitor Enclosure 1 (Foldout Page).**

__ 2. **Verify proper containment isolation and VX operation. <u>REFER</u> <u>TO</u> Enclosure 3 (Containment Isolation VX System Verification).**

3. **Verify proper NS operation as follows:**

a. **<u>IF</u>** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation) is in effect, **<u>THEN</u>**:

__ 1) Operate NS as directed by EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).

__ 2) **<u>GO</u> <u>TO</u>** Step 4.

__ b. Verify NS pumps - ON.

RESPONSE NOT OBTAINED:

b. Perform the following for affected train(s):

__ 1) Reset ECCS.

__ 2) Reset D/G load sequencer.

__ 3) Manually start affected pump.

__ 4) **<u>IF</u> <u>AT</u> <u>ANY</u> <u>TIME</u>** a B/O occurs, **<u>THEN</u>** restart S/I equipment previously on.

1. **Cold Leg Recirc Switchover Criterion:**

   - **IF** FWST level decreases to 37% (1AD-9, D/8 "FWST 2/4 LO LEVEL" lit), **THEN GO TO** EP/1/A/5000/ES-1.3 (Transfer To Cold Leg Recirculation).

2. **CA Suction Source Switchover Criteria:**

   - **IF** either of the following annunciators are lit, **THEN REFER TO** AP/1/A/5500/006 (Loss of S/G Feedwater):

     - 1AD-5, H/4 "CACST LO LEVEL"

     OR

     - 1AD-8, B/1 "UST LO LEVEL".

3. **Position Criteria for 1NV-202B and 1NV-203A (NV Pumps A&B Recirc Isol):**

   - **IF** NC pressure is less than 1500 PSIG **AND** NV S/I flowpath is aligned, **THEN** close 1NV-202B and 1NV-203A.

   - **IF** NC pressure is greater than 2000 PSIG, **THEN** open 1NV-202B and 1NV-203A.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

5. (Continued)

c) **WHEN** the ND pump(s) suction valve from the FWST is closed, **THEN** perform the following:

(1) Attempt to manually open the affected containment sump suction valve(s).

__ • 1NI-185A (ND Pump 1A Cont Sump Suct)

__ • 1NI-184B (ND Pump 1B Cont Sump Suct).

(2) **IF** affected containment sump suction valve will not open, **THEN** dispatch operator(s) to open the affected valve(s):

__ • 1NI-185A (ND Pump 1A Cont Sump Suct) (AB-545, EE-FF, 52-53, Rm 217)

__ • 1NI-184B (ND Pump 1B Cont Sump Suct) (AB-545, FF-GG, 52-53, Rm 217).

3) **IF** both containment sump suction valves are closed, **THEN**:

__ a) **IF** a valid red **OR** orange path procedure is in effect, **THEN** **RETURN TO** procedure in effect.

__ b) **GO TO** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirculation).

***Question*: 05-86**

1 Pt(s) Unit 1 is in Mode 5 following refueling. The RO reports the following conditions:

Primary conditions:

- ND 1A inlet temperature 85 ºF
- ND 1B inlet temperature 85 ºF
- NC pressure 218 psig

Secondary conditions:

- S/G 1A temperature 75 ºF
- S/G 1B temperature 72 ºF
- S/G 1C temperature 68 ºF
- S/G 1D temperature 71 ºF
- All S/Gs pressures are 0 psig.

Based on the reported conditions, what is the action required by Selected License Commitments?

A. Reduce NC pressure to less than or equal to 200 psig immediately.

B. Increase 1C S/G secondary temperature to greater than 70 ºF immediately.

C. Reduce NC pressure to less than or equal to 200 psig within 30 minutes.

D. Increase 1C S/G secondary temperature to greater than 70 ºF within 30 minutes.

Question: 05-86 ***Answer: C***

LEVEL:	SRO

K/A	SYS035	**Title**	Steam Generator
	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	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-CF-SG
Objectives	25
REFERENCES	SLC 16.5-7
Author	RJK
Time	6/24/2005 11:42 AM 57 minutes

Distracter Analysis:

A. **Incorrect**: the action time is 30 minutes.
B. **Incorrect**: Pressure must be reduced, not temperature increased per the SLC.
C. **Correct**: .
D. **Incorrect**: Pressure must be reduced, not temperature increased per the SLC.

	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
	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				

16.5 REACTOR COOLANT SYSTEM

16.5-7 Steam Generator (SG) Pressure/Temperature Limitation

COMMITMENT The temperatures of both the reactor and secondary coolants in the SGs shall be greater than 70°F when the pressure of either coolant in the SG is greater than 200 psig.

APPLICABILITY: At all times.

REMEDIAL ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ------------NOTE------------ All Required Actions must be completed whenever this Condition is entered. -------------------------------- COMMITMENT not met.	A.1 Reduce SG pressure of the applicable side to ≤ 200 psig.	30 minutes
	AND	
	A.2 Perform an engineering evaluation to determine the effect of the overpressurization on the structural integrity of the SG.	Prior to increasing SG temperatures > 200°F
	AND	
	A.3 Determine that the SG remains acceptable for continued operation.	Prior to increasing SG temperatures > 200°F

TESTING REQUIREMENTS

	TEST	FREQUENCY
TR 16.5-7-1	-------------------------------NOTE------------------------------ Only applicable when the temperature of either the reactor or secondary coolant is < 70°F. --- Verify that the pressure in each side of the SG is < 200 psig.	Once per hour

BASES The limitation on SG pressure and temperature ensures that the pressure-induced stresses in the SGs do not exceed the maximum allowable fracture toughness stress limits. The limitations of 70°F and 200 psig are based on a SG RT_{NDT} of 60°F and are sufficient to prevent brittle fracture.

REFERENCES

1. Letter from NRC to Gary R. Peterson, Duke, Issuance of Improved Technical Specifications Amendments for Catawba, September 30, 1998.

***Question*: 05-87**

1 Pt(s) Given the following conditions:

- Unit 1 was operating at 100% power.
- All four Unit 1 switchyard tie breakers opened.
- AP/1/A/5500/003 (Load Rejection Case II Switchyard Not Available) was entered.
- Steam dumps in T-avg Mode.
- Tave-Tref deviation is +3 °F.
- Turbine load is 40 MWe.
- Unit 1 is stabilized at 16% power.

Which one of the following correctly describes current plant status and the correct procedure to address this situation?

A. Reactor power is greater than turbine load, one steam dump valve has failed open; enter AP/1/A/5500/028 (Secondary Steam Leak).

B. Reactor power is greater than turbine load, more than one steam dump valve has failed open; enter AP/1/A/5500/028 (Secondary Steam Leak).

C. Reactor power is matched to turbine load with all steam dump valves closed; continue in AP/1/A/5500/003 Load Rejection Case II (Switchyard Not Available).

D. Reactor power is matched to turbine load with steam dump valves throttled to reduce temperature to 557°F; continue in AP/1/A/5500/003 Load Rejection Case II (Switchyard Not Available).

Question*: 05-87** ***Answer: B

LEVEL:	SRO

K/A	SYS041	**Title**	Steam Dump/Turbine Bypass Control
	A2.02	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5/43.5/45.3/45.13)** Steam valve stuck open
		Importance	3.6/3.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-STM-IDE
Objectives	2,3,4
REFERENCES	AP/1/A/5500/028 rev 04 AP/1/A/5500/003 rev 032 **Verified on simulator (see below)**
Author	RJK
Time	7/1/2005 1:56 PM 144 minutes

Distracter Analysis:

A. **Incorrect**: Each open steam dump is worth 3.8% of unit steam flow. There is more than that if all dump valves are to be closed. An operator misunderstands how many valves it takes to cause that much power.

B. **Correct**: Two valves plus generator load plus the secondary in operation is correct.

C. **Incorrect**: Based on all valves closed, there is too much secondary power. But an operator might think that stable conditions and Tref controller showing only 3 degree is correct.

D. **Incorrect**: 557 is not a controlling temperature in this situation, but the operator may get confused as to what these low load conditions require.

Test was preformed on Simulator setup at BOC 100%

1. 2 Atmospheric Steam dumps stuck open
2. Full load rejection. Inserted control banks until the following reached:
3. Power 16.2 %
4. Tave 560 degrees
5. Condenser Steam Valves just closed
6. Turbine carrying 40 MWs
7. Each valve is 35/9 = 3.89 X 2 = 7.9 % steam flow.
8. Power should only be 8-10 % if steam dumps are closed.

	Objective	I S S	N L O	L P R O	L P S O	P T R Q
1	Describe the purpose of the IDE System.			X	X	
2	List the banks of steam dumps and the number of valves in each bank.			X	X	
3	Describe the capacity of the Steam Dump System.			X	X	X
4	Describe the controllers in the Steam Dump System. • Describe the inputs to each controller • Discuss the plant conditions required to "enable" the controller			X	X	X
5	Discuss the conditions required to "arm" each bank of dump valves. • Discuss the plant conditions that would cause Steam Dump "actuation"			X	X	X
6	State the number of steam dumps that can be isolated with the unit at 100% power.			X	X	X
7	Discuss the purpose and state the setpoint of each of the following: • P-12 Lo-Lo T_{avg} Interlock • C-7A • C-7B • C-9			X	X	X
8	Describe the controls associated with the IDE System.			X	X	X
9	Describe the system response to a failure of each input to IDE.			X	X	X
10	Describe how to transfer modes of operation of the IDE System.			X	X	X
11	Discuss how a cooldown is accomplished using the IDE System.			X	X	X

2) The second method matches the steam dump demand signal on the "Stm Dump Ctrl" with "% Stm Dump Demand" meter before swapping to pressure mode.

3) Method 1 is found in AP/002, 003, 010; EP/ES-0.1, 0.2, 1.2, 3.1, 3.2, 3.3; ECA-1.1, 3.1, 3.2; FR-C.2.

4) Method 2 is found in AP/027, EP/ES-0.2 (this procedure uses both methods), E-1, E-3, FR-C.1, H.1, H.4.

5) Bottom line: If there is a demand signal set on the "Stm Dump Ctrl", there will be dump operation when taken to pressure mode, regardless of the indication on the "% Stm Dump Demand" meter.

H. Load Rejection Controller (Obj. # 4)

1. Used during a load rejection to prevent a large Tavg increase on a loss of load.

2. Enabled by Steam Dump Select switch being in "Tavg" position and no reactor trip (P-4 Train B).

3. Compares auctioneered high Tavg to Tref and sends a signal to modulate all banks as necessary. A lead/lag circuit conditions the auctioneered high Tavg signal. This circuit initially boosts the magnitude of any change in auctioneered high Tavg by a factor of 2. This is to make the steam dumps respond in an anticipatory manner and to prevent overshoot.

4. A 3 degree deadband exists on the controller to allow rod control to actuate to decrease Tavg.

5. Sends signal to modulate dumps open one bank at a time.

   a) Bank one open fully, then Bank 2 starts opening, etc.

6. Arming Signals (Obj. # 5)

   a) "T_{avg}" mode selected

   b) C-7A or C-7B actuated.

      1) C-7A arms condenser dumps.

      2) C-7B arms atmospheric dumps.

   c) NO Reactor Trip (P-4 Train A) - atmospheric dumps.

   d) C-9 - Condenser Dumps

7. Load Rejection Signals

   a) Load detected by turbine impulse pressure channel II.

      1) Different channel than reactor control uses for T_{ref} calculation.

   b) Load signal goes thru Isol amp to derivative circuit.

   c) Derivative circuit generates output signal proportional to rate of change of impulse pressure.

1) Output zero for nonchanging pressure signal.

d) Load Reduction Bistables

1) C7A Loss of Load Interlock (Obj. # 7)

(a) 10% Step load decrease or a ramped load decrease over a given period of time.

(b) Energizes latching relay.

(c) Activates C-7A loss of load interlock status light

(1) LOSS OF LOAD INTLK COND DMP VLVS.

(d) With C-9 activated, will arm banks 1, 2, 3.

(1) Energizes arming solenoid valves.

(2) C-9 not activated will block arming signals (Banks 1, 2, 3)

(e) C-7A Reset-take "STM DUMP SELECT SWITCH" to "RESET"

2) C7B Loss of Load Interlock (Obj. # 7)

(a) 30% step load decrease or a ramped load decrease over a period of time.

(b) Energizes latching relay

(c) Activates C-7B interlock status light

(1) LOSS OF LOAD INTLK ATMOS DUMP

(d) Arms Banks 4 and 5 with:

(1) <u>NO</u> (Train A - P-4) Reactor Trip

(2) STM DUMP SEL. SWITCH IN "Tavg"

(3) (Train A P-4) Reactor Trip <u>blocks</u> arming signal for Bank 4 and 5.

(e) C-7B Reset - Take STM DUMP SELECT SW. to RESET

1. PURPOSE

1.1 The Steam Dump System (IDE) accomplishes several purposes: (Obj. #1)

A. Enables Reactor plant to follow turbine load reductions that exceed rod control capability.

B. Allows load reduction from 100% to plant auxiliary loads without a Reactor trip.

C. Allows turbine trip and Reactor trip from 100% without lifting the SM safety valves.

D. Allow cooldown capability to hot shutdown from hot standby.

E. Provide heat removal capability for the reactor from the point of adding heat until the turbine is on line.

2. GENERAL DESCRIPTION

2.1 The IDE System accomplishes its purpose by use of five banks of dump valves with a total capacity of approximately 70% divided into two groups

A. Condenser dumps (Obj. # 2)

1. Three banks (1, 2 and 3) of 3 valves each.
2. Capacity of ~35%. (Obj. # 3)

B. Atmospheric Dumps (Obj. # 2)

1. Two banks (4 and 5) with 4 valves and 5 valves respectively.
2. Capacity of ~35%. (Obj. # 3)
3. Takes a minimum of 50% Steam Dump Controller output to start opening. Both banks full open at 100% Steam Dump Controller output.

2.2 The banks are actuated by three controllers (Obj # 4):

A. **STEAM PRESSURE** - Maximum controller output is 49%

B. **LOAD REJECTION** - Maximum controller output is 100%.

C. **PLANT TRIP** - Maximum controller output is 49%

2.3 These controllers send an actuation signal to the steam dumps and control T_{avg} at or near a reference signal. Certain plant conditions are required to actuate the controller and arm the dump valves.

2.4 The signal to the dump valve must pass thru a pneumatic circuit, which contains block valves and arming valves. These solenoid valves and their arming signals determine which dump valves will open.

2.5 A "block" circuit (P-12) prevents cooldown below 553°F to keep T_{avg} above the minimum temperature for criticality (551° F). This is accomplished by blocking the air to the dumps.

____ 2.169 Ensure the following steps have been signed off:

- ☐ Step 2.109
- ☐ Step 2.110.

____ 2.170 After entering Mode 1, then change the OAC to Mode 1 using the OAC "Plant Mode" application.

> **CAUTION:** To prevent T-AVG from decreasing while performing Steps 2.171, 2.172, 2.174, and 2.175, reactor power should be adjusted to ensure condenser steam dumps are open maintaining T-AVG at 557°F (T.S. Limit is 551°F).

____ 2.171 Increase reactor power to 10%.

2.172 Perform the following to restore from Enclosure 4.12 (Secondary Heatup Checklist):

____ 2.172.1 For Enclosure 4.12 (Secondary Heatup Checklist):

- ☐ Slowly open each valve listed on the checklist.
- ☐ Initial by each in the "Return Position" column.

____ 2.172.2 Secure from the Increased Monitoring and Increased Surveillance initiated to drain the piping specified on Enclosure 4.12 (Secondary Heatup Checklist) every 4 hours.

____ 2.173 Ensure venting of the high pressure feedwater heaters has been secured per OP/1/A/6250/001 (Condensate and Feedwater System). {PIP 03-591}

____ 2.174 Bring the turbine generator to 1800 rpm per OP/1/B/6300/001 (Turbine-Generator).

____ 2.175 Place turbine generator on line per OP/1/B/6300/001 (Turbine-Generator).

____ 2.176 **WHEN** reactor power is steady at or being increased above 10%, verify the following:

- ☐ "P-10 NUCLEAR AT POWER" light on 1SI-18 is lit.
- ☐ "P-7 LO PWR RX TRIPS BLOCKED" light on 1SI-18 is dark.
- ☐ "S/R HI SHUTDOWN FLUX ALM BLOCKED" annunciator on 1AD-2 (D/2) is dark.
- ☐ "S/R HI VOLTAGE FAILURE" annunciator on 1AD-2 (D/1) is dark.

Question: 05-88

1 Pt(s)

Unit 2 is operating at 100% power when containment parameters vary as shown below:

Containment	**1200**	**1500**	**1800**	**2100**	**2400**
Temperature (°F)					
Upper	85	86	87	86	85
Lower	105	107	106	105	106
Humidity (% rel)					
Upper	25	26	25	26	25
Lower	15	15	18	14	15
Containment pressure (psig)	0.11	0.13	0.15	0.18	0.19
Aux. Bldg. pressure (in Hg)	29.1	29.2	29.3	29.4	29.5

Which one of the following statements correctly describes the cause of the trends in the containment atmospheric parameters?

A. Normal external heating from the sun.

B. Auxiliary Building pressure has increased.

C. A packing leak on the letdown backpressure control valve.

D. An air leak on the AOV for PORV 2NC-36.

***Question*: 05-88** ***Answer:* D**

LEVEL:	SRO

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

SOURCE	BANK (CNS 1999 exam)
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-CNT-VQ page 6
Objectives	2
REFERENCES	Lesson plan
Author	RJK
Time	7/1/2005 2:16 PM 55 minutes

Distracter Analysis:

A. **Incorrect**: The temperatures do not reflect the pressure rise, so the outside temps are not affecting. But an operator may think even small chances can cause the pressure rise.

B. **Incorrect**: An increase in Auxiliary Building pressure would cause a drop in containment pressure as the containment pressure instrument is referenced to external Aux. Bldg. pressure. An operator may think there is a reverse effect of barometric pressure on containment pressure

C. **Incorrect**: This valve is in the auxiliary building and the liquid is Subcooled, but the operator may think its further out in the CNT side with hot loop coolant.

D. **Correct answer**: cont. pressure increasing without other cont. parameters increasing.

	Objective	**ISS**	**NLO**	**LPRO**	**LPSO**	**PTRQ**
1	State the purpose of the VQ system	X	X	X	X	
2	Describe the sources of pressure fluctuations in containment during normal operations	X	X	X	X	X
3	Describe the signal that will auto stop a VQ fan			X	X	X
4	Given appropriate plant conditions, apply Limits and Precautions associated with related station procedures.			X	X	X
5	Explain how an air addition from containment is accomplished			X	X	X
6	Explain how an air release from containment is accomplished			X	X	X
7	Describe the signals or conditions that will terminate a release or addition			X	X	X
8	Describe the effect a S_H signal has on VQ			X	X	X
9	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
10	Show the flow path for a release or addition when given a drawing of the VQ system	X	X			

TIME: 1.0 Hour

B. The VQ System is necessary because containment pressure will vary with different plant conditions. (OBJ. 2)

1. Sources of pressure increase

    a) Plant heatup - air inside containment expands during heatup

    b) Air leaks from air operated components inside containment

2. A source of pressure decrease is air contraction during plant cooldowns

3. Changes in atmospheric pressure can affect VQ pressure readings.

    a) VQ pressure transmitters are referenced to atmospheric pressure in the Annulus.

    b) If atmospheric pressure increases, then indicated containment pressure decreases.

    c) If atmospheric pressure decreases, then indicated containment pressure increases.

C. VQ is designed to handle pressure fluctuations during normal operation, and is NOT used during the accident conditions.

D. The system is manually operated from the control room.

E. The VQ system is non-safety related except for the containment isolation valves and associated piping.

2.2 Components

A. Containment Air Release Fans

1. Two fans per unit (A and B fans) with normal flow rates at 250-300 SCFM per fan. Used only to release air from containment.

2. Fans are large enough to relieve containment pressure during normal operations but small enough to prevent opening ice condenser doors from the pressure differential created across the doors. The fans take suction on upper containment.

3. The fan could lower containment pressure to -2.8 psig should the release not properly terminate automatically with the closure of VQ10.

4. The fans are controlled manually from switches located on the HVAC control panel (Rear of MC 5) in the control room (ON/OFF).

5. Fans stop automatically upon low air flow of 80 SCFM to prevent overheating of fan motors. (OBJ. 3)

6. Heater in the filter train must have its supply breaker closed to run the associated fan.

7. A time delay upon fan start bypasses the low flow fan trip until fan is running.

Question: 05-89

1 Pt(s) Unit 1 was operating at 100% power.

Given the following:

0900 The unit was stabilized at 58% by the crew following a trip of 1A CF pump.

1300 Chemistry just reported that Dose equivalent I-131 was 175 μCi/gm based on a sample taken 1 hour ago.

Which ONE of the following describes the operator actions that will comply with the requirements of Technical Specifications and what 10CFR limit forms the basis for this LCO?

Reference Provided

A. Restore dose equivalent I-131 to within limits within 48 hours or be in Mode 3 with Tavg less than 500 ºF within the following 6 hours.
Prevents exceeding 10CFR100 limits.

B. Restore dose equivalent I-131 to within limits within 48 hours or be in Mode 3 with Tavg less than 500 ºF within the following 6 hours.
Prevents exceeding 10CFR20 limits.

C. Be in Mode 3 with Tavg less than 500 ºF within 6 hours.
Prevents exceeding 10CFR100 limits.

D. Be in Mode 3 with Tavg less than 500 ºF within 6 hours.
Prevents exceeding 10CFR20 limits.

Question: 05-89 ***Answer: C***

LEVEL:	SRO

K/A	GENERIC	Title	
	G2.1.34	Description	Ability to maintain primary and secondary plant chemistry within allowable limits **(CFR: 41.10 / 43.5 / 45.12)**
		Importance	2.3/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-CH-PC
Objectives	17
REFERENCES	TS 3.4.16 PROVIDED
Author	RJK
Time	7/1/2005 2:36 PM 51 minutes

Distracter Analysis:

A. **Incorrect**: When above the limit, Action C is immediately entered.

B. **Incorrect**: When above the limit, Action C is immediately entered.

C. **Correct:**

D. **Incorrect**: Student may think that reducing power to put I-131 in the acceptable range is all that needs to be done. Action A would still apply.

***Question*: 05-89**

---

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

0900 The unit was stabilized at 58% by the crew following a trip of 1A CF pump.

1300 Chemistry just reported that Dose equivalent I-131 was 175 μCi/gm based on a sample taken 1 hour ago.

Which ONE of the following describes the operator actions that will comply with the requirements of Technical Specifications?

Reference Provided

A. Restore dose equivalent I-131 to within limits within 4 hours or be in Mode 3 with Tavg less than 500 ºF within the following 6 hours.

B. Restore dose equivalent I-131 to within limits within 48 hours or be in Mode 3 with Tavg less than 500 ºF within the following 6 hours.

C. Be in Mode 3 with Tavg less than 500 ºF within 6 hours.

D. Reduce power to less than 50%.

Question: 05-89 ***Answer: C***

LEVEL:	SRO

K/A	GENERIC	**Title**	
	G2.1.34	**Description**	Ability to maintain primary and secondary plant chemistry within allowable limits **(CFR: 41.10 / 43.5 / 45.12)**
		Importance	2.3/2.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Application
Lesson	OP-CN-CH-PC
Objectives	17
REFERENCES	TS 3.4.16 PROVIDED
Author	RJK
Time	7/1/2005 2:36 PM 51 minutes

Distracter Analysis:

A. **Incorrect**: When above the limit, Action C is immediately entered.

B. **Incorrect**: When above the limit, Action C is immediately entered.

C. **Correct:**

D. **Incorrect**: Student may think that reducing power to put I-131 in the acceptable range is all that needs to be done. Action A would still apply.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purposes of controlling primary system chemistry.			X	X	
2	List the sources of fission products in the NC System Coolant			X	X	
3	State the production process for N-16, AR-41 and CO-60 activation products.			X	X	
4	Define the term "Crud".			X	X	X
5	List the adverse effects CRUD has on primary systems.			X	X	X
6	State four mechanisms that could cause a crud burst.			X	X	X
7	Define Dose Equivalent I-131 and E-bar.			X	X	X
8	Explain the methods used to detect and analyze failed fuel.			X	X	X
9	List the major sources of tritium in the reactor coolant system.			X	X	
10	Show the production formulas of tritium			X	X	
11	List five problems related to tritium production.			X	X	
12	List the chemicals routinely added to the NC System Coolant and the reason for adding each.			X	X	X
13	Discuss the purpose of using demineralizers in primary systems.			X	X	
14	Explain what occurs to a mixed demineralizer if the inlet temperature limit is exceeded.			X	X	
15	Explain the purpose of the cation demineralizer.			X	X	
16	Describe in general term the actions required per AP/1/A/5500/018 (High Activity in the Reactor Coolant).			X	X	X
17	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
18	Describe the ways fission products enter the NC System Coolant.			X	X	X
19	State the mechanism for CRUD Production, including the most likely areas for buildup.			X	X	X

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

LCO 3.4.16 The specific activity of the reactor coolant shall be within limits.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) $\geq$ 500°F.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 > 1.0 μCi/gm.	-------------------Note------------------- LCO 3.0.4.c is applicable. ---	
	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.	Once per 4 hours
	AND	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours
B. Gross specific activity of the reactor coolant not within limit.	B.1 Be in MODE 3 with T_{avg} < 500°F.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met. OR DOSE EQUIVALENT I-131 in the unacceptable region of Figure 3.4.16-1.	C.1 Be in MODE 3 with T_{avg} < 500°F.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.16.1	Verify reactor coolant gross specific activity $\leq 100/\bar{E}$ μCi/gm.	7 days
SR 3.4.16.2	------------------------------NOTE--------------------------------- Only required to be performed in MODE 1. -- Verify reactor coolant DOSE EQUIVALENT I-131 specific activity $\leq$ 1.0 μCi/gm.	14 days AND Between 2 and 6 hours after a THERMAL POWER change of $\geq$ 15% RTP within a 1 hour period

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.16.3	-------------------------------NOTE---------------------------------- Not required to be performed until 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for $\geq$ 48 hours. --	
	Determine $\bar{E}$ from a sample taken in MODE 1 after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for $\geq$ 48 hours.	184 days

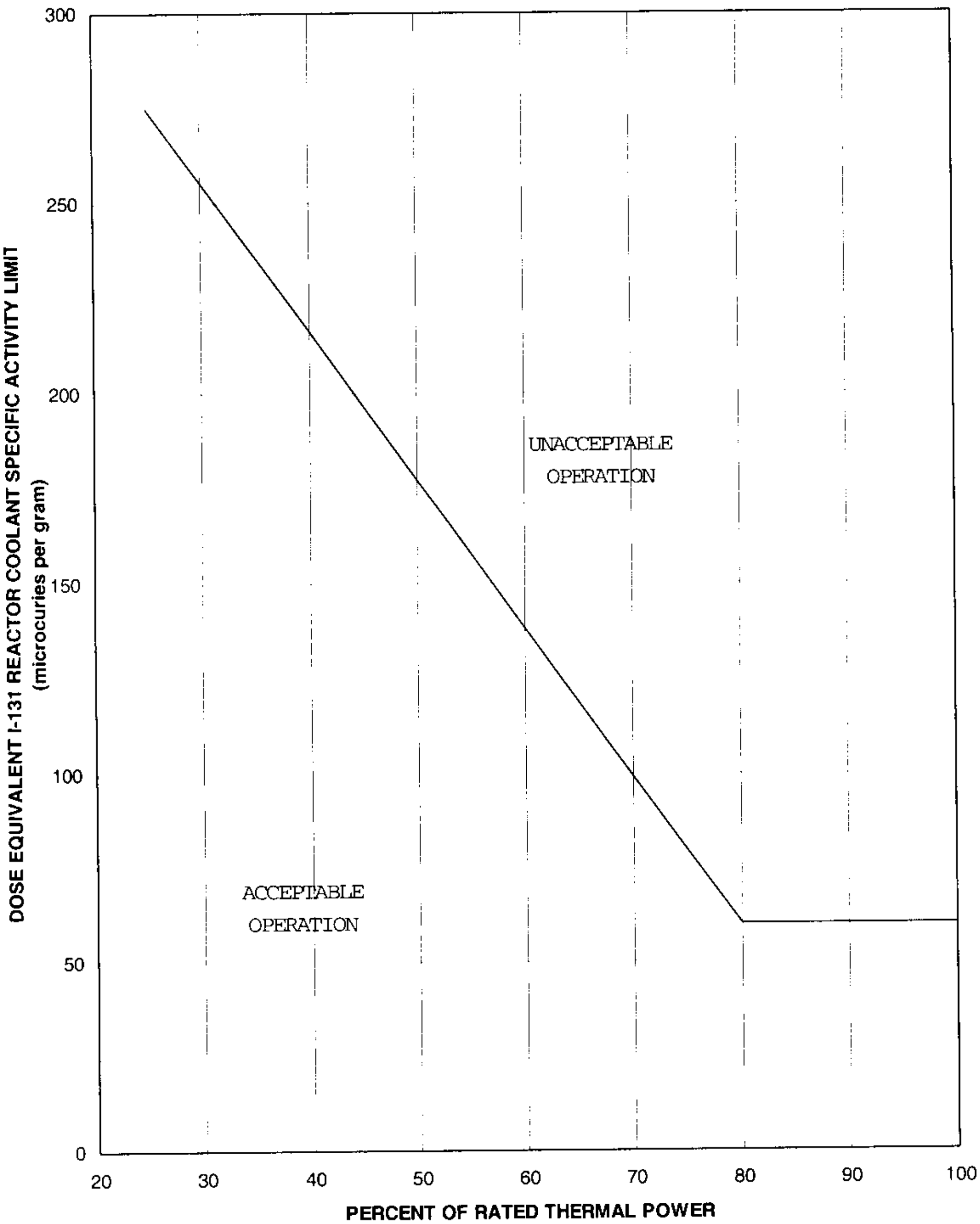

Figure 3.4.16-1 (page 1 of 1)
Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity
Limit Versus Percent of RATED THERMAL POWER

Question: 05-90

1 Pt(s) Given the following information:

- Repair work on 2A safety injection pump was completed and a retest scheduled on dayshift.
- The red tags were lifted on dayshift for the retest.
- Delays in the schedule have caused the retest to be rescheduled for nightshift.
- The red tags remain lifted.

Which of the following statements lists the person (by title) who shall coordinate the completion of the retest and how the lifted red tags are controlled while the plant transitions to nightshift?

A. Maintenance Work Group supervisor.
No additional actions are required for the lifted tags.

B. Work Control Center SRO.
No additional actions are required for the lifted tags.

C. Outage Control Group Supervisor.
Lifted tags must be voided and new tags placed until the schedule allows the test to begin.

D. Unit 2 Supervisor (SRO).
Lifted tags must be rehung until the schedule allows the test to begin.

Question: 05-90 **Answer: B**

LEVEL:	SRO

K/A	GENERIC	Title	
	G2.2.20	Description	Knowledge of the process for managing troubleshooting activities. **(CFR: 43.5 / 45.13)**
		Importance	2.2/3.3

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-ADM-NS-02
Objectives	10
REFERENCES	OMP 2-18 rev 065 page 5 of 18
Author	RJK
Time	7/1/2005 2:40 PM 147 minutes

Distracter Analysis:

A. **Incorrect**: The MNT supervisor is not responsible for coordinating the retest. The crews are not required to re-verify already approved lifted tags.

B. **Correct**: WCC SRO is responsible for coordinating the retest. The lifted tags are allowed until the test is performed.

C. **Incorrect**: Outage Control Group are the only one allowed to void tags. The lifted tags are allowed until the test is performed.

D. **Incorrect**: The lifted tags are allowed until the test is performed.

4.7. Whenever a:

- Removal/Removal Addendum
- Restoration/Partial Restoration
- Tag Lift/Rehang

must be turned over to a new shift, the new shift does not have to re-verify that the components' positions are correct if approval has been given for the above. However, a pre-job brief shall be conducted with the new shift to cover details of the evolution.

4.8. The OSM, SS, Work Control Center SRO (WCC SRO) or Chemistry Staff member or designee shall be responsible for coordinating functionals or testing with the work group when realigning or restoring a component or system. Work groups shall be readily available to support this process, and in particular when a component/system has a hazardous substance that could leak from a component/system.

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
5	Given a specific component, develop a tagout boundary for repair of that component using controlled references. • Isolate high energy before low energy • Tag open a vent or drain • Double isolate high energy boundaries or check valve used as isolations • Access the equipment database	X	X	X	X	
6	Describe the responsibilities of the NLO for preparing, placing and clearing tagouts.	X	X	X	X	
7	Given a copy of a Tagout Record (R&R) Sheet, explain each entry made: • Initial entries • Removal entries • Restoration entries	X	X	X	X	
8	Explain how tags and tag stickers are properly placed on components and controls.	X	X	X	X	
9	Explain the process for voiding tags / R&R's.	X	X	X	X	
10	Explain the process for tag lifts / rehangs	X	X	X	X	
11	Describe the performance of periodic safety tag audits • Purpose • Frequency • Discrepancy • Violation resolution	X	X	X	X	
12	Describe the process for developing a Tagout/R&R when the Red Tag Computer Program is unavailable.	X	X	X	X	
13	Describe the conditions that would require Electrical Circuit Isolation tags to be hung.	X	X	X	X	
14	Describe how plant personnel can identify the responsible group for a given Electrical Circuit Isolation.	X	X	X	X	

4.6. The person executing a:

- Removal/Removal Addendum
- Restoration/Partial Restoration
- Tag Lift/Rehang

shall be a qualified to the Safety Tagging program and is responsible for reviewing the procedures affected and any tagouts that are currently placed in order to determine if there are any adverse affects and executing the tagout instructions as written.

Shall have in their possession the R&R paperwork or a copy of the R&R paperwork used for tag placement, tag lifts or tag removal. The R&R paperwork steps shall be signed after each tag is placed, lifted, re-hung, or removed.

If an inadequate boundary is discovered during removal or an incorrect restoration position is indicated, the evolution shall be stopped, supervision shall be involved in resolving the problem and a PIP shall be written.

4.7. Whenever a:

- Removal/Removal Addendum
- Restoration/Partial Restoration
- Tag Lift/Rehang

must be turned over to a new shift, the new shift does <u>not</u> have to re-verify that the components' positions are correct if approval has been given for the above. However, a pre-job brief shall be conducted with the new shift to cover details of the evolution.

4.8. The OSM, SS, Work Control Center SRO (WCC SRO) or Chemistry Staff member or designee shall be responsible for coordinating functionals or testing with the work group when realigning or restoring a component or system. Work groups shall be readily available to support this process, and in particular when a component/system has a hazardous substance that could leak from a component/system.

***Question*: 05-91**

1 Pt(s) A compensatory action has been used for the past 3 days to maintain proper refrigerant levels due to a refrigerant leak on Control Room "A" chiller. Maintenance now has a plan to repair the leak.

Given the following sequence of events:

- Control room chiller "A" is shutdown and red tagged for the leak repair.
- Control room chiller "A" is re-energized/realigned in preparation for retesting.
- Control room chiller "A" is retested and no refrigerant leaks are found.

Which of the following statements describe the first time the chiller is required to be declared inoperable and when the chiller can be declared operable?

A. When the refrigerant leak was initially discovered 3 days ago.
When the chiller is re-energized/realigned.

B. When the refrigerant leak was initially discovered 3 days ago.
When the chiller is retested and no leaks found.

C. When the chiller is shutdown and red tagged.
When the chiller is re-energized/realigned.

D. When the chiller is shutdown and red tagged.
When the chiller is retested and no leaks found.

Question: 05-91 *Answer: D*

LEVEL:	SRO

K/A	GENERIC	Title	
	G2.2.21	Description	Knowledge of pre- and post-maintenance operability requirements **(CFR: 43.2)**
		Importance	2.3/3.5

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-ADM-TS
Objectives	4
REFERENCES	NSD -203 appendix F example 23.
Author	RJK
Time	29 minutes add 60 minutes from original replaced question.

Distracter Analysis:

A. **Incorrect**: The initial leak is not a requirement for inoperability, and the compaction ensures operable but degraded. And an operator might think it can be cleared as soon the leak is repaired.

B. **Incorrect**: The initial leak is not a requirement for inoperability, and the compaction ensures operable but degraded. But an operator might think it cannot do the short term requirements either.

C. **Incorrect**: Without the testing we will not declare a component operable, but the operator may think that the leak repair and realignment is sufficient.

D. **Correct**: **See below.**

NSD 203 appendix F

As an example of an effect on mission-time, the design basis of McGuire's Control Room Area Chilled Water System (CRACWS) is to maintain the control room temperature for thirty days of continuous occupancy following a design basis accident. Should one train of CRACWS develop a refrigerant leak or other condition that would prevent it from performing its safety function for thirty days following a postulated accident, then that train is inoperable. It does not matter if the train is currently operating and maintaining control room temperature within acceptable limits. If a compensatory action can be implemented to replenish refrigerant during the thirty day period (refer to 203.7.3 and/or guidance in this appendix on pre-approved compensatory measures), then the CRACWS train can be declared Operable But Degraded/Nonconforming

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	Describe the purpose of Tech Specs.			X	X	X
2	Describe the different sections of Tech Specs.			X	X	X
3	Describe the information contained in each LCO as follows: • Limiting Condition for Operation • Applicability • Required Action • Completion Time • Surveillance Requirements • Condition			X	X	X
4	Describe Technical Specifications as they apply to the responsibilities of a Licensed Operator in accordance with NSD 203 (Operability) and CNS Site Directive 3.1.18 (Compensatory Actions).			X	X	X
5	Describe OMP 2-29 (Technical Specification Action Item Logbook).			X	X	X
6	Contrast the UFSAR change and Technical Specification Amendment processes.			X	X	X
7	Describe information included in Section 1.0 of Tech Specs.			X	X	X
8	Describe Specific Technical Specifications as found in Sections 2.0 and 3.0.			X	X	X
9	Describe information in the following sections: • Section SR 3.0 Surveillance Requirements • Section 4.0 Design Features • Section 5.0 Administrative Controls			X	X	X
10	Describe information contained in "Selected Licensee Commitments".			X	X	X
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	Describe how we ensure short term surveillances are performed within their required time intervals.			X	X	X

account for the variation in the measurement of the hot leg temperature due to the temperature gradient which may exist in the hot leg (hot leg streaming phenomenon). A 1F uncertainty was calculated for a 9F temperature gradient in the hot leg at the time of the RTD bypass removal modification. Subsequently, hot leg temperature gradients as large as 14F were observed at both McGuire and Catawba. When the additional uncertainty was factored into the instrument channel analysis calculations, the TS Table 3.3.1-1 OTΔT and OPΔT Allowable Values were deemed nonconservative. An Operability Evaluation was performed. At the time, both Catawba and McGuire confirmed that procedural controls included a process instrument tolerance range considerably more conservative than either the existing Allowable Values or the proposed Allowable Values. Therefore, no compensatory actions were required to maintain operability. The operability recommendation was Operable But Degraded/Nonconforming.

23. Time or Condition Dependent Degradation

An Operability Assessment is required upon discovery of conditions which do not affect the ability of an SSC to perform its specified function(s) currently but may affect the mission-time of the SSC or its future operability due to continuing time-dependent degradation or changes in operating conditions. When system capability is degraded to a point where it cannot perform with reasonable assurance or reliability, the system should be judged inoperable, even at this instantaneous point in time, the system could provide the specified function (Reference NRC Inspection Manual Part 9900).

As an example of an effect on mission-time, the design basis of McGuire's Control Room Area Chilled Water System (CRACWS) is to maintain the control room temperature for thirty days of continuous occupancy following a design basis accident. Should one train of CRACWS develop a refrigerant leak or other condition that would prevent it from performing its safety function for thirty days following a postulated accident, then that train is inoperable. It does not matter if the train is currently operating and maintaining control room temperature within acceptable limits. If a compensatory action can be implemented to replenish refrigerant during the thirty day period (refer to 203.7.3 and/or guidance in this appendix on pre-approved compensatory measures), then the CRACWS train can be declared Operable But Degraded/Nonconforming.

As an example of an effect upon future operability, a degrading High Pressure Injection nozzle thermal sleeve was discovered on Oconee Unit 2 in 2001. Analysis showed that the component was operable, but could become inoperable after two more cycles of operation. An Operability Evaluation was performed and the component was confirmed to be Operable. Corrective actions were initiated to inspect and eventually replace the component within a period bounded by the Operability Evaluation. In this case, the long timeframe of the degradation and the availability of planned inspection/replacement during refueling outages were consistent with an operability determination of Operable. In other cases where degradation is more rapid and/or the need for special inspections must be carried out under more unusual conditions, the SSC would be declared Operable But Degraded/Nonconforming. The threshold between Operable and Operable But Degraded/Nonconforming for such conditions is a matter of judgment. Corrective action(s) for inspections, etc. would not normally constitute compensatory actions consistent with the definition in 203.5.

24. Trips of Systems/Components

Generally, when a component or device trips it is considered inoperable. The following are exceptions to that guidance (i.e., examples of when a component trips but remains operable):

- [CNS/MNS] When a Control Room Chiller trips due to service water alignment that would be automatically restored on receipt of a safety signal, the chiller is operable.
- [CNS/MNS] When Emergency Diesel Generator (EDG) trips due to a non-safety trip that would be bypassed upon receipt of an emergency start signal and would not prevent the EDG from operating long enough to complete its specified functions post accident, then the EDG is operable.
- [ONS] When a Keowee unit receives a Normal Lockout, but remains capable of emergency start and emergency operation, then the Keowee unit is operable.
- An SSC whose conservative state is tripped. For example, a Reactor Protective System (RPS) channel that trips or is intentionally placed in the tripped condition is considered operable - i.e., it has performed its intended function.

Question: 05-92

1 Pt(s) A planned special exposure (PSE) will be used to perform a critical task in the RCA.

- 3 volunteers are being considered for the task.
- Two people are required to perform the task.
- Each person performing the task will receive 2.5 Rem (TEDE).

Worker	Occupational exposure for 2005	PSE Exposure for 2005	Previous years PSE exposure
1	1500 mrem	0 Rem	0 Rem
2	1800 mrem	2 Rem	15 Rem
3	500 mrem	2 Rem	21 Rem

Which one of the following teams, if any, can you choose to perform this task and not exceed any exposure limits?

A. 1 and 2.

B. 1 and 3.

C. 2 and 3.

D. No team can be formed without exceeding exposure limits.

Question*: *05-92 ***Answer: A***

LEVEL:	SRO

K/A	GENERIC	**Title**	
	G2.3.4	**Description**	Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized **(CFR: 43.4 / 45.10)** Radiation hazards that may arise during abnormal situations, including maintenance activities and various contamination conditions.
		Importance	2.5/3.1

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-RAD-HP rev 20
Objectives	17
REFERENCES	HP lesson plan page 11
Author	RJK
Time	8/17/2005 10:52 AM 71 minutes plus 27 minutes.

Distracter Analysis: The PSE dose does not add to your occupational dose. PSE annual is limited to 5 REM. Lifetime PSE dose is limited to 25 annual or 25 REM

A. **Correct**:
B. **Incorrect**: Operator 3 will exceed his lifetime PSE dose
C. **Incorrect**: Operator 3 will exceed his lifetime PSE dose
D. **Incorrect**: Because there is a team available that meets the criteria

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
	D. Summarize the function of the ALARA Committee in accordance with the System ALARA Manual Section VIII.					
11	Describe how external radiation dose is minimized.			X	X	
12	Describe how internal dose is minimized.			X	X	
13	Describe the proper method for removal of protective clothing during normal and emergency situations.			X	X	
14	Describe the potential for changing or abnormally high radiological conditions due to changes in plant conditions.			X	X	
15	When given a set of conditions based on industry operating experience, explain your responsibility in preventing these events from occurring at CNS.			X	X	
16	State the approval requirements for an individual to exceed the EXCLUDE dose limit.			X	X	
17	Summarize the requirements for a planned special exposure per Radiation Protection Policy II-2. A. State the dose limits. B. State the effect of planned special exposure dose on future occupational dose. C. State NRC reporting requirements.			X	X	
18	Summarize the emergency exposure procedure per Radiation Protection Policy II-2. A. State personnel selection criteria. B. State exposure limits for protecting valuable property. C. State exposure limits for situations where it's necessary to save lives or prevent loss of life or prevent harm to a large population.			X	X	
19	Summarize an understanding of the specific responsibilities of station personnel in regards to Radiological Work Practices per NSD-507. A. All employees B. Supervision			X	X	

10CFR20 Limits / Duke Energy Limits (Obj. #2)

Conditions of Exposure	NRC(10CFR20) Limits	DE Basic Administrative Control	DE Maximum Administrative Control
Adult Total Effective Dose Equivalent (TEDE)	5.0 rem/year	2.0 rem/year	5.0 rem/year
Adult Lens Dose Equivalent (LDE) (Lens of Eye)	15.0 rem/year		15.0 rem/year
Adult Shallow-Dose Equivalent (SDE) 1. Skin 2. Extremities	50 rem/year		50 rem/year
Any Internal Organ (for example, thyroid)	50 rem/year		50 rem/year
Minors	10% of Adult and may not enter High Rad Area		10% of Adult and may not enter High Rad Area
Public	100 mrem		
Declared Pregnant Woman (TEDE)	500 mrem /pregnancy	50 mrem/month	500 mrem /pregnancy
If the radiation worker is found to have exceeded, or is within 50 mrem of the 500 mrem allowed by the time the pregnancy is declared, a limit of 50 mrem for the remainder of the pregnancy will be applied.			
Planned Special Exposure	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.	Lifetime PSE limits are five times the TEDE/LDE/SDE limits. Annual PSE limits equal the TEDE/LDE/SDE limits.

2.2 Exposure Extensions and Reductions (Obj. #16)

A. Changing of administrative exposure limits above 2000 mrem shall be controlled by a step process of authorization and documentation to ensure doses are kept ALARA and NRC limits are not exceeded.

B. If it is desired for an employee to exceed the 2000 mrem admin limit, the following must be satisfied (NSD 507 requires an extension if an individual is to exceed 90% of his ADMIN limit or 1800 mrem).

1. Exposure extension request form must be completed by the Section Requester.
    a) Obtain RP assistance.
2. Cannot be declared pregnant or a minor.
3. Extension becomes invalid after employee termination or at year end.
4. Shall not be extended above 2000 mrem.
5. Must receive approval of Section and RP Managers.
6. For extensions above 4500 mrem Station Manager and Nuclear Site Vice President approvals are also required.

C. If an extension is no longer required the proper forms shall be filled out for Exposure limit reduction.

1. If the individual's dose has exceeded 80% of the yearly admin limit (i.e. 80% of 2000, or 1600 mrem), then the new limit is calculated by the following formula.
    a) 1.33 x current dose.
2. RP should assist with the reduction.

2.3 Planned Special Exposure (Obj. #17)

A PSE is an infrequent exposure to radiation separate from, and in addition to, the NRC dose limits. This type of exposure has several requirements associated with it and can be used only in an exceptional situation where alternatives that might avoid the higher exposure are unavailable or impractical.

A. The RP Manager, Section Manager, and Nuclear Site Vice President shall approve all Planned Special Exposures.

B. Dose from Planned Special Exposures will not be used in controlling future occupational doses, but will be included in future Planned Special Exposures.

C. Limits for Planned Special Exposure are per the previous exposure limit table.

D. The NRC shall be notified within 30 days of any Planned Special Exposure.

2.4 Emergency Exposure (Obj. #18)

***Question*: 05-93**

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

- Alert declared 10 minutes ago due to a steam generator tube rupture.
- TSC and OSC are not yet activated.
- RP/0/A/5000/003 (Alert) in progress.

Which one of the following tasks is performed by shift radiation protection technicians prior to TSC activation?

A. Independently verify protective action recommendations.

B. Perform off-site dose monitoring/surveys.

C. Contact state, local or federal authorities concerning the release.

D. Grant permission for any needed planned emergency exposures.

Question: 05-93 *Answer: B*

LEVEL:	SRO

K/A	GENERIC	Title	
	G2.4.36	Description	Knowledge of chemistry / health physics tasks during emergency operations **(CFR: 43.5)**
		Importance	2.0/2.8

SOURCE	New
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-EP-SEP
Objectives	20
REFERENCES	RP/0/A/5000/003 rev 040
Author	RJK
Time	6/27/2005 2:01 PM 47 minutes

Distracter Analysis:

A. **Incorrect**: PARs are not required with an Alert classification. RP could assist in the PARs based on the Dose assessments they perform.

B. **Correct**:

C. **Incorrect**: This is performed by the control room before the TSC is manned by contacting the environmental management group.

D. **Incorrect**: Only the RP manager is used for this purpose, but someone may think that prior to manning the ERO, an RP tech could be consulted.

RP / 03 immediate actions

____ 2.4 **IF** there is an indication of a radioactive release **AND** the TSC is not activated, contact RP shift to perform off-site dose assessment per HP/0/B/1009/026.

	Objective	ISS	LPRO	LPSO	PTRQ
11	Describe the symptoms that may or will require a site assembly or evacuation per RP/0/A/5000/010 and NSD 114.			X	
12	Describe the procedure for securing from a site assembly or evacuation.			X	
13	Explain the purpose of the NSD for Site Assembly/Evacuation per NSD 114.			X	
14	Describe the procedure for site assembly during the following per NSD 114: • inability to reach assembly point • working in RCA			X	
15	Summarize the procedure for site assembly per NSD 114 including: • who may enter the plant during a site assembly • the procedure to account for personnel			X	
16	State the time frames in which immediate and follow-up notifications are to be made to various offsite agencies.			X	X
17	Prepare and evaluate Emergency Notification Forms for both initial and follow-up notification for any given accident scenario.			X	X
18	When given a copy of RP/0/A/5000/002, apply the Immediate Actions required for a Notification of Unusual Event.			X	X
19	Summarize the subsequent actions required for the Notification of Unusual Event procedure per RP/0/A/5000/002: • Describe the procedure to terminate the emergency. • Describe the procedure to give a follow-up message. 1. For events lasting greater than one hour. 2. Significant change in the situation. 3. Escalation to a higher classification.			X	X
20	When given a copy of RP/0/A/5000/003, apply the Immediate Actions required for an Alert.			X	X

Alert

1. Symptoms

1.1 Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant.

2. Immediate Actions

NOTE:	
	1. Lines in left margin are for place keeping. Immediate actions may be performed simultaneously.
	2. Security events may require the suspension of access to and movement about the site. Staffing and activation of the on-site emergency response facilities could complicate or interfere with security operations resulting in unwarranted casualties.

_____ 2.1 **IF** a security event exists, discuss the feasibility of conducting a site assembly and activating the TSC/OSC with the Security Shift Supervisor at 5765 or 5766.

_____ 2.1.1 **IF** site assembly and activation of the TSC/OSC are not feasible, refer to the following procedure enclosures for guidance and N/A the steps in this procedure under Immediate Actions concerning site assembly and ERO activation:

_____ A. RP/0/B/5000/026, "Site Response to Security Events," Enclosure 4.2 - Step 5 that evaluates taking protective action

_____ B. RP/0/B/5000/026, "Site Response to Security Events," Enclosure 4.3 - Activation of ERO during an Imminent Security Event

_____ 2.1.2 **IF** the security event involves an insider threat, implement 2-person rule for access to all vital areas.

_____ 2.1.3 Consider delaying other actions in this procedure that could endanger site personnel until the security threat is terminated.

_____ 2.2 **IF** TSC, OSC and EOF have **NOT** been previously activated, notify the ERO to staff emergency response facilities by performing the following steps (2.2.1 and 2.2.2):

_____ 2.2.1 Notify site personnel to activate the TSC and OSC by making the following announcement **twice** over public address system:

"This is the Operations Shift Manager. An Alert has been declared. Unit(s) _____ is (are) affected. Activate the TSC, OSC, and EOF."

_____ 2.2.2 Activate Emergency Response Organization by completing Enclosure 4.1 of this procedure.

_____ 2.3 Notify off-site agencies within 15 minutes of Emergency declaration time using an Emergency Notification Form. Refer to one of the following notification procedures for instructions:

- RP/0/A/5000/006A, "Notifications to States and Counties from the Control Room"
- RP/0/A/5000/006B, "Notifications to States and Counties from the Technical Support Center"
- SR/0/B/2000/004, "Notifications to States and Counties from the Emergency Operations Facility"

_____ 2.4 **IF** there is an indication of a radioactive release **AND** the TSC is not activated, contact RP shift to perform off-site dose assessment per HP/0/B/1009/026.

_____ 2.5 **IF** a radioactive release or hazardous material spill is occurring or has occurred **AND** the TSC is not activated, contact Environmental Management (EM), ext. 3333 for assistance in reporting to state, local or federal authorities. After hours, contact the Environmental Duty person by phone or pager. **IF** no answer, page 8-777-3333 which will page all Environmental Management personnel.

_____ 2.6 Conduct a Site Assembly using RP/0/A/5000/010, "Conducting a Site Assembly or Preparing the Site for an Evacuation."

_____ 2.7 Notify the NRC using RP/0/B/5000/013, "NRC Notification Requirements." This notification should be made as quickly as possible but shall be made within one hour of the emergency declaration time.

2.7.1 Initiate Emergency Response Data System (ERDS) transmission by performing the following:

_____ A. Type "**ERDS**" or select "**Main**," then "**General**," then "**ERDS**" on a Control Room OAC workstation connected to the affected unit's OAC

_____ B. Initiate ERDS transmission by depressing **F1** or clicking "**Activate**."

_____ C. **IF** ERDS transmission will not connect to the NRC, inform the NRC using ENS. The TSC Data Coordinator will troubleshoot and initiate ERDS transmission upon arrival in the TSC.

3. Subsequent Actions

NOTE: Subsequent Actions are not required to be followed in any particular sequence.

3.1 **IF** a security event has occurred, perform the following to account for site personnel:

_____ 3.1.1 **WHEN** Security notifies the OSM that the security threat has been terminated, make the following announcement **twice** over the public address system:

"This is the Operations Shift Manager. The security event has been terminated. The security event has been terminated."

Question*: *05-94

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1 Pt(s) Which one of the following sets of safety function priorities form the bases for protection of the reactor coolant system pressure boundary?

A. Subcriticality, Core Cooling, Heat Sink.

B. Core Cooling, Heat Sink, NC Integrity.

C. Heat Sink, NC Integrity, NC Inventory.

D. Subcriticality, NC Integrity, NC Inventory.

Question: *05-94*   *Answer: C*

LEVEL:	SRO

K/A	GENERIC	**Title**	
	G2.4.22	**Description**	Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations **(CFR: 43.5 / 45.12)**
		Importance	3.0/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-EP-CSF
Objectives	2
REFERENCES	Lesson plan information page 10
Author	RJK
Time	7/1/2005 3:17 PM 64 minutes

Distracter Analysis:

A. **Incorrect**: Subcriticality is strictly for the fuel barrier. But an operator might think that if you do not shutdown, NC may be damaged due to overheating.

B. **Incorrect**: Core cooling not a factor. But if Subcriticality is not picked, this is the next highest priority set.

C. **Correct**:

D. **Incorrect**: Subcriticality is strictly for the fuel barrier. But an operator might think that if you do not shutdown, NC may be damaged due to overheating.

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

BARRIER	CRITICAL SAFETY FUNCTION
Fuel Matrix and Fuel Clad	Maintenance of SUBCRITICALITY (minimize energy production in the fuel)
	Maintenance of Core Cooling (Provide adequate reactor coolant to remove heat from the fuel)
	Maintenance of a HEAT SINK (Provide adequate secondary coolant for heat removal from
	Control of Reactor Coolant INVENTORY (maintain enough reactor coolant for effective heat removal and pressure control)
Reactor Coolant System Pressure Boundary	Maintenance of a HEAT SINK (provide adequate heat removal from the RCS)
	Maintenance of Reactor Coolant System INTEGRITY (prevent failure of RCS)
	Control of Reactor Coolant INVENTORY (prevent flooding and loss of pressure control)
Containment Vessel	Maintenance of CONTAINMENT Integrity (prevent failure of containment vessel)

***Question*: 05-95**

1 Pt(s) Given the following conditions:

- Unit 1 tripped from 100% power due to a complete loss of offsite power
- The transient caused a LOCA
- 1A D/G output breaker 86D relay actuated
- 1ETB undervoltage status lights are DARK

2 minutes later the RO reports the following indications on 1A and 1B NI pump E30 pushbuttons:

- 1A NI pump "ON" and "OFF" lights are DARK
- 1B NI pump "ON" and "OFF" lights are DARK
- 1A and 1B D/G load sequencer "RESET" lights are DARK
- ECCS train "A" and "B" "RESET" lights are DARK

1 hour later, the following conditions exist:

- 1A D/G load sequencer "RESET" light is DARK
- 1B D/G load sequencer "RESET" light is LIT
- ECCS train "A" and "B" "RESET" lights are LIT
- Pressurizer level is 40%
- NC pressure is stable
- All NC Thots are 340°F
- Subcooling is 12°F
- The SRO is at Step 19 of EP/1/A/5000/ES-1.2, Post LOCA Cooldown and Depressurization.

Reference provided

Which one of the following component manipulations is performed next in EP/1/A/5000/ES-1.2?

A. Stop one NV pump

B. Stop one NI pump

C. Start one ND pump

D. Isolate cold leg accumulators

Question: 05-95 ***Answer: B***

LEVEL:	SRO

K/A	APE056	**Title**	Loss of Offsite Power
	AA2.03	**Description**	Ability to determine and interpret the following as they apply to the Loss of Offsite Power: **(CFR: 43.5 / 45.13)** Operations status of safety injection pump.
		Importance	3.8/3.9

SOURCE	NEW
LEVEL of KNOWLEDGE	Analysis
Lesson	OP-CN-ECCS-NI
Objectives	
REFERENCES	EP/1/A/5000/ES-1.2 PROVIDED (pages 17-19, and 32-33)
Author	JKS
Time	8/17/2005 9:41 AM 61 minutes

Distracter Analysis: 1A NV pump and 1A NI pump is off because 1ETA has no power due to the 86D relay. 1B NI and NV pumps are running. Normally, when the D/G sequencer actuates, both the on and off lights on NI pumps are dark until the sequencer is reset (this is different than most sequencer controlled equipment). Therefore based on board E30 indication alone, it is plausible that 1A NI is running since no flow or amp indication is given.

A. **Incorrect**: This would be correct if both NV pumps are on and both NI pumps are on.
B. **Incorrect**: This would be correct if one NV pump is on and BOTH NI pumps are on.
C. **Incorrect**: This would be correct if determined subcooling was less than required based on pump status assumed. IF BOTH ND pumps are off, one is started. 1B ND pump should be running.
D. **Correct**:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
19. **Reduce NV S/I flow as follows:**	
__ a. Verify both NV pumps - ON.	__ a. **GO TO** Step 20.
__ b. Determine required NC subcooling from the following table:	

NI PUMP STATUS	NC SUBCOOLING (°F)	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
0	18	30
1	7	12
2	6	11

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ c. Verify NC subcooling based on core exit T/Cs - GREATER THAN REQUIRED SUBCOOLING.	c. Perform the following: __ 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30. 2) **IF** all NC T-Hots are less than 345°F, **THEN**: __ a) **IF** both ND pumps are off, **THEN** start one ND pump. __ b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump. __ c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 19.d. __ d) **GO TO** Step 30.
__ d. Verify Pzr level - GREATER THAN 25% (34% ACC).	__ d. Observe Note prior to Step 16 and **RETURN TO** Step 16.
__ e. Stop one NV pump.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

20. **Reduce NI injection flow as follows:**

__ a. Verify any NI pump - ON.

__ a. **GO TO** Step 21.

__ b. Determine required NC subcooling from table:

NI PUMP STATUS	NC SUBCOOLING (°F)			
	ONE NV PUMP ON		ALL NV PUMPS OFF	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
1	42	82	1000	1000
2	4	8	7	16

__ c. Verify NC subcooling based on core exit T/Cs - GREATER THAN REQUIRED SUBCOOLING.

c. Perform the following:

__ 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30.

2) **IF** all NC T-Hots are less than 345°F, **THEN**:

__ a) **IF** both ND pumps are off, **THEN** start one ND pump.

__ b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump.

__ c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 20.d.

__ d) **GO TO** Step 30.

__ d. Verify Pzr level - GREATER THAN 25% (34% ACC).

__ d. Observe Note prior to Step 16 and **RETURN TO** Step 16.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
20. (Continued)	
e. Verify one of the following conditions is satisfied:	__ e. **<u>GO TO</u>** Step 30.
__ • NC pressure - STABLE OR INCREASING	
OR	
__ • NC subcooling based on core exit T/Cs - INCREASING.	
__ f. Stop one NI pump.	
__ g. **<u>RETURN TO</u>** Step 20.a.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
29. **Verify adequate shutdown margin as follows:**	
__ a. Obtain current NC boron concentration from Primary Chemistry.	
__ b. Perform shutdown margin calculation. **<u>REFER</u> <u>TO</u>** OP/0/A/6100/006 (Reactivity Balance Calculation).	
__ c. Verify NC boron concentration - GREATER THAN OR EQUAL TO REQUIRED BORON CONCENTRATION.	__ c. Borate as required to restore shutdown margin.
30. **Verify S/I flow not required as follows:**	
__ a. NC subcooling based on core exit T/Cs - GREATER THAN 0°F.	a. Perform the following: __ 1) Manually start S/I pumps and align valves as required to restore NC subcooling. __ 2) **<u>GO</u> <u>TO</u>** Step 31.
__ b. Pzr level - GREATER THAN 11% (20% ACC).	b. Perform the following: __ 1) Manually start S/I pumps and align valves as required to restore Pzr level. __ 2) Observe Note prior to Step 16 and **<u>RETURN</u> <u>TO</u>** Step 16.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
31. **Isolate CLAs as follows:**	
__ a. Verify NC subcooling based on core exit T/Cs - GREATER THAN 0°F.	a. Perform the following: __ 1) **<u>IF</u>** at least two NC T-Hots are less than 328°F, **<u>THEN</u> <u>GO</u> <u>TO</u>** Step 31.c. __ 2) **<u>GO</u> <u>TO</u>** Step 32.
__ b. Verify Pzr level - GREATER THAN 11% (20% ACC).	__ b. Observe Note prior to Step 16 and **<u>RETURN</u> <u>TO</u>** Step 16.
__ c. Dispatch operator to restore power to all CLA discharge isolation valves. **<u>REFER</u> <u>TO</u>** Enclosure 4 (Power Alignment for CLA Valves).	
__ d. Maintain NC pressure greater than CLA pressure until the CLAs are isolated or vented.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
31. (Continued)	
e. **WHEN** power is aligned, **THEN**:	
1) Close all of the following valves: __ • 1NI-54A (C-Leg Accum A Disch Isol) __ • 1NI-65B (C-Leg Accum B Disch Isol) __ • 1NI-76A (C-Leg Accum C Disch Isol) __ • 1NI-88B (C-Leg Accum D Disch Isol).	1) Perform the following: a) Vent any CLA which cannot be isolated as follows: __ (1) Open 1NI-47A (C-Leg Accum N2 Sup Cont Isol). __ (2) Place breaker 1CB-1 (behind 1MC-6) (Key #11) to "ON". (3) Open the valve for the CLA(s) to be vented: __ • 1NI-50 (C-Leg Accum A N2 Supply Isol) __ • 1NI-61 (C-Leg Accum B N2 Supply Isol) __ • 1NI-72 (C-Leg Accum C N2 Supply Isol) __ • 1NI-84 (C-Leg Accum D N2 Supply Isol). __ (4) Close 1NI-47A (C-Leg Accum N2 Sup Cont Isol). __ (5) Open 1NI-83 (C-Leg Accums N2 Vent Ctrl) to depressurize the affected CLA(s). (RNO continued on next page)

Question: 05-95

1 Pt(s) Given the following conditions:

- Unit 1 tripped due to a loss of offsite power
- The transient caused a LOCA
- 1ETA 86D relay actuated
- 1ETB undervoltage status lights are DARK

2 minutes later the RO reports the following indications on 1A and 1B NI pump E30 pushbuttons:

- 1A NI pump "ON" and "OFF" lights are DARK
- 1B NI pump "ON" and "OFF" lights are DARK
- 1A and 1B D/G load sequencer "RESET" lights are DARK
- ECCS train "A" and "B" "RESET" lights are DARK

1 hour later, the following conditions exist:

- 1A D/G load sequencer "RESET" light is DARK
- 1B D/G load sequencer "RESET" light is LIT
- ECCS train "A" and "B" "RESET" lights are LIT
- Pressurizer level is 40%
- The SRO is at Step 19 of EP/1/A/5000/ES-1.2, Post LOCA Cooldown and Depressurization.

Reference provided

What is the minimum required subcooling to allow securing the first running ECCS pump?

A. 8°F

B. 11°F

C. 12°F

D. 82°F

Question: 05-95 ***Answer: D***

LEVEL:	SRO

K/A	APE056	**Title**	Loss of Offsite Power
	AA2.03	**Description**	Ability to determine and interpret the following as they apply to the Loss of Offsite Power: **(CFR: 43.5 / 45.13)** Operations status of safety injection pump.
		Importance	3.8/3.9

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-EL-EPC rev 029	OP-CN-EL-EPL
Objectives	2	15
REFERENCES	AP/1/A/5500/029 rev 013 EPC lesson plan page 31 EPL lesson plan pages 11 and 12	
Author	RJK	
Time	8/17/2005 9:41 AM	61 minutes

Distracter Analysis: 1A NV pump and 1A NI pump is off because 1ETA has no power due to the 86D relay. 1B NI and NV pumps are running. Normally, when the D/G sequencer actuates, both the on and off lights on NI pumps are dark until the sequencer is reset (this is different than most sequencer controlled equipment). Therefore based on board E30 indication alone, it is plausible that 1A NI is running since no flow or amp indication is given.

A. **Incorrect**: This would be correct if one NV pump is on and BOTH NI pumps are on.
B. **Incorrect**: This would be correct if both NV pumps are on and both NI pumps are on.
C. **Incorrect**: This would be correct if both NV were on and one NI pump are on.
D. **Correct**:

ACTION/EXPECTED RESPONSE — RESPONSE NOT OBTAINED

19. **Reduce NV S/I flow as follows:**

__ a. Verify both NV pumps - ON.

__ a. **GO TO** Step 20.

__ b. Determine required NC subcooling from the following table:

NI PUMP STATUS	NC SUBCOOLING (°F)	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
0	18	30
1	7	12
2	6	11

__ c. Verify NC subcooling based on core exit T/Cs - GREATER THAN REQUIRED SUBCOOLING.

c. Perform the following:

__ 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30.

2) **IF** all NC T-Hots are less than 345°F, **THEN**:

__ a) **IF** both ND pumps are off, **THEN** start one ND pump.

__ b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump.

__ c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 19.d.

__ d) **GO TO** Step 30.

__ d. Verify Pzr level - GREATER THAN 25% (34% ACC).

__ d. Observe Note prior to Step 16 and **RETURN TO** Step 16.

__ e. Stop one NV pump.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
20. **Reduce NI injection flow as follows:**	
__ a. Verify any NI pump - ON.	__ a. **GO TO** Step 21.
__ b. Determine required NC subcooling from table:	

NI PUMP STATUS	NC SUBCOOLING (°F)			
	ONE NV PUMP ON		ALL NV PUMPS OFF	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
1	42	82	1000	1000
2	4	8	7	16

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ c. Verify NC subcooling based on core exit T/Cs - GREATER THAN REQUIRED SUBCOOLING.	c. Perform the following: __ 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30. 2) **IF** all NC T-Hots are less than 345°F, **THEN**: __ a) **IF** both ND pumps are off, **THEN** start one ND pump. __ b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump. __ c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 20.d. __ d) **GO TO** Step 30.
__ d. Verify Pzr level - GREATER THAN 25% (34% ACC).	__ d. Observe Note prior to Step 16 and **RETURN TO** Step 16.

Question: 05-95

1 Pt(s) Given the following conditions:

- Unit 1 tripped due to a loss of offsite power.
- 1ETA is de-energized due to a failure of 1A diesel generator
- AP/1/A/5500/007 (Case II Loss of all Power to an Essential Train) is in progress.

The following annunciators are LIT:

- 1AD-11 A/1 4KV ESS PWR TRAIN A TROUBLE
- 1AD-11 A/2 600V ESS PWR LC TRAIN A TROUBLE
- 1AD-11 A/3 600/120V ESS PWR MCC/PNL TRN A TRBL
- 1AD-11 H-1 125VDC ESS PWR CHANNEL A TROUBLE
- Diesel Engine Control Panel 1A E/5 LOSS OF DC CONTROL POWER

The following control board indicating lights are DARK:

- OPEN/CLOSE indication for ETA Normal Feeder from ATC.
- OPEN/CLOSE indication for ETXA and ETXC feeder breakers.
- OPEN/CLOSE indicating lights for "A" train valves such as 1NI-9A.
- Status lights: SWGR ETA UV on Phase X, Y, Z

Which of the following statements describe the cause of the indication failures and an action to restore power?

A. Train "A" 4160 and 600 volts essential power busses are de-energized.
Remain in AP/1/A/5500/007 to restore power to 1ETA, 1ELXA, and 1ELXC.

B. Channel A Vital AC 1ERPA is de-energized.
Remain in AP/1/A/5500/007 to restore power to 1EMXA and 1ERPA.

C. Channel A Vital AC and DC, 1ERPA and 1EDA, are de-energized.
GO TO AP/1/A/5500/029 (Loss of Vital or Aux Control Power) to restore 1EDA.

D. Channel A Vital DC 1EDA and D/G Auxiliary Control Power are de-energized.
GO TO AP/1/A/5500/029 (Loss of Vital or Aux Control Power) to restore 1EDA.

Question*: 05-95** ***Answer: D

LEVEL:	SRO

K/A	APE056	**Title**	Loss of Offsite Power
	AA2.45	**Description**	Ability to determine and interpret the following as they apply to the Loss of Offsite Power: **(CFR: 43.5 / 45.13)** Indicators to assess status of ESF breakers (tripped/ not-tripped) and validity of alarms (false/not-false)
		Importance	3.6/3.9

SOURCE	NEW	
LEVEL of KNOWLEDGE	Analysis	
Lesson	OP-CN-EL-EPC rev 029	OP-CN-EL-EPL
Objectives	2	15
REFERENCES	AP/1/A/5500/029 rev 013 EPC lesson plan page 31 EPL lesson plan pages 11 and 12	
Author	RJK	
Time	8/17/2005 9:41 AM	61 minutes

Distracter Analysis: 1EDE is powered through auctioneered DC power systems 1EDA or the D/G DC battery buss. If lost, you will lose control power to all 4160, 600 volt powered equipment indicators on the control board. The choice to restore proper indications would be restoring power to 1EDA in AP/29

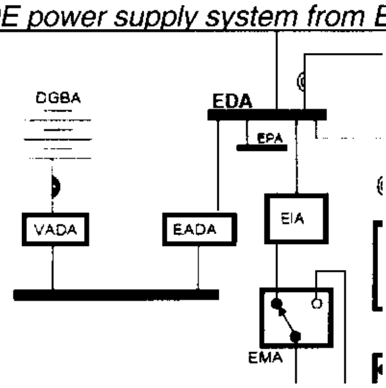
A. **Incorrect**: While it's true that the essential busses need to be energized, the ability to operate the components requires the control power buss. But a confused operator may want to start here to restore.

B. **Incorrect**: 1ERPA is not a power source to address this problem, but may think that using AP/07 to energize EMXA will energize the charger for the vital buss.

C. **Incorrect**: 1ERPA has no bearing on the control board indication failures, but the operator may know that 1EDA is an input to the EDE system and choose this answer.

D. **Correct**:

EDE power supply system from EPL lesson plan



	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

	Objective	I S S	N L O	L P R O	L P S O	P T R Q
1	State the purpose of the Vital Instrumentation and Control System	X	X	X	X	
2	Describe the operation of Kirk-Key Interlocks	X	X	X	X	
3	Describe the operation of Battery Chargers	X	X	X	X	
4	Describe the operation of Batteries	X	X	X	X	
5	Describe the operation of Static Inverters	X	X	X	X	
6	Describe the operation of Manual Bypass Switches	X	X	X	X	
7	Describe the operation of Auctioneering Diode Assemblies	X	X	X	X	
8	Describe the basic actions required of an NLO for a loss of Vital or Auxiliary Control Power per AP/1/A/5500/0029 (Loss of Vital or Auxiliary Control Power)	X	X			
9	Describe operation of the Vital I & C System when configured for normal alignment	X	X	X	X	X
10	Describe operation of the Vital I & C System when configured for a battery charger being removed from service	X	X	X	X	X
11	Describe operation of the Vital I & C System when configured for a battery being removed from service	X	X	X	X	X
12	Describe operation of the Vital I & C System when configured for an equalizing charge on a battery	X	X	X	X	X
13	Describe operation of the Vital I & C System when configured for an Inverter being removed from service	X	X	X	X	X
14	Sketch channel A of the Vital I & C System per training drawing CN-SYS-EL-EPL-11	X	X	X	X	
15	Evaluate the impact a failure of any Vital I & C component will have on unit operation	X	X	X	X	X
16	Describe the Ground Detection controls and indications used at Catawba Nuclear Station	X	X	X	X	X
17	Describe how a ground is indicated on the ground detection devices used at Catawba Nuclear Station	X	X	X	X	X
18	Given appropriate plant conditions, apply the Limits and Precautions associated with OP/1/A/6350/008 (125 VDC/125 VAC Vital Instrument and Control Power System	X	X	X	X	X

l) CF to CA, CF containment isolations, CF regulator valves, CF regulator bypass valves, and CA tempering isolation valves close

m) Letdown orifice isolations fail closed

n) NV153A fails to the VCT position

o) NV466, NV181A, and NV242A fail closed

p) Main steam isolations and bypasses fail closed

q) Pzr PORVs fail closed

r) Lose auto control of Pzr heaters

s) VP isolates and fans shutdown

4. EDE (EDF) carry the following loads:

   a) ETA (ETB) Swgr. Control Power

   b) ELXA & ELXC (ELXB & ELXD) Control Power

   c) D/G Sequencer 1A (1B) Control Power

   d) Aux. S/D Panel A (B) Control Power

   e) CA Turbine A (B) Train Control Power

   f) PZR Heater Gr. 1A (1B) Aux. S/D Pnl. Control

   g) NV System A (B) Solenoid Vlvs. (Aux. S/D Panel)

5. A loss of EDA or EDD concurrent with a loss of EDE or EDF, respectively would be the worst case failure for the Vital I & C System and plant response. The following action would occur in this case: (Obj #15)

   a) In the particular case of losing either EDA or EDD, control circuits are de-energized which result in closure of the main stream isolation valves, resulting in a turbine trip and reactor trip if reactor power is greater than 69%.

   b) As stated, the worst case occurs upon a loss of channel A or channel D. Assuming a concurrent loss of 125 VDC Panelboard EDE or EDF, the following actions take place.

      1) Lose control of 4160 V loads.

      2) Lose control of 600 V essential loads.

      3) Lose control of D/G sequencer loads.

      4) KC to NDHX opens.

      5) No MD CA pump indication.

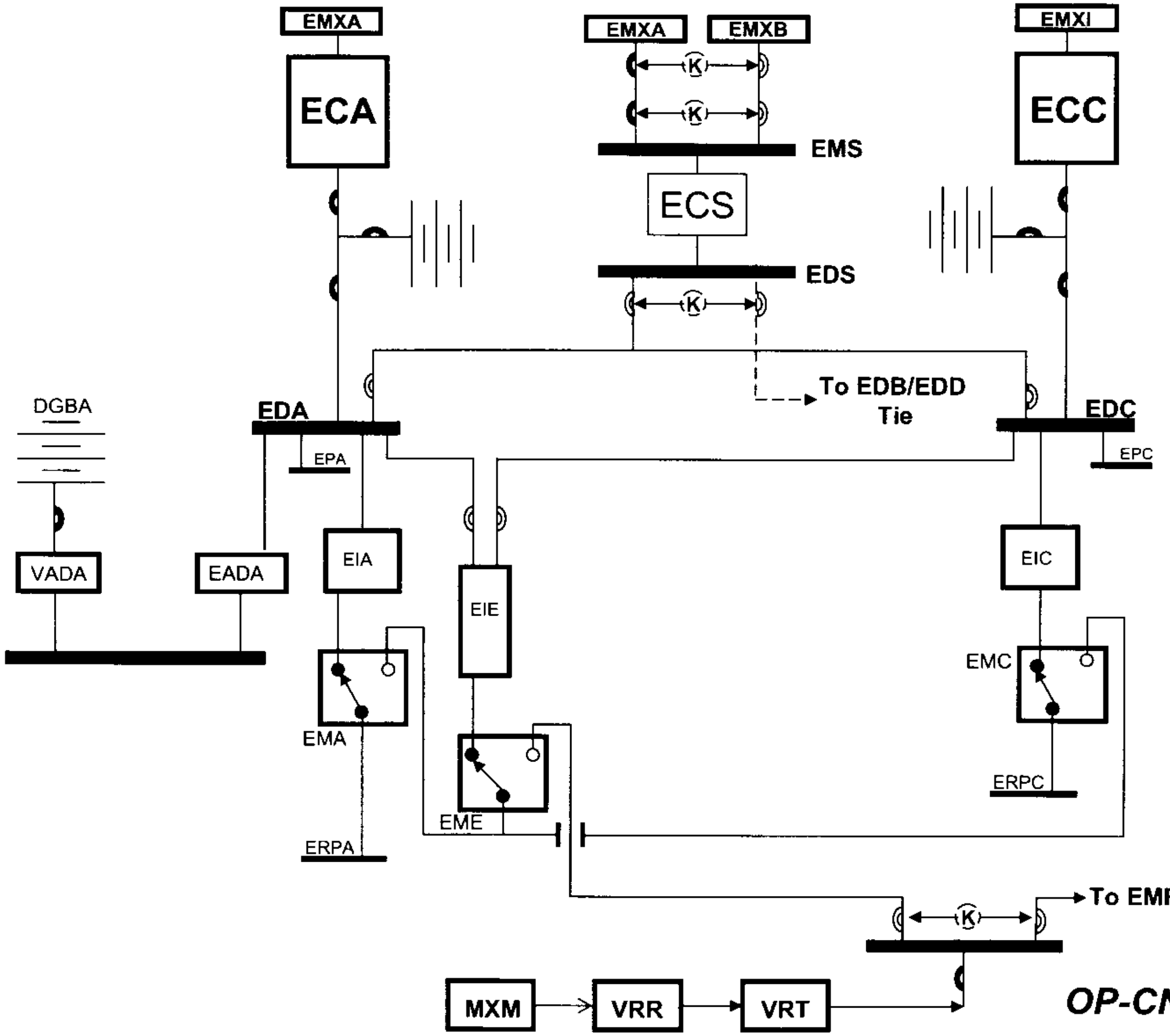
      6) Auxiliary Building containment isolation valves close.

      7) Tempering isolation valves close.

8) VP isolation valves close.
9) Main steam isolation valves close.
10) Letdown isolates, divert to VCT, BA valve fails open, RMUW valve fails closed.
11) PORV's fail closed.
12) AHU Glycol supply valves close.
13) Receive reactor trip alert Annunciators.
14) Lose permissives for NS valves and VX damper.
15) Lose RN swap to SNSWP.
16) Lose Post Accident Recorders.
17) CAPT Electronic overspeed not available.
18) CA suction auto transfer to RN not available.
19) CA reset not available.
20) TD CA pump auto start.

G. Static Inverters (Obj. #5)

1. Four per unit, designated as follows:
   a) EIA - Channel A
   b) EIB - Channel B
   c) EIC - Channel C
   d) EID - Channel D
2. Static inverters convert 125 VDC power to 120 VAC power.
3. Each inverter supplies a 120 VAC Panelboard (ERPA, ERPB, ERPC and ERPD) through a Manual Bypass Switch.
4. Static inverters have a synchronizing circuit which compares the frequency and phase of the alternate 120 VAC 60 Hz supply from VRD to the inverter output. It compares the two signals only if the sync. disconnect switch is closed and the alternate AC source breaker is closed at VRD. This synchronizing circuit causes the inverter to turn in sync. with the alternate source which allows the 120 VAC panelboard power supply to be swapped without power interruption.
5. To prevent damage on inverter restart after shutdown, a 60 second wait is required to allow the capacitors and rectifiers to cool down.
6. Static inverters must be "Pre-charged" prior to closing the DC input breaker. Once the "Pre-charge" button is released, the "Battery Input" breaker must be closed immediately to prevent blowing the inverter input fuses.



OP-CN-EL-EPL-11

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. **Symptoms**

- **1AD-11, G/1 "120 VAC ESS PWR CHANNEL A TROUBLE" Alarm - LIT**
- **1AD-11, G/2 "120 VAC ESS PWR CHANNEL B TROUBLE" Alarm - LIT**
- **1AD-11, G/3 "120 VAC ESS PWR CHANNEL C TROUBLE" Alarm - LIT**
- **1AD-11, G/4 "120 VAC ESS PWR CHANNEL D TROUBLE" Alarm - LIT**
- **1AD-11, H/1 "125 VDC ESS PWR CHANNEL A TROUBLE" Alarm - LIT**
- **1AD-11, H/2 "125 VDC ESS PWR CHANNEL B TROUBLE" Alarm - LIT**
- **1AD-11, H/3 "125 VDC ESS PWR CHANNEL C TROUBLE" Alarm - LIT**
- **1AD-11, H/4 "125 VDC ESS PWR CHANNEL D TROUBLE" Alarm - LIT**
- **1AD-11, I/4 "240/120VAC NORM AUX CONTROL PWR TROUBLE" Alarm - LIT**
- **1AD-11, J/3 "125VDC NORM AUX CONTROL PWR TROUBLE" Alarm - LIT**
- **Status lights lit for a single channel indicating a loss of that channel**
- **Loss of control power indication for control board components.**

Question: 05-96

1 Pt(s) Given the following conditions:

- EP/2/A/5000/FR-C.2 (Response to Degraded Core Cooling) is in progress.
- Reactor coolant pumps (NCP) 2A and 2C are in service.
- Reactor vessel dynamic D/P was 3% less than required.
- Steam generator pressures have been reduced to 110 psig.

Determine the remaining actions to address the degrading core cooling conditions?

A. Shutdown all NCPs and depressurize the NC system by depressurizing the steam generators to atmospheric pressure.

B. Shutdown one NCP and depressurize the NC system by depressurizing the steam generators to atmospheric pressure.

C. Continue to run both NCPs as long as vessel D/P is indicated. Do not depressurize the steam generators further.

D. Continue to run both NCPs and start an additional NCP to increase vessel D/P. Do not depressurize the steam generators further.

Question: 05-96 *Answer: A*

LEVEL:	SRO

K/A	WE06	Title	
	EA2.2	Description	Ability to determine and interpret the following as they apply to the (Degraded Core Cooling) **(CFR: 43.5 / 45.13)** Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.
		Importance	3.5/4.1

SOURCE	New
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-EP-FRC
Objectives	2
REFERENCES	EP/2/A/5000/ FR-C.2 (Response to Degraded Core Cooling) revision 15 And background document
Author	RJK
Time	6/30/2005 2:40 PM 146 minutes

Distracter Analysis:

A. **Correct**: Pumps must be shutdown due to loss of Seal D/P when S/Gs are depressurized to atmospheric pressure.

B. **Incorrect**: At this point, the only viable effort left is the continue blow down of the S/G to lower NC pressure and increase SI flow. You cannot operate a NCP with low Seal D/P as you depressurize the NC system. An operator may think a cooldown leaving one pump on to sacrifice is acceptable.

C. **Incorrect**: Not allowed per procedure because it is not ADEQUATE! Other actions require pumps to be shutdown. An operator may think that seeing the low but indicated D/P means that some core cooling is taking place.

D. **Incorrect**: There is insufficient coolant to create the vessel D/P adding more pumps will not help. C-2 makes no previsions to start any NC pumps. But an operator may assume more is better.

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

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
18. (Continued)	
	(6) **WHEN** CLA(s) is vented, **THEN**: __ 1. Close 1NI-83. 2. Close valve(s) previously opened: __ • 1NI-50 (C-Leg Accum A N2 Supply Isol) __ • 1NI-61 (C-Leg Accum B N2 Supply Isol) __ • 1NI-72 (C-Leg Accum C N2 Supply Isol) __ • 1NI-84 (C-Leg Accum D N2 Supply Isol). __ 3. Place breaker 1CB-1 (behind 1MC-6) to "OFF".
	e) **IF** CLA(s) cannot be vented, **THEN** perform the following: __ (1) Consult station management for further actions. __ (2) **GO TO** Step 19.
__ 2) Notify dispatched operator to open and lock breakers. **REFER TO** Enclosure 6 (Power Alignment for CLA Valves).	
__ 19. **Symptoms for EP/1/A/5000/FR-C.1 (Response To Inadequate Core Cooling), should be closely monitored during subsequent steps.**	
__ 20. **Stop all NC pumps.**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
21. **Depressurize intact S/Gs to atmospheric pressure 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 less than 100°F in an hour while dumping steam in the following steps. __ 2) Dump steam using intact S/G PORV(s). 3) **<u>IF</u>** any intact S/G PORV cannot be opened from the control room, **<u>THEN</u>**: __ a) Dispatch operator(s) to operate affected S/G(s) PORV. **<u>REFER TO</u>** Enclosure 7 (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). __ 4) **<u>GO TO</u>** Step 22.

STEP 20: Stop all NC pumps.

PURPOSE:

To ensure all NC pumps have been stopped.

APPLICABLE ERG BASIS:

In preparation for the subsequent depressurization of the S/Gs to atmospheric pressure, the NC pumps are stopped due to the anticipated loss of Number 1 seal requirements. Continued operation may result in damage to the NC pumps.

PLANT SPECIFIC INFORMATION:

KNOWLEDGE/ABILITY:

Question: 05-97

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1 Pt(s) Given the following conditions:

- Unit 1 is at 100% power.
- Excore detector N41 failed high.
- Control rod bank select is in automatic; rods are not moving.
- The following annunciators are in alarm:
  - 1AD-2 A/1 P/R HI NEUTRON FLUX RATE ALERT
  - 1AD-2 A/3 P/R NEUTRON FLUX HI SET POINT ALERT
  - 1AD-2 E/8 OVER POWER ROD STOP

Select the correct immediate action and procedure to address this situation.

A. Verify reactor is tripped; enter EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

B. Adjust turbine load and boron concentration to maintain Tavg within 1° F of Tref; enter AP/1/A/5500/015 Case I, Failure of Rods to Move.

C. Place control rods in manual; enter AP/1/A/5500/016 Case IV, Power Range Malfunction.

D. Verify all rod motion stopped; enter AP/1/A/5500/016 Case IV, Power Range Malfunction.

Question: 05-97 *Answer: D*

LEVEL:	RO/SRO

K/A	SYS012	Title	Reactor Protection
	A2.1.20	Description	Ability to execute procedure steps. **(CFR: 41.10 / 43.5 / 45.12)**
		Importance	4.3/4.2

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-IC-ENB
Objectives	11 and 12
REFERENCES	AP/1/A/5500/016 rev 20
Author	RJK
Time	7/11/2005 9:49 AM 71 minutes

Distracter Analysis:

A. **Incorrect**: There is no requirement to trip the reactor. But an operator who thinks control bank malfunctions means he has no control may act conservatively.

B. **Incorrect**: Not an immediate action. But this is a valid action to ensure T-Avg remains at program values.

C. **Incorrect**: This is the RNO action ONLY IF the rods are moving. The step is not performed. But an operator would think to place them in manual to prevent any other failure from affecting the suspect rod control system.

D. **Correct**: Per AP-16 case 4, the only requirement is to verify.

AP-16 Case 4 Immediate action

C. Operator Actions

__ 1. Verify all rod motion - STOPPED.	__ IF unwarranted rod motion is occurring, THEN place "CRD BANK SELECT" to manual.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the ENB system.			X	X	
2	Describe the principle of operation of each detector used.			X	X	
3	Describe the overlap provided between each range.			X	X	X
4	Describe the function of each output from each range of nuclear instrumentation.			X	X	X
5	Explain the function of each portion of the individual ranges when given a block diagram of each range.			X	X	X
6	Explain the function of all indications and controls associated with ENB.			X	X	X
7	Describe the "Gamma Compensation" used by each range.			X	X	X
8	Describe the effects of "over" and "under" compensation in the Intermediate Range.			X	X	X
9	Describe the plant response to a given detector or instrument failure.			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	List the symptoms as given for each case in AP/1/A/5500/016, Malfunction of Nuclear Instrumentation.			X	X	
12	FROM MEMORY state the Immediate Actions as required by AP/1/A/5500/016, Malfunction of Nuclear Instrumentation.			X	X	X
13	Describe the source range instrumentation response for voiding in the core/downcomer region of the core and for core uncovery.			X	X	X
14	State from memory all Tech Spec actions for the applicable system, subsystem and components, which require remedial action to be taken in less than 1 hour.			X	X	

A. Purpose

__ • **To verify proper operator response in the event of a Rod Control System malfunction.**

B. Symptoms

Case I. Failure of Rods to Move

__ • 1AD-2, A/10 "ROD CONTROL URGENT FAILURE" - LIT

__ • No automatic rod motion occurring when expected

__ • No manual rod motion occurring when expected

__ • 1AD-2, A/4 "T-REF/T-AUCT HI/LO" - LIT.

Case II. Continuous Rod Movement

__ • Unwarranted continuous rod movement

__ • 1AD-2, A/4 "T-REF/T-AUCT HI/LO" - LIT.

A. **Purpose**

- **To verify the proper response in the event of a nuclear instrumentation malfunction.**

B. **Symptoms**

Case I. Source Range Malfunction

- Indication lost or erratic
- 1AD-2, D/1 "S/R HI VOLTAGE FAILURE" - LIT
- 1AD-2, D/3 "S/R HI FLUX LEVEL AT SHUTDOWN" - LIT
- 1AD-2, D/4 "S/R HI FLUX LEVEL AT SHUTDOWN" - LIT.

Case II. Audio Count Rate Malfunction

- Audible count rate lost.

Case III. Intermediate Range Malfunction

- Indication lost or erratic
- 1AD-2, C/1 "I/R HI VOLTAGE FAILURE" - LIT
- 1AD-2, C/2 "I/R COMPENSATING VOLTAGE FAILURE" - LIT
- 1AD-2, C/3 "I/R HI FLUX LEVEL ROD STOP" - LIT
- S/R failure to re-energize during shutdown.

Case IV. Power Range Malfunction

- Indication lost or erratic
- 1AD-2, A/1 "P/R HI NEUTRON FLUX RATE ALERT" - LIT
- 1AD-2, A/2 "P/R HI NEUTRON FLUX LO SETPOINT ALERT" - LIT
- 1AD-2, A/3 "P/R HI NEUTRON FLUX HI SETPOINT ALERT" - LIT
- 1AD-2, B/3 "COMPARATOR P/R CHANNEL DEVIATION" - LIT
- 1AD-2, B/5 "P/R HI VOLTAGE FAILURE" - LIT
- 1AD-2, E/8 "OVER POWER ROD STOP" - LIT
- 1AD-4, C/5 "DFCS TROUBLE" - LIT.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Verify all rod motion - STOPPED.**	__ **IF unwarranted rod motion is occurring, THEN place "CRD BANK SELECT" to manual.**
__ 2. **Verify 1AD-2, E/8 "OVER POWER ROD STOP" - DARK.**	__ **Adjust Turbine load to maintain T-Avg at T-Ref.**
3. **Identify failed P/R channel:** __ • N-41 OR __ • N-42 OR __ • N-43 OR __ • N-44.	
__ 4. **Ensure unaffected channels - OPERABLE.**	
5. **Request IAE to place the following bistables in the tripped condition. REFER TO Model W/O #91002943:** __ • OT DELTA T __ • OP DELTA T.	

***Question*: 05-98**

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1 Pt(s) Given the following conditions:

- 1B diesel generator (D/G) is paralleled to 1ETB with 5750 KW of load for a periodic test.
- Unit 1 reactor trip occurs due to a complete loss of offsite power.
- 1A diesel generator fails to start.

Which one of the following describes the status of 1ETB and the correct procedure response?

A. 1B D/G output breaker trips and locks out due to over current, 1ETB remains de-energized and crew enters EP/1/A/5000/ECA-0.0, Loss of All AC Power.

B. 1B D/G output breaker trips on over current, but 1ETB is re-energized by the sequencer, crew enters EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

C. 1B D/G output breaker remains closed, 1ETB loads are shed and blackout loads are re-energized by the sequencer, crew enters EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

D. 1B D/G output breaker remains closed, 1ETB remains energized with no sequencer actuation, crew enters EP/1/A/5000/E-0, Reactor Trip or Safety Injection.

Question*: 05-98** ***Answer: B

LEVEL:	RO/SRO

K/A	SYS064	**Title**	Emergency Diesel Generators
	A.2.16	**Description**	Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: **(CFR: 41.5 / 43.5 / 45.3 / 45.13)** Loss of offsite power during full-load testing of ED/G
		Importance	3.3/3.7

SOURCE	NEW
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-DG-EQB rev 028
Objectives	10
REFERENCES	Lesson plan pages 9 and 10
Author	RJK
Time	7/11/2005 1:59 PM 140 minutes

Distracter Analysis: The loss of offsite power and the main generator results in an extreme overload condition for the diesel generator. The output breaker will trip on over-current then be restored through normal blackout sequencer operation.

A. **Incorrect**: A lockout does not occur on a simple over-current situation. But clearly the operator would pick this if he thinks both D/Gs are down.

B. **Correct**:

C. **Incorrect**: This sounds correct since the statement describes actions by the sequencer. But if it were true, nothing starts the sequencer except the power failure.

D. **Incorrect**: This is not true; there is nothing to just trip the 1ATD feeder in this situation to create an isolated diesel and 1ETB. An operator may assume some action prevents the output breaker from tripping thus the plant only trips and they enter E-0.

OBJECTIVES

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the D/G Sequencer System			X	X	X
2	State the design criteria for the Sequencer System.			X	X	X
3	State the power supplies for the Sequencer System			X	X	X
4	List the two-(2) modes of sequencer operation and specify which is the priority mode.			X	X	X
5	State the initiating signals, setpoints, and logic required to actuate each mode of sequencer operation.			X	X	X
6	Describe the interlocks associated with each mode of operation that will prevent actuation of the sequencer.			X	X	X
7	Describe the Load Groups associated with the sequencer including: • The total number of groups • Groups unique to a particular mode • Group(s) that receive start permissive versus start signal			X	X	X
8	Compare the "Committed Sequence" of sequencer operation to the "Accelerated Sequence".			X	X	X
9	Describe how the "Accelerated Sequence" of operation is different for Blackout versus LOCA initiation.			X	X	X
10	Describe sequencer operation during a station blackout initiation of the sequencer, including: • When diesel generator receives start signal • Checks and action performed by sequencer after 8 second timer times out • Sequencer actions if blackout still present 8.5 seconds after initiating event (logic and load shed relay actions) • Logic required for sequencer to close D/G Output Breaker • Logic required for accelerated versus committed loading sequence			X	X	X

2.5 Basic Function

A. Initiating Signals (Obj. #5,6)

1. Blackout - 2/3 undervoltage relays actuated on the train related Essential switchgear ETA(B).

   a) Setpoint is 84.1% of the normal 4160v.

   b) Interlocked with lockout 86 N, S, or B to prevent sequencer actuation if a lockout of the normal (86N) or alternate (86S) feeder breaker to the Essential switchgear or a failure of either breaker (86B) exists.

   c) Degraded Buss Voltage -2/3 undervoltage relays, with a setpoint of less than or equal to 90%, provide a signal to trip the incoming breakers after a 10 minute time delay. The sequencer will then actuate when voltage decays to the undervoltage setpoint for the sequencer actuation on Blackout described above.

      1) If power is restored to greater than 90% before the 10 minute timer is completed, the timer is reset.

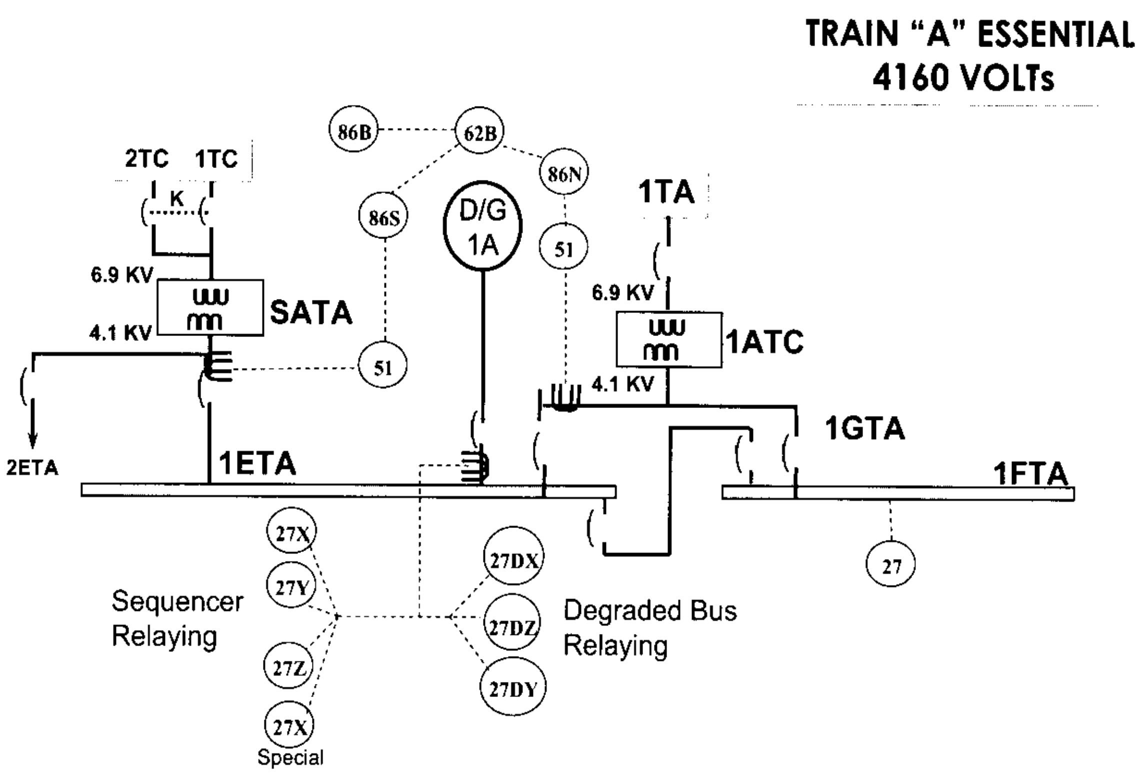
      2) An annunciator alerts the Control Room Operators 5 seconds after the 90% set point is reached.

      3) If an S_s signal exists and the Auxiliary Shutdown Panel transfer switch is in the "Control Room" position, then the incoming breakers trip after a 5 seconds rather than 10 minutes.

         (a) If a switchyard low voltage alarm comes in and is verified valid with TCC, then action will be taken to have SPOC place a jumper to bypass the 5 second time delay, to prevent the sequencer from beginning to load when the Ss occurs and then starting again when the degraded bus condition occurs.

2. Ss Signal from the train related solid state protection system. This actuation is interlocked with the Auxiliary Shutdown Panel (ASP) "Local/Remote" switch to prevent actuation of the sequencer if the associated train ASP is in "Local" position.

3. Whenever the sequencer is actuated, the Train Related Standby Diesel Generator is started.


TRAIN "A" ESSENTIAL
4160 VOLTs
86B
62B
86N
86S
D/G
1A
51
2TC
1TC
K
1TA
6.9 KV
4.1 KV
SATA
51
6.9 KV
1ATC
4.1 KV
1GTA
2ETA
1ETA
1FTA
27X
27Y
27Z
27X
Special
Sequencer
Relaying
27DX
27DZ
27DY
Degraded Bus
Relaying
27

Question: 05-99

1 Pt(s) Initial conditions:

- Unit 1 had a complete loss of switchyard
- The crew was performing steps in EP/1/A/5000/ES-0.2, Natural Circulation Cooldown
- Station management recommended a rapid cooldown due to secondary inventory concerns
- The crew transitioned to EP/1/A/5000/ES-0.3, Natural Circulation Cooldown with Steam Void in the Vessel

Current conditions:

- During the cooldown, a steam bubble formed in the reactor vessel
- Reactor vessel Upper Range (UR) level is 92%.
- The STA notes a YELLOW path on NC INVENTORY and confers with the OSM regarding the need to transition to EP/1/A/5000/FR-I.3, Response to Voids in Reactor Vessel.

Which one of the following is the correct action to control void growth such that natural circulation is not interrupted, and which procedure will be used to accomplish this?

A. Open reactor vessel head vents per EP/1/A/5000/FR-I.3.

B. Open reactor vessel head vents per EP/1/A/5000/ES-0.3.

C. Energize pressurizer heaters per EP/1/A/5000/FR-I.3.

D. Energize pressurizer heaters per EP/1/A/5000/ES-0.3.

Question: 05-99 Answer: D

LEVEL:	RO/SRO

K/A	SYS002	Title	Reactor Coolant system
	Generic 2.1.23	Description	Ability to perform specific system and integrated plant procedures during all modes of plant operation **(CFR: 45.2 / 45.6)**
		Importance	3.9/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	
Objectives	11
REFERENCES	EP/1/A/5000/ES-0.3 Natural Circulation Cooldown with Steam Voids in Vessel, LP OP-CN-EP-EP1, ES-0.3 basis document
Author	JEG
Time	11/22/2005 0700 AM 33 minutes

Distracter Analysis: ES-0.3 is implemented if the 50 °F/hr cooldown of ES-0.2 limit is not fast enough. ES-0.3 is designed to perform a plant cooldown on natural circulation, assuming that a void will develop in the reactor vessel head region. The operator monitors the void growth and the procedure requires that level in RV head be maintained greater than 73% UR level. The void level is controlled by the use of pressurizer heaters, (to control subcooling), and charging and letdown. FR-I.3 is entered from a yellow path on CSF status trees when Reactor vessel upper range level is not greater than 95%. This sends the crew to FR-I.3. This procedure is primarily for venting a hard bubble in the PZR, not collapsing a steam void. A transition to FR-I.3 in not necessarily incorrect, however, the first step will direct the crew back to ES0.3. Therefore, for the current conditions, NO actions are performed in FR-I.3 even if a transition occurs. ES 0.3 is used to maintain level greater than 73% to prevent a loss of natural circulation by increasing pressure (using PZR heaters).

A. **Incorrect**: No actions are taken in FR-I.3 for this condition, however, this IS an action in FR-I.3 to vent a non-condensible bubble.

B. **Incorrect**: This is the correct procedure to be in, however, this procedure does not vent the head, this is the action taken in FR-I.3 is the bubble is non-condensible gas.

C. **Incorrect**: No actions are taken in FR-I.3, this action is not in FR-I.3 but is an action that is used to control void formation in other procedures and is the correct ACTION in this condition.

D. **Correct**:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. ~~Operator Actions~~

__ 1. **IF EP/1/A/5000/ES-0.3 (Natural Circulation Cooldown With Steam Void In Vessel) is in progress, THEN RETURN TO procedure and step in effect.**

2. **Verify S/I has been terminated as follows:**

   __ **RETURN TO procedure and step in effect.**

   __ • Both NI pumps - OFF

   __ • 1NI-9A (NV Pmp C/L Inj Isol) - CLOSED

   __ • 1NI-10B (NV Pmp C/L Inj Isol) - CLOSED.

__ 3. **Verify VI pressure - GREATER THAN 50 PSIG.**

   In subsequent steps, control room control is lost for the following valves and local operation will be required:

   __ • 1NV-294 (NV Pmps A&B Disch Flow Ctrl)

   __ • 1NV-309 (Seal Water Injection Flow).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Control Pzr level as follows:**	
__ a. Verify Pzr Level - GREATER THAN 25%.	a. Perform the following: __ • Control charging and letdown as necessary to increase Pzr level to greater than 25%. __ • Maintain charging flow less than 180 GPM.
__ b. Verify Pzr Level - LESS THAN 90%.	b. Perform the following: __ 1) Operate Pzr heaters to maintain Pzr pressure stable. 2) Decrease Pzr level to less than 90% by one of the following methods: __ • Control charging and letdown OR __ • Continue cooldown to shrink NC System inventory.
__ 6. **Verify "REACTOR VESSEL UR LEVEL" - GREATER THAN 73%.**	**Perform the following:** __ a. Increase NC System pressure to restore "REACTOR VESSEL UR LEVEL" to greater than 73%. __ b. Control NC System depressurization in subsequent steps to maintain "REACTOR VESSEL UR LEVEL" greater than 73%. __ c. **<u>RETURN TO</u>** Step 4.

***Question*: 05-99**

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1 Pt(s) Unit 1 CA pump sump was being pumped down when 1EMF52 (Clean Area Floor DRN HI RAD) Trip 2 alarm sounded.

Which of the following statements describes the automatic actions that occur, if any, and the required actions to clear the alarm per OP/1/A/6500/014 (Operations Controlled Liquid Waste Systems)?

A. Flow is diverted to the ND/NS room sumps and pumped to the recycle holdup tank.
Reset 1EMF52 Trip 2 alarm.
If a second Trip 2 alarm is received flush 1EMF52 with demineralized water.

B. No automatic actions occur.
Flush 1EMF52 with demineralized water.
Obtain RP permission to reset the 1EMF52 Trip 2 alarm.

C. No automatic actions occur.
Reset 1EMF52 Trip 2 alarm.
If a second Trip 2 alarm is received flush 1EMF52 with demineralized water.

D. Flow is diverted to the ND/NS room sumps and pumped to the recycle holdup tank.
Flush 1EMF52 with demineralized water.
Obtain RP permission to reset the1EMF52 Trip 2 alarm.

Question*: 05-99** ***Answer: D

LEVEL:	RO/SRO

K/A	SYS068	**Title**	Liquid Radwaste System
	Generic 2.1.23	**Description**	Ability to perform specific system and integrated plant procedures during all modes of plant operation **(CFR: 45.2 / 45.6)**
		Importance	3.9/4.0

SOURCE	NEW
LEVEL of KNOWLEDGE	Memory
Lesson	OP-CN-WE-WL rev 015
Objectives	11
REFERENCES	OP/1/A/6500/014 rev 068 Lesson plan pages 17 and 22
Author	RJK
Time	8/17/2005 9:17 AM 18 minutes

Distracter Analysis:

A. **Incorrect**: After a trip 2 on 1EMF52, the flowpath must be flushed, and the EMF reset with RP approval. Automatic action is correct.

B. **Incorrect**: Automatic actions do occur. The other part is correct.

C. **Incorrect**: After a trip 2 on 1EMF52, the flowpath must be flushed, and the EMF reset with RP approval. Automatic actions do occur.

D. **Correct**:

	Objective	ISS	NLO	LPRO	LPSO	PTRQ
1	State the purpose of the Liquid Waste System	X	X	X	X	
	• State the purpose of each of the subsystems			X	X	
2	Describe the Reactor Coolant Drain Tank (NCDT) Subsystem.	X	X			
	• State the purpose of the NCDT	X	X			
	• State the purpose for using a cover gas in the NCDT	X	X			
	• State the normal discharge flow path and the refueling discharge flow path of the NCDT	X	X			
	• List the basic steps for placing a NCDT gas cylinder in service and removing it from service	X	X			
3	Discuss operation of the WL system for:	X	X	X	X	X
	• Normal Alignment	X	X	X	X	X
	• Performing a normal liquid waste release	X	X	X	X	X
	• Filling and Draining various components	X	X			
4	Describe the Automatic actions caused by an alarm on EMF-49 or EMF-57	X	X	X	X	X
5	State the system designator and nomenclature for major components	X				
6	Describe the categories of liquid waste			X	X	X
7	Explain how unidentified leakage inside containment is monitored			X	X	X
8	Discuss how VUCDT Contents can indicate a steam or NC System leak inside containment			X	X	X
9	Describe operation of the WL system during a Station blackout			X	X	
10	Summarize the Technical Specifications and Selected Licensee Commitments applicable to the WL system			X	X	
11	Explain how to respond to Liquid Waste System annunciator alarms			X	X	
12	Identify the information required to perform a release rate calculation			X	X	X
13	List and explain the process monitoring requirements for liquid waste releases			X	X	
14	Explain the hydrological effects on liquid effluent releases			X	X	

2. Components:
   a) (3) Auxiliary Monitor Tanks, 20,000 gal. cap. each.
   b) (11) Vendor Supplied demineralizers, loaded with various different types of resins to treat different types of liquid influents.
   c) (1) Spent resin container (Powdex Storage Tank)
   d) (3) Auxiliary Monitor Tank Pumps
   e) EMF-57 Monitor Tank Building Liquid Discharge Monitor (Obj. # 4)
      - Controlling EMF during release from MTB
      - Auto closes 1WL-X28
      - Required by Selected Licensee Commitment (16.11-2)
   f) Monitor Tank Building Sumps
      1) 1 Building Sump
      2) 1 Truck Bay Sump
   g) EMF-58 Noble Gas Activity Monitor required by S.L.C. (16.11-7)
   h) Release flow instrumentation required by S.L.C. (16.11-2)
   i) Monitor tank gaseous effluent monitoring instrument required by S.L.C. (16.11-7)

2.2 Misc. Sumps

A. Aux. Feedwater (CA) Pump Room Sumps

1. Turbine Driven CA pump (CAPT) pit – one sump per unit
   a) These receive condensate drains from the steam driven turbine.
   b) "Man-Auto-Standby" pump controls near sump.
   c) Two sump pumps per unit
   d) Required by Tech. Specs. (Design Basis Specifications). If the A Sump pump becomes inoperable, the CAPT and SSF (Standby Shutdown Facility) become inoperable. If the B CAPT Sump Pump becomes inoperable, this renders the CAPT inoperable (Obj. #10).
2. Motor Driven CA pump pits – two sumps per unit
   a) "Man-Auto" controls near sump.
   b) One pump per sump
3. Normal discharge to Turbine Building Sump through EMF-52.
4. Contaminated discharge to ND/NS Sump when Solenoid valves automatically divert flow on a high rad. signal from EMF-52 (trip 2).
5. Sized to handle a 50 GPM leak for 10 mins.(500 gal capacity)

D. EMF's associated with the WL systems

1. EMF-47 (NB Evaporator Condenser Monitor)

a) Monitors Boron Recycle Evaporator condenser, downstream of filter

b) Automatically diverts flow from the RMWST to the RHT (via NB-219) through the recycle feed demineralizers. This ensures NC makeup water is maintained within the Tech Spec limits.

2. EMF-49 (Liquid Waste Discharge Monitor)

a) Monitors all liquid waste discharge to the RN discharge header from the Aux Building

b) Automatically terminates discharge flow (closes 1WL-124)

3. EMF-52 (Clean Area Floor Drain Monitor)

a) Monitors discharge of CA pump room sumps (floor drain sumps C and D) to the turbine building sump.

b) Automatically diverts flow from turbine building sump to ND/NS sump

c) Per the annunciator response, resetting the Trip 2 alarm will cause the flow to realign to the turbine building sump. Therefore, the alarm shall not be reset without RP permission.

4. EMF-57 (Waste Monitor Tank Building Liquid Discharge Monitor)

a) Monitors all liquid waste discharge to the RL system from the MTB.

b) Automatically terminates discharge flow (closes 1WL-X28)

E. Operations Liquid Waste Release (Obj. #3, 12)

1. Factors Affecting Releases (Obj. #14)

a) While the activity of waste water (to be discharged) at power is low, it is still above the levels established by regulations. Therefore, it is necessary to dilute the activity so that the levels to which the general public is exposed is within applicable regulations.

For liquid releases from the Auxiliary Building, the liquid effluent, after treatment and sampling, is released via the RN discharge flowpath to the RL system discharge into the lake. At CNS, the RL discharge is downstream and to the opposite side of the plant from the RL intake.

For releases from the Monitor Tank Building, the liquid being released is discharged directly into the RL System at a point in the service building.

1. Initial Conditions

_____ 1.1 Review the Limits and Precautions.

_____ 1.2 Radwaste Chemistry personnel has been notified of evolution.
Person notified ______________________________

_____ 1.3 Unit 1 valve key has been obtained from the key locker.

2. Procedure

NOTE:	1. Valves 1WL-847 and 1WL-848 are operated from panel 1ELCC0013 (AB-543, MM-53, Rm 212). 2. If the flush is being performed due to an 1EMF 52, Trip 2 alarm, the following automatic actions should have occurred: • 1WL-847 should have opened. • 1WL-848 should have closed.

_____ 2.1 **<u>IF</u>** 1EMF-52 is in Trip 2 alarm, perform the following:

_____ 2.1.1 Ensure 1WL-847 (Floor Drn Sump D Disch To ND & NS Rooms Sump) is open.

_____ 2.1.2 Ensure 1WL-848 (Floor Drn Sump D Disch To Turb Bldg Sump) is closed.

_____ 2.2 Close 1WL-844 (1EMF-52 Inlet) (AB-548, CC-52, Rm 250).

_____ 2.3 Unlock 1WL-845 (1EMF-52 Outlet) (AB-548, CC-52, Rm 250).

_____ 2.4 Close 1WL-845 (1EMF-52 Outlet).

NOTE:	The meter reading for 1EMF-52 in the next step can be obtained in the Control Room from the Process Radiation Monitoring panel or from the OAC

_____ 2.5 Record value of 1EMF-52 meter pre-flush:
__________ cpm

_____ 2.6 Open 1WL-D65 (YM Flush Supply) (AB-543, CC-52, Rm 250).

_____ 2.7 Open 1WL-443 (1EMF-52 Inlet Drn Isol) (AB-548, CC-52, Rm 250)

NOTE: 1EMF-52 flush shall be limited to a 10 minute flushing period. If needed, an additional 2 flushes may be performed.

_____ 2.8 Flush 1EMF-52 for ten minutes.

_____ 2.9 Contact Control Room to determine if 1EMF-52 reading has decreased to a stable value, less than Trip 2 setpoint.

_____ 2.10 **IF** 1EMF-52 reading has decreased to a stable value, less than Trip 2 setpoint, go to Step 2.13.

_____ 2.11 **IF** 30 minutes total flush time has occurred **AND** 1EMF-52 reading has **NOT** decreased to a stable value, less than Trip 2 setpoint:

- Submit an R005 work Request to investigate and repair 1EMF-52.
- Go to Step 2.13.

_____ 2.12 **IF** 30 minutes total flush time has **NOT** occurred **AND** 1EMF-52 has **NOT** decreased to a stable value, less than Trip 2 setpoint, return to Step 2.8.

NOTE: The following steps are for returning 1EMF-52 to service.

_____ 2.13 Close 1WL-443 (1EMF-52 Inlet Drn Isol) (AB-543, CC-52, Rm 250).

_____ 2.14 Close 1WL-D65 (YM Flush Supply) (AB-543, CC-52, Rm 250).

NOTE: The meter reading for 1EMF-52 in the next step can be obtained in the Control Room from the Process Radiation Monitoring panel or from the OAC.

_____ 2.15 Record value of 1EMF-52 meter post flush:
__________ cpm

CAUTION: Operation of the sump pump in manual in the next step bypasses the sump level switch. Do **NOT** allow the sump level to decrease to the point where pump suction will be lost.

2.16 Set the flow rate through 1EMF-52 as follows:

_____ 2.16.1 Open 1WL-844 (1EMF-52 Inlet).

_____ 2.16.2 Start one of the following sump pumps from 1ELCC0013 (AB-543, MM-53, Rm 212):

☐ FLOOR DRAIN SUMP PUMP 1D1
☐ FLOOR DRAIN SUMP PUMP 1D2

NOTE: The setpoint for 1EMF52 Clean Area Floor Drn Loss of Flow alarm is 2 gpm.

_____ 2.16.3 Throttle open 1WL-845 (1EMF-52 Outlet) to obtain 4-8 gpm flow through 1EMF-52.

_____ 2.16.4 Lock 1WL-845 (1EMF-52 Outlet).

_____ 2.16.5 Place the control switch for the pump started in Step 2.16.2 in "AUTO".

☐ "FLOOR DRAIN SUMP PUMP 1D1"
☐ "FLOOR DRAIN SUMP PUMP 1D2"

_____ 2.17 Notify Chemistry to determine if the CA pit sumps and D Floor Drain sump pump discharges may be directed to the Turbine Building sump.
Person notified_____________________________

2.18 **IF** 1EMF-52 discharge was diverted to the ND/NS Sump **AND** notified by chemistry that the sump pump discharges may be realigned to the Turbine Building Sump, perform the following:

_____ 2.18.1 Ensure 1EMF-52 Trip 2 is cleared.

NOTE: Valves 1WL-847 and 1WL-848 are operated from panel 1ELCC0013 (AB-543, MM-53, Rm 212).

_____ 2.18.2 Open 1WL-848 (Floor Drn Sump Disch To Turb Bldg Sump).

_____ 2.18.3 Close 1WL-847 (Floor Drn Sump Disch To ND & NS Rooms Sump).

_____ 2.19 Notify Radwaste Chemistry the flush is complete.
Person notified ______________________________

_____ 2.20 Notify RP to adjust the new setpoint on 1EMF-52 per HP/0/B/1000/010 (Determination of Radiation Monitor Setpoints).
Person notified ______________________________

NOTE:	1EMF-52 is now returned to normal service.

2.21 Do **NOT** file this enclosure in the Control Copy folder of this procedure.

1EMF 52 CLEAN AREA FLOOR DRN HI RAD

B/3

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

ORIGIN: 1EMF-52 gamma scintillation detector.

PROBABLE CAUSE: Contamination present in one or more of the following auxiliary building Unit 1 side "non-radiation areas":

- Floor Drain Sump D
- Unit 1 CA pump sumps
- Unit 1 UHI room sump

AUTOMATIC ACTIONS:

1. 1WL-848 (Floor Drain Sump D Disch to Turb Bldg Sump) closes.
2. 1WL-847 (Floor Drain Sump D Disch to ND & NS Rooms Sump) opens.

IMMEDIATE ACTIONS: Verify the automatic actions occur by verifying valve position indications at the Auxiliary Waste Processing Panel (AB-543, MM-53).

> **NOTE:** A Trip 2 Alarm on 1EMF-52 will cause the Floor Drain Sump D Discharge to align to the ND & NS Rooms Sump. Resetting the Trip 2 Alarm on 1EMF-52 will cause the Floor Drain Sump D Discharge to realign to the Turbine Building Sump. {PIP 96-1698}

SUPPLEMENTARY ACTIONS:

1. Do **NOT** reset the Trip 2 Alarm on 1EMF-52 until RP gives permission. {PIP 96-1698}
2. Notify Radiation Protection personnel of this alarm.
3. Notify Radwaste Chemistry personnel of this alarm.
4. Notify Engineering of this alarm and the need to flush 1EMF 52.
5 Monitor the activity level for 1EMF-52.
6 **WHEN** directed by Engineering, flush 1EMF-52 per OP/1/A/6500/014 (Operations Controlled Liquid Waste Systems). {PIP 04-720}

REFERENCES:

1. CNM-1346.05-33
2. NSM CN-50133
3. NSM CN-60056

Question: 05-100

1 Pt(s) Given the following leakage results from one hour ago:

- Current Identified leakage = 1.40 gpm
- Current Unidentified leakage = 0.73 gpm

Five minutes ago additional leakage is quantified as follows:

- One Pzr PORV leaking = 0.30 gpm

At this point the function of the pressurizer relief tank becomes a collector of _________ leakage that ______________ a unit shutdown.

A. identified, requires

B. unidentified, requires

C. identified, does not require

D. unidentified, does not require

Question*: 05-100** ***Answer: C

LEVEL:	RO/SRO

K/A	SYS007	**Title**	Pressurizer Relief Tank
	G2.1.28	**Description**	Knowledge of the purpose and function of major system components and controls. **(CFR 41.7)**
		Importance	3.2/3.3

SOURCE	BANK CNS exam bank
LEVEL of KNOWLEDGE	Comprehension
Lesson	OP-CN-PS-NC
Objectives	10
REFERENCES	TECH SPEC's 3.4.11, 3.4.13
Author	RJK
Time	7/11/2005 3:45 PM 5 minutes plus 40 minutes

Distracter Analysis: Per Tech Spec, the PRT is a tank to quantify leakage, this leakage is considered identified. The leakage is less than the T.S. limit of 10 gpm and no shutdown is required.

A. **Incorrect**: The leakage is identified but the leakage is less than T.S. and the PORV can be isolated to stop the leak.

B. **Incorrect**: The leakage is identified but the leakage is less than T.S. and the PORV can be isolated to stop the leak.

C. **Correct**:

D. **Incorrect**: The leakage is identified. If the operator thinks the leakage is unidentified, then leakage is greater than T.S and a shutdown is required.

	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

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

--NOTES--

Separate Condition entry is allowed for each PORV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more PORVs inoperable and capable of being manually cycled.	A.1 Close and maintain power to associated block valve.	1 hour
B. One or two PORVs inoperable and not capable of being manually cycled.	B.1 Close associated block valves.	1 hour
	<u>AND</u>	
	B.2 Remove power from associated block valves.	1 hour
	<u>AND</u>	
	B.3 Restore PORV(s) to OPERABLE status.	72 hours

(continued)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE; and

d. 150 gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> Pressure boundary LEAKAGE exists. <u>OR</u> Primary to secondary LEAKAGE not within limit.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.13.1	------------------------------NOTES-------------------------------- 1. Not required to be performed until 12 hours after establishment of steady state operation. 2. Not applicable to primary to secondary LEAKAGE. -- Verify RCS Operational LEAKAGE within limits by performance of RCS water inventory balance.	------NOTE------ Only required to be performed during steady state operation -------------------- 72 hours
SR 3.4.13.2	---------------------------------NOTE-------------------------------- Not required to be performed until 12 hours after establishment of steady state operation. -- Verify primary to secondary LEAKAGE is ≤ 150 gallons per day through any one SG.	--------NOTE-------- Only required to be performed during steady state operation ----------------------- 72 hours

EXAM KEY AND PROVIDED REFERENCES

Q	A	REFERENCE	Q	A	REFERENCE
1	A		51	B	
2	D		52	D	
3	B		53	B	
4	D		54	C	
5	C		55	A	
6	A		56	D	
7	D		57	A	
8	B		58	C	STEAM TABLES
9	B		59	A	
10	B		60	C	
11	A		61	B	
12	C		62	A	
13	D		63	B	
14	D		64	B	
15	B		65	D	
16	D		66	D	
17	B		67	A	
18	A		68	B	TS 3.1.5, 3.1.6
19	A		69	C	
20	C		70	D	
21	A		71	C	
22	A		72	C	
23	D		73	B	
24	A		74	B	
25	C	STEAM TABLES	75	A	
26	B		76	A	
27	B		77	D	
28	D		78	A	
29	D		79	B	
30	B		80	A	
31	C		81	D	
32	C		82	B	
33	B		83	A	
34	A		84	C	
35	A		85	B	
36	D		86	C	
37	B		87	B	
38	C		88	D	
39	D		89	C	TS 3.4.16
40	A		90	B	
41	C		91	D	
42	D		92	A	
43	D		93	B	
44	A		94	C	
45	B		95	D	
46	D		96	A	
47	D		97	D	
48	C		98	B	
49	D		99	D	
50	D		100	C	

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

LCO 3.4.16 The specific activity of the reactor coolant shall be within limits.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) $\geq$ 500°F.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 > 1.0 μCi/gm.	------------------Note------------------ LCO 3.0.4.c is applicable. ---	
	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.	Once per 4 hours
	<u>AND</u>	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours
B. Gross specific activity of the reactor coolant not within limit.	B.1 Be in MODE 3 with T_{avg} < 500°F.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met. OR DOSE EQUIVALENT I-131 in the unacceptable region of Figure 3.4.16-1.	C.1 Be in MODE 3 with $T_{avg} < 500°F$.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.16.1	Verify reactor coolant gross specific activity $\leq 100/\bar{E}$ μCi/gm.	7 days
SR 3.4.16.2	-----------------------------NOTE----------------------------- Only required to be performed in MODE 1. -- Verify reactor coolant DOSE EQUIVALENT I-131 specific activity ≤ 1.0 μCi/gm.	14 days AND Between 2 and 6 hours after a THERMAL POWER change of $\geq$ 15% RTP within a 1 hour period

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.16.3	-------------------------------NOTE--------------------------------- Not required to be performed until 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for $\geq$ 48 hours. ---	
	Determine $\bar{E}$ from a sample taken in MODE 1 after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for $\geq$ 48 hours.	184 days

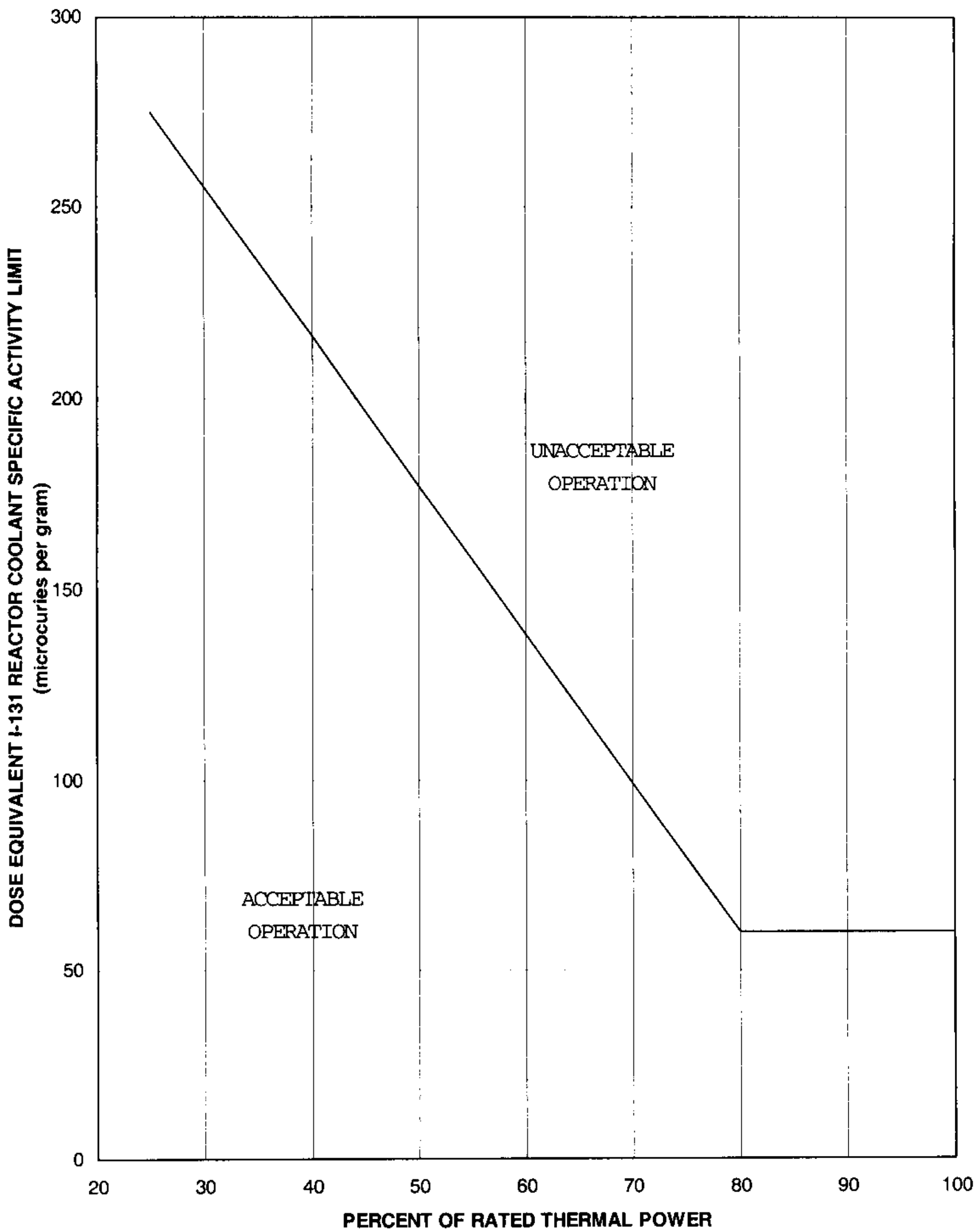

Figure 3.4.16-1 (page 1 of 1)
Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity
Limit Versus Percent of RATED THERMAL POWER

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Shutdown Bank Insertion Limits

LCO 3.1.5 Each shutdown bank shall be within insertion limits specified in the COLR.

APPLICABILITY: MODE 1,
MODE 2 with any control bank not fully inserted.

-------------------------------NOTE--------------------------------
This LCO is not applicable while performing SR 3.1.4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within limits.	A.1.1 Verify SDM is within the limit specified in the COLR. OR A.1.2 Initiate boration to restore SDM to within limit. AND A.2 Restore shutdown banks to within limits.	1 hour 1 hour 2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.5.1	Verify each shutdown bank is within the limits specified in the COLR.	12 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Control Bank Insertion Limits

LCO 3.1.6 Control banks shall be within the insertion, sequence, and overlap limits specified in the COLR.

APPLICABILITY: MODE 1,
MODE 2 with $k_{eff} \geq 1.0$.

--------------------------------NOTE--------------------------------
This LCO is not applicable while performing SR 3.1.4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank insertion limits not met.	A.1.1 Verify SDM is within the limit specified in the COLR. <u>OR</u> A.1.2 Initiate boration to restore SDM to within limit. <u>AND</u> A.2 Restore control bank(s) to within limits.	1 hour 1 hour 2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Control bank sequence or overlap limits not met.	B.1.1 Verify SDM is within the limit specified in the COLR.	1 hour
	OR	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.2 Restore control bank sequence and overlap to within limits.	2 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.6.1 Verify estimated critical control bank position is within the limits specified in the COLR.	Within 4 hours prior to achieving criticality

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.6.2	Verify each control bank insertion is within the limits specified in the COLR.	12 hours AND Once within 4 hours and every 4 hours thereafter when the rod insertion limit monitor is inoperable
SR 3.1.6.3	Verify sequence and overlap limits specified in the COLR are met for control banks not fully withdrawn from the core.	12 hours