APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Operator Licensing Exam Report: 50-458/OL 88-01 Operating License: NPF-47

Docket No: 50-458

Licensee: Gulf States Utilities
P. O. Box 220
St. Francisville, Louisiana 70775

Facility Name: River Bend Station (RBS)

Examination at: River Bend Station

Chief Examiner: _____ 8/18/88
D. N. Graves, Examiner Date
Operator Licensing Section
Division of Reactor Safety

Approved by: _____ 8/18/88
J. L. Pellet, Section Chief Date
Operator Licensing Section
Division of Reactor Safety

Summary

NRC Administered Examinations Conducted During the Week of July 11, 1988 (Report 50-458/OL 88-01)

NRC administered examinations to two reactor operator and one senior reactor operator candidates. Two candidates passed all portions of the examinations taken and have been issued the appropriate license. One candidate failed the Integrated Plant Operations section of the operating examination.

DETAILS

1. Persons Examined

		SRO	RO	Total
License Examinations:	Pass -	1	1	2
	Fail -	0	1	1

2. Examiners

D. N. Graves, Chief Examiner

3. Examination Report

Performance results for individual examinees are not included in this report as it will be placed in the NRC Public Document Room and these results are not subject to public disclosure.

a. Examination Review Comment/Resolution

In general, editorial comments or changes made during the examination, or subsequent grading reviews are not addressed by this resolution section. All comments proposed by the facility were accepted for incorporation into the examination and answer key. The full text of the comments is attached.

b. Site Visit Summary

(1) At the end of the written examination administration, the facility licensee was provided a copy of the examination and answer key for the purpose of commenting on the examination content validity. It was explained to the facility licensee that regional policy was to have examination results finalized within 30 days. Thus, a timely response was desired to attain this goal.

(2) At the conclusion of the site visit, the facility representative and chief examiner discussed written examination review comments.

c. Master Examination and Answer Key

Master copies of the RBS license examinations and answer keys are attached. The facility licensee comments which have been accepted are incorporated into the answer key.

d. Facility Examination Review Comments

The facility licensee comments regarding the written examination are attached.

e. Simulation Facility Fidelity Report

No simulator deficiencies or discrepancies were noted or observed during the simulator portion of the operating examinations.

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: RIVER BEND 1

REACTOR TYPE: BWR-GE6

DATE ADMINISTERED: 88/02/12

EXAMINER: GRAVES, D.

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
25.00	100.00	_____	_____	1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00		_____ Final Grade	_____%		Totals

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

_____
Candidate's Signature

QUESTION 1.01 (2.00)

a. Explain the effect that tends to make the Moderator Temperature Coefficient more positive when moderator temperature is increased.(1.0)

b. Explain the effect on Fuel Temperature Coefficient due to increasing moderator temperature. (1.0)

ANSWER 1.01 (2.00)

a. The positive effect occurs because moderator is expanded out of the core [0.5] and fewer neutrons are absorbed in the moderator at higher temperature. [0.5] (1.0)

b. As temperature increases, slowing down time and length become longer. [0.5] Any change in resonance peaks will become more significant as neutrons spend more time in resonant energy spectrum. [0.5] (1.0)

REFERENCE
River Bend Station, LOTM-TH-1.17-2 page 2
K102 K111 2.5 2.5 NU OL

292004K102 292004K111 ...(KA'S)

QUESTION 1.02 (1.00)

The reactor scrams from full power, equilibrium xenon conditions. Six (6) hours later the reactor is brought critical and power stabilized low in the intermediate range. If power level is maintained at this level, which one of the following statements is CORRECT concerning control rod motion?

a. Rods will have to be withdrawn since Xenon will closely follow its normal buildup rate.

b. Rods will have to be inserted due to Xenon decay.

c. Rods will have to be rapidly inserted since the critical reactor will cause a high rate of Xenon burnout.

d. Rods will approximately remain as is as the Xenon establishes its equilibrium value for this power level.

ANSWER 1.02 (1.00)

a (1.0)

REFERENCE
River Bend Station, LOTM-TH-1.22-2; HLO-147-2, LO.4b.
K114 3.1/3.2 NU 87

292006K114 ...(KA'S)

QUESTION 1.03 (2.00)

List and briefly explain two (2) of the reasons that cause a high reactor pressure transient to be more severe at EOL than BOL. (2.0)

ANSWER 1.03 (2.00)

1. At EOL, there is a slower scram reactivity insertion rate (0.5) because the control rods are further withdrawn than at BOL (0.5).

2. Beta, the delayed neutron fraction, is smaller at EOL (0.5). This results in a shorter reactor period at EOC than at BOL for the same positive reactivity addition (0.5).

REFERENCE
River Bend Tech Spec Bases 3/4.1.4
River Bend Station, HLO-139-0, Lesson Objective IID
K106 3.7/3.7 K103 3.6/4.1 NU 87

292003K106 295001K103 ...(KA'S)

QUESTION 1.04 (3.00)

For each of the events below, state the order in which the three reactivity coefficients will respond (first, second, and third). ALSO indicate whether each coefficient will be adding + or - reactivity during the event. Use all three coefficients for each event. (3.0)

a. Rod drop at power

b. Turbine stop valve fails shut at power

c. One recirc pump trips at power

ANSWER 1.04 (3.00)

a. Doppler (-), MTC (-), Void (-)

b. Void (+), Doppler (-), MTC (-)

c. Void (-), Doppler (+), MTC (+)

(0.25 for each + or - and 0.25 for the order)

REFERENCE
River Bend Station, LOTM-TH-1.17 thru 1.19
K101 3.2/3.2 K105 2.9/2.9 K110 3.2/3.2 NU OL

292004K101 292004K105 292004K110 ...(KA'S)

QUESTION 1.05 (3.00)

A reactor startup is in progress. You have been given an estimated critical rod position for the conditions at 0800. You start to pull control rods at 0800 for the approach to critical. HOW WOULD EACH OF THE FOLLOWING conditions or events AFFECT the ACTUAL CRITICAL ROD POSITION (more rod withdrawal, less rod withdrawal, or no significant effect)? (3.0)

a. One reactor recirculation pump is stopped.

b. Xenon is changing due to extended power operation, terminated 16 hours previously.

c. Shutdown cooling is stopped (significant decay heat).

d. Reactor head vent is inadvertently closed.

e. Moderator temperature is gradually decreasing.

f. Reactor Water Cleanup System isolates (significant decay heat).

ANSWER 1.05 (3.00)

a. No significant effect
b. Less rod withdrawal
c. More rod withdrawal
d. No significant effect
e. Less rod withdrawal
f. More rod withdrawal [0.5 EA.]

REFERENCE
River Bend Station, LOTM-TH-1.17-2; 1.22-2
K106 4.2 NU OL

292008K106 ...(KA'S)

QUESTION 1.06 (2.50)

While River Bend is operating at 90% power, extraction steam to the highest pressure feedwater heater is removed. An engineer observed that the turbine load increased by 20 MW electric and concluded that this action has improved (increased) the plant's thermodynamic efficiency (not heat rate). Is this conclusion correct? Explain your answer. (Include what caused electrical output to increase.) (2.5)

ANSWER 1.06 (2.50)

No [0.5]. (Thermc efficiency is a comparison of Energy In to Energy Out.) The increase in output results from no steam being diverted to the high pressure feedwater heater [0.5] and increased Rx. power due to colder feedwater temperature [0.5]. Because the feedwater is now cooler, more energy from the reactor is required to bring the water up to saturation temperature [1.0] thus thermo efficiency is down.

REFERENCE
River Bend Station, HL0-314-0; L0-VI
River Bend Station, Simulator Malfunction #93
River Bend Station, HL0-114-2, L0.II.2
K105 2.7/2.8 NU 87

293005K105 ...(KA'S)

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.07 (2.50)

The reactor is operating at 100% power when one SRV fails open. Describe the response of each of the parameters listed below. Include the initial change, the trend for that parameter over the next five minutes, and the reason(s) for the response. (2.5)

a. Indicated Steam Flow (total)

b. Turbine Steam Flow

c. Reactor Power

ANSWER 1.07 (2.50)

Indicated steam flow initially increases (.25) due to the SRV drawing more steam off the reactor (.25). As reactor pressure decreases, the turbine control valves close down to control pressure (.25) resulting in reduced turbine steam flow (.25). Reactor power initially decreases (.25) due to the depressurization (.25). Turbine steam flow decreasing causes a slight decrease in FW temperature (.25) causing reactor power to begin increasing again (.25) which causes the pressure control system to increase turbine and total steam flow (.25). Final conditions will be slightly higher reactor power with the steam flow shared between the turbine and the SRV OR the reactor will scram on high power (.25).

REFERENCE
River Bend Station, AOP-0035
A107 2.9/3.0 A109 3.1/3.3 K122 3.5/3.6 NU OL

239002A107 239002A109 292008K122 ...(KA'S)

QUESTION 1.08 (1.00)

Describe the difference between cavitation and gas binding in a centrifugal pump. (1.0)

ANSWER 1.08 (1.00)

Cavitation occurs when water flashes to steam in the pump eye. (Loss of NPSH) [0.5]
Gas binding means that the pump is filled with a non-condensable gas. [0.5]

REFERENCE
River Bend Station, LOTM-TH-2.4-2 page 2
K112 2.9 TH OL

293006K112 ...(KA'S)

QUESTION 1.09 (1.50)

Indicate HOW each of the following changes will affect reactor CRITICAL POWER (INCREASE or DECREASE). If CRITICAL POWER will not be affected, state this. (1.5)

a. Loss of extraction steam to a feedwater heater.

b. Mass flow rate through the core is increased.

c. Reactor pressure is increased.

ANSWER 1.09 (1.50)

a. CRITICAL POWER increases (0.5).

b. CRITICAL POWER increases (0.5).

c. CRITICAL POWER decreases (0.5).

REFERENCE
LOTM-TH-3.7-0, Transition Boiling, pg 3
River end Station, LOTM-TH-4.8-2
K122 K123 K124 2.9 2.8 2.7 NU OL

293009K122 293009K123 293009K124 ...(KA'S)

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.10 (1.00)

Using Figure 1, (next page), match the regions of the curve below (a - d) to the correct area (1 - 7) on the curve. (1.0)

(a) Region I =
(b) Region II =
(c) Region III =
(d) Region IV =

1. Nucleate Boiling
2. Film Boiling
3. Partial Film Boiling
4. Single Phase Convection
5. Forced Convection
6. Burn Out Flux
7. Onset of Transition Boiling

ANSWER 1.10 (1.00)

a = 4
b = 1
c = 3
d = 2
(0.25 each)

REFERENCE
River Bend Station, LOTM-TH4.5-2 page 3 (Figure 3)
K108 2.9

TH NW

293008K108 ...(KA'S)

QUESTION 1.11 (1.00)

List two factors which determine the rate of heat transfer in a heat exchanger. (1.0)

ANSWER 1.11 (1.00)

1. Surface area available. (0.5)
2. Temperature difference between the two fluids. (0.5)

REFERENCE
River Bend Station, LOTM-TH3-10.2 page 13
K106 2.7

TH NW

293007K106 ...(KA'S)

QUESTION 1.12 (1.00)

A temperature instrument with an out of date calibration sticker on it is reading 450 deg F. A recently calibrated pressure gage sensing in the same area indicates 390 psig. Is the temperature instrument reading accurately (within + or - 2 deg F)? If not, how close is it reading to the actual temperature? Assume the system is under saturated conditions. SHOW ALL WORK. (1.0)

ANSWER 1.12 (1.00)

390 psig + 14.7 psig = 404.7 psia (0.25)

Saturated temperature for 404.7 psia:
(456.28 deg F - 444.6 deg F) (4.7/50) + 444.6 deg F =445.7 deg F (0.5)

The temperature instrument is reading 4.3 deg too high (0.25)

REFERENCE
Steam Tables
293003 K1.23 2.8/3.1 TH OL

293003K123 ...(KA'S)

QUESTION 1.13 (2.00)

Consider two RPV conditions: low power and low flow (<10%) OR high power and high flow (>85%).

a. During which condition is REQUIRED NPSH for a recirculation pump greater? (0.5)

b. During which condition is AVAILABLE NPSH for a recirculation pump greater? (0.5)

c. What provides the majority of the available Net Positive Suction Head for the Recirculation System during: (1.0)

1. Low speed pump operation (low power)?

2. High speed pump operation (high power)?

ANSWER 1.13 (2.00)

a. High flow high power (0.5)

b. High flow high power (0.5)

c. 1. Height of water in the reactor vessel (0.5)
2. Subcooling effect of the incoming feedwater (0.5)

REFERENCE
River Bend Station, LOTM-TH-2.4-2 page 2
KA = 2.8 KA402 = 3.1/3.2 TH OL

2U2001K402 2S3006K110 ...(KA'S)

QUESTION 1.14 (1.50)

Following an automatic initiation of LPCI at a reactor pressure of 400 psig, reactor pressure decreases to 100 psig. For each of the parameters listed below, determine any change (i.e. increase, decrease, or remain the same).

a. LPCI injection flow

b. LPCI pump discharge head (assume constant NPSH)

c. LPCI pump power requirements

ANSWER 1.14 (1.50)

a. Increase [0.5]

b. Decrease [0.5]

c. Increase [0.5]

REFERENCE
G.E. Heat Transfer and Fluid Flow, Ch. 6 pg. 6-95 & 6-96. SLO 6-10.
River Bend Station, LOTM-TH-2.4-2, p. 5 & p. 3; HLO-104-3, L.O.II.3. & L.O.II.10
KA 291004 K1.05 = 2.8/2.9 TH OL

291004K105 ...(KA'S)

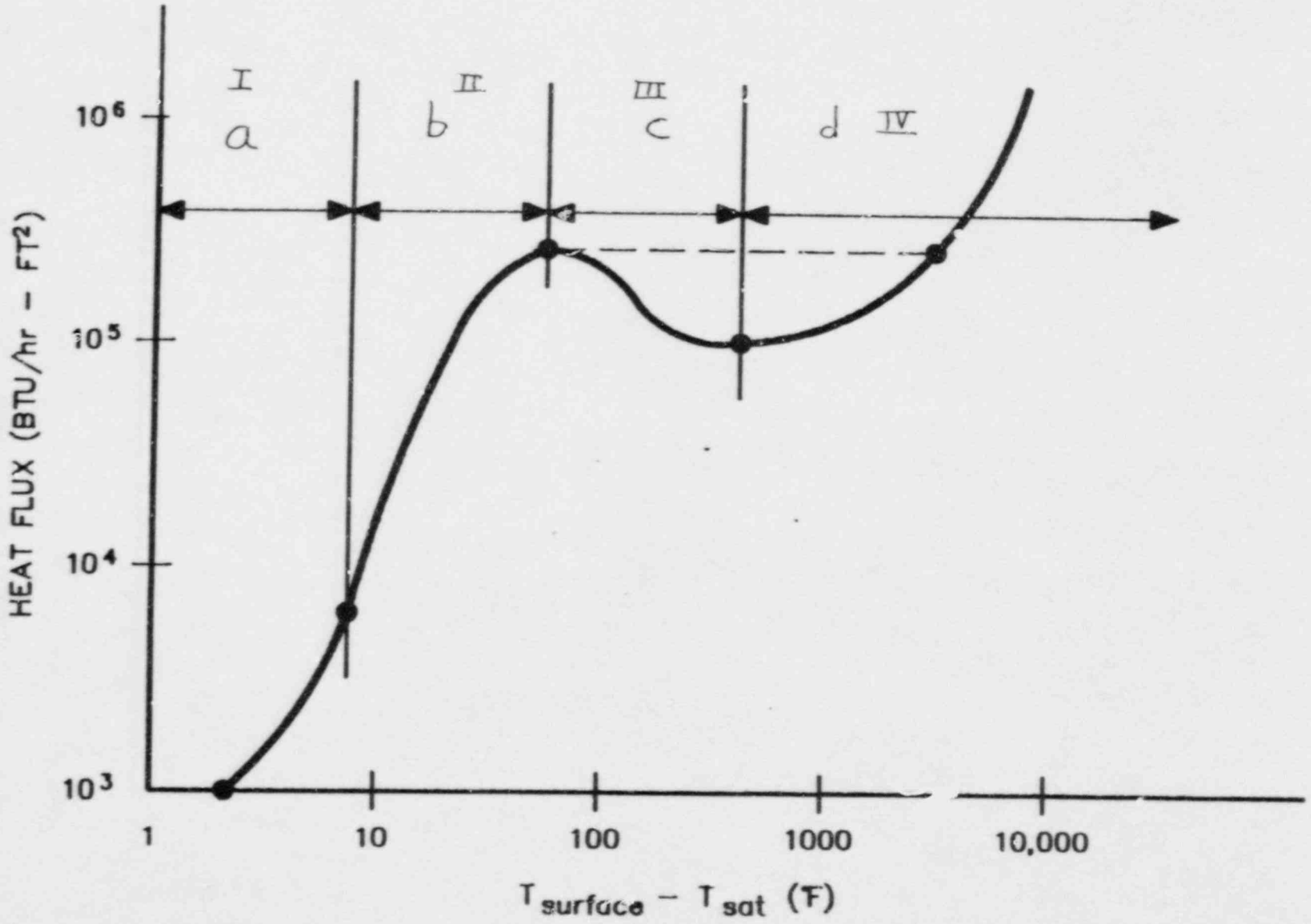

I
a
II
b
III
c
d
IV
10^6
10^5
10^4
10^3
HEAT FLUX (BTU/hr - FT²)
1
10
100
1000
10,000
$T_{surface} - T_{sat}$ (F)

Figure 1

NRC LICENSE EXAMINATION HANDOUT

EQUATIONS, CONSTANTS, AND CONVERSIONS

$\dot{Q} = m*C_p*deltaT$ $\dot{Q} = U*A*deltaT$

$P = P_o*10^{sur*(t)}$ $P = P_o*e^{t/T}$ $SUR = 26/T$

$T = l^*/\rho + (\beta-\rho)/\bar{\lambda}\rho$ $T = l/(\rho-\beta)$ $T = (\beta-\rho)/\bar{\lambda}\rho$

$\rho = (K_{eff}-1)/K_{eff} = deltaK_{eff}/K_{eff}$ $\rho = l^*/TK_{eff} + \bar{\beta}_{eff}/(1+\bar{\lambda}T)$

$\lambda = ln2/t_{\frac{1}{2}} = 0.693/t_{\frac{1}{2}}$ $\bar{\lambda} = 0.1$ seconds^{-1}

$I = I_o*e^{-ux}$

$CR = S/(1-K_{eff})$

$R/hr = 6*CE/d^2$ feet

Water Parameters

1 gallon = 8.345 lb_m = 3.87 liters
1 ft^3 = 7.48 gallons
Density @ STP = 62.4 lb_m/ft^3 = 1 gm/cm^3
Heat of vaporization = 970 Btu/lb_m
Heat of fusion = 144 Btu/lb_m
1 atmosphere = 14.7 psia = 29.9 inches Hg.

Miscellaneous Conversions

1 curie = 3.7×10^{10} disintegrations per second
1 kilogram = 2.21 lb_m
1 horsepower = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 inch = 2.54 centimeters
degrees F = 9/5 degrees C + 32
degrees C = 5/9 (degrees F - 32)
1 Btu = 778 $ft-lb_f$

U. S. NUCLEAR REGULATORY COMMISSION
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: RIVER BEND 1

REACTOR TYPE: BWR-GE6

DATE ADMINISTERED: 88/07/12

EXAMINER: GRAVES, D.

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
25.00	25.00	_____	_____	5.	THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00	_____	_____	6.	PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00	_____	_____	7.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00	_____	_____	8.	ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00		_____ Final Grade	_____%		Totals

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

_____ _____
Candidate's Signature

QUESTION 5.01 (1.50)

Compare withdrawing a center control rod at 90% rod density to withdrawing a center control rod at 40% rod density. In which situation is control rod worth greater for the withdrawn control rod? JUSTIFY YOUR ANSWER. (1.5)

ANSWER 5.01 (1.50)

Withdrawal of a center control rod at 90% density has greater worth (0.5).

(The control rod worth is proportional to the local neutron flux / the core average neutron flux squared.)

With 90% rod density the core average neutron flux is very small. (0.25)

Withdrawing a central control rod, increases the local flux in the area of withdrawn rod substantially. Because the rod causes the value of the term (local neutron flux / core average neutron flux) squared to be large its worth for this condition is quite high. Higher than withdrawing the rod at 40% rod density, when core average flux will be higher. (0.75)

REFERENCE
River Bend Station, LOTM-TH-1.20-2; HLO-145-2, L.O.II.7
K1.12 2.9 NU OL

292005K112 ...(KA'S)

QUESTION 5.02 (2.00)

List and briefly explain two (2) of the reasons that cause a high reactor pressure transient to be more severe at EOL than at BOL. (2.0)

ANSWER 5.02 (2.00)

1. At EOL, there is a slower scram reactivity insertion rate (0.5) because the control rods are further withdrawn than at BOL (0.5).

2. Beta, the delayed neutron fraction, is smaller at EOL (0.5). This results in a shorter reactor period at EOC than at BOL for the same positive reactivity addition (0.5).

REFERENCE
River Bend Tech Spec Bases 3/4.3.4
River Bend Station, HLO-139-0, Lesson Objective IID
K106 3.7/3.7 K103 3.6/4.1 NU 87

292003K106 295001K103 ...(KA'S)

QUESTION 5.03 (3.00)

For each of the events below, state the order in which the three reactivity coefficients will respond (first, second, and third). ALSO indicate whethe each coefficient will be adding + or - reactivity during the event. Use all three coefficients for each event. (3.0)

a. Rod drop at power

b. Turbine stop valve fails shut at power

c. One recirc pump trips at power

ANSWER 5.03 (3.00)

a. Doppler (-), MTC (-), Void (-)

b. Void (+), Doppler (-), MTC (-)

c. Void (-), Doppler (+), MTC (+)

(0.25 for each + or - and 0.25 for the order)

REFERENCE
River Bend Station, LOTM-TH-1.17 thru 1.19
K101 3.2/3.2 K105 2.9/2.9 K110 3.2/3.2 NU OL

292004K101 292004K105 292004K110 ...(KA'S)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.04 (2.50)

Answer the following with regard to the Control Cell Core (CCC) operating strategy:

a. What constitutes a CONTROL CELL? (0.5)

b. While operating at power, what is the position of the non-control cell control rods? (0.5)

c. Why do control rod movements result in a lower kw/ft change per notch in a CCC than in a conventional cor.? (1.0)

d. TRUE or FALSE. Using the CCC operating strategy eliminates the need for control rod sequence pattern exchanges. (0.5)

ANSWER 5.04 (2.50)

a. Four fuel bundles and a control rod (0.5)

b. Fully withdrawn (0.5)

c. All control rod movements are associated with low reactivity cells (1.0).

d. True (0.5)

REFERENCE
River Bend Station, LOTM-1-2 (Vol. 1), Section M.2.p.17;
HLO-002-2, L.O.II.8
K1.12 = 2.9
K1.23 = 2.1

NU OL

292005K112 292008K123 ...(KA'S)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.05 (2.50)

The reactor is operating at 100% power when one SRV fails open. Describe the response of each of the parameters listed below. Include the initial change, the trend for that parameter over the next five minutes, and the reason(s) for the response. (2.5)

a. Indicated Steam Flow (total)

b. Turbine Steam Flow

c. Reactor Power

ANSWER 5.05 (2.50)

Indicated steam flow initially increases (.25) due to the SRV drawing more steam off the reactor (.25). As reactor pressure decreases, the turbine control valves close down to control pressure (.25) resulting in reduced turbine steam flow (.25). Reactor power initially decreases (.25) due to the depressurization (.25). Turbine steam flow decreasing causes a slight decrease in FW temperature (.25) causing reactor power to begin increasing again (.25) which causes the pressure control system to increase turbine and total steam flow (.25). Final conditions will be slightly higher reactor power with the steam flow shared between the turbine and the SRV OR the reactor will scram on high power (.25).

REFERENCE
River Bend Station, AOP-0035
A107 2.9/3.0 A109 3.1/3.3 K122 3.5/3.6 NU OL

239002A107 239002A109 292008K122 ...(KA'S)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.06 (1.50)

A reactor water sample indicates the following isotopes present:

Tritium (H3)	Kr 87
Mn 56	I 131
Ni 57	Xe 133
Fe 59	Cs 137
Co 60	Ba 140

a. Which of the above are fission products and which are corrosion products? (1.0)

b. Does the presence of fission products in the coolant mean a fuel element failure or defect exists? (0.5)

ANSWER 5.06 (1.50)

a. Fission products: Tritium, I, Kr, Xe, Cs, Ba (0.1 each)

Corrosion products: Fe, Ni, Co, Mn (0.1 each)

b. No (0.5)

REFERENCE
River Bend Station, HLO-308-1, L.O.II.8.; LOTM-TH-5.4-2;
HLO-077-0, L.O.II.5
SG15 = 3.6
K3.01 = 3.6
K3.06 = 2.7

NU OL

2040006015 204000K301 204000K306 ...(KA'S)

QUESTION 5.07 (1.00)

Briefly explain the bases for the LHGR limit. (1.0)

ANSWER 5.07 (1.00)

Due to the expansion of the fuel pellet, the gap between the pellet and the cladding can be eliminated (0.33). This friction between the two materials will cause a concentration of cladding stress (0.33). This stress can exceed the yield stress of the cladding (0.33). Accepted "to prevent exceeding 1% plastic strain on the cladding."

REFERENCE
River Bend Station, LOTM-TH-4.9.2 page 4
K107 3.6 TH NW

293009K107 ...(KA'S)

QUESTION 5.08 (1.00)

List two places in a BWR in which heat is transferred by conduction, and the conducting material is not solid. (1.0)

ANSWER 5.08 (1.00)

a. The helium gap between the fuel pellet and the cladding. (The fuel pellet to the cladding material.)(0.5)

b. The boundary or laminar layer between the cladding and the coolant (0.5).

REFERENCE
River Bend Station LOTM-TH-4.2-2, Volume 6, Chapter 4, page 7
K1.01 = 3.2 TH NW

293007K101 ...(KA'S)

QUESTION 5.09 (1.00)

The APLHGR limit is to limit fuel cladding temperature to a maximum of 2200 degrees F. Briefly describe why this value was chosen as opposed to a higher and lower value. (1.0)

ANSWER 5.09 (1.00)

The value is high enough to allow reasonable fuel pellet temperatures for efficient steam production (0.5). The selection was low enough to prevent fuel and cladding damage during a LOCA (0.5). [If ECCS water is injected, a thermal shock would occur causing the clad to brittle fracture. Below 2200 degrees F a zirc-water reaction is not self-sustaining.]

REFERENCE
River Bend Station, LOTM-TH-4.10-2 page 2
K111 3.6 TH NW

293009K111 ...(KA'S)

QUESTION 5.10 (2.50)

a. What is the relationship between MAPRAT and MAPLHGR? (1.0)

b. The process computer prints out a MAPRAT of 1.05. Is this acceptable (YES or NO)? (0.5)

c. What physical consequence could occur if the MAPRAT limit is exceeded and under what conditions? (1.0)

ANSWER 5.10 (2.50)

a. MAPRAT = MAPLHGR (actual) / MAPLHGR (limit) (1.0)

b. No (0.5)

c. The clad temperature could exceed 2200 deg F (0.5) during a LOCA or core uncovery (0.5).

REFERENCE
River Bend LOTM-TH-4.10-2; HLP-125-2, O.L. II.1
293009 K1.11 2.8/3.6, K1.13 3.1/3.6 TH OL

293009K111 293009K113 ...(KA'S)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.11 (2.50)

While River Bend is operating at 90% power, extraction steam to the highest pressure feedwater heater is removed. An engineer observed that the turbine load increased by 20 MW electric and concluded that this action has improved (increased) the plant's thermodynamic efficiency (not heat rate). Is this conclusion correct? Explain your answer. (Include what caused electrical output to increase.) (2.5)

ANSWER 5.11 (2.50)

No [0.5]. (Thermo efficiency is a comparison of Energy In to Energy Out.) The increase in output results from no steam being diverted to the high pressure feedwater heater [0.5] and increased Rx. power due to colder feedwater temperature [0.5]. Because the feedwater is now cooler, more energy from the reactor is required to bring the water up to saturation temperature [1.0] thus thermo efficiency is down.

REFERENCE
River Bend Station, HLO-314-0; LO-VI
River Bend Station, Simulator Malfunction #93
River Bend Station, HLO-114-2, LO.II.2
K105 2.7/2.8 NU 87

293005K105 ...(KA'S)

QUESTION 5.12 (1.00)

A temperature instrument with an out of date calibration sticker on it is reading 450 deg F. A recently calibrated pressure gage sensing in the same area indicates 390 psig. Is the temperature instrument reading accurately (within + or - 2 deg F)? If not, how close is it reading to the actual temperature? Assume the system is under saturated conditions. SHOW ALL WORK. (1.0)

ANSWER 5.12 (1.00)

390 psig + 14.7 psig = 404.7 psia (0.25)

Saturated temperature for 404.7 psia:
(456.28 deg F - 444.6 deg F) (4.7/50) + 444.6 deg F =445.7 deg F (0.5)

The temperature instrument is reading 4.3 deg too high (0.25)

REFERENCE
Steam Tables
293003 K1.23 2.8/3.1 TH OL

293003K123 ...(KA'S)

QUESTION 5.13 (1.00)

A reactor heat balance was performed (by hand) during the midnight shift due to the Process Computer being OOC. The GAF's were computed, but the APRM GAIN ADJUSTMENTS HAVE NOT BEEN MADE. Which of the following statements is TRUE concerning reactor power? (1.0)

SELECT ONLY ONE ANSWER (Only one is true!)

a. If the feedwater temperature used in the heat balance calculation was LOWER than the actual feedwater temperature, then the actual power is HIGHER than the currently calculated power.

b. If the reactor recirculation pump heat input used in the heat balance calculation was OMITTED, then the actual power is LOWER than the currently calculated power.

c. If the steam flow used in the heat balance calculation was LOWER than the actual steam flow, then the actual power is LOWER than the currently calculated power.

d. If the RWCU return temperature used in the heat balance calculation was HIGHER than the actual RWCU return temperature, then the actual power is LOWER than the currently calculated power.

ANSWER 5.13 (1.00)

b. (1.0)

REFERENCE
River Bend Station, HLO-115-2, L.O.II.1&2, V. #1; LOTM-TH-3.5-2; LOTM-TH-3.13-2.
K1.11 = 3.1 NU OL

293007K111 ...(KA'S)

QUESTION 5.14 (2.00)

Consider two RPV conditions: low power and low flow (<10%) OR high power and high flow (>85%).

a. During which condition is REQUIRED NPSH for a recirculation pump greater? (0.5)

b. During which condition is AVAILABLE NPSH for a recirculation pump greater? (0.5)

c. What provides the majority of the available Net Positive Suction Head for the Recirculation System during: (1.0)

1. Low speed (low power) pump operation?

2. High speed (high power) pump operation?

ANSWER 5.14 (2.00)

a. High flow high power (0.5)

b. High flow high power (0.5)

c. 1. Height of water in the reactor vessel (0.5)
2. Subcooling effect of the incoming feedwater (0.5)

REFERENCE
River Bend Station, LOTM-TH-2.4-2 page 2
K1.10= 2.8 KA4.02 = 3.1/3.2
TH OL

202001K402 293006K110 ...(KA'S)

(***** END OF CATEGORY 05 *****)

QUESTION 6.01 (1.50)

While operating RHR Pump A in the Shutdown Cooling Mode, a LPCI initiation signal is received. All actions/trips occur in accordance with system design. LIST the actions required to be performed by the operator to use the A Loop of RHR in the LPCI mode. Component numbers are not required, but component descriptions should be specific enough to accurately identify the components. (1.5)

ANSWER 6.01 (1.50)

1. Close Pump A Shutdown Cooling Suction Valve (F006A).

2. Open Pump A Suppression Pool Suction Valve (F004A).

3. Take the pump control switch to OFF/OPEN and then to START/ON.

(3 @ 0.5 each)

REFERENCE
RBS, HLO-021-1 LO 4 & 7, LOTM-19-2, PP. 45 - 48
(3.6/3.7, 3.9/3.9, 4.2*/4.2)
203000K114 203000K401 205000K108 ...(KA'S)

QUESTION 6.02 (2.00)

The HPCS Diesel Generator Mode Select Switch was inadvertently left in the "MAINTENANCE" position (all other controls normal). A valid LOCA signal is received. The Division III bus, E22-S004, becomes deenergized and the operators take the following mitigating actions in the indicated order:

1. Place the HPCS Pump Control Switch on 1H13-P601 to TRIP.

2. Place the HPCS D/G Mode Select Switch to Automatic.

EXPLAIN the responses of BOTH the HPCS D/G AND the HPCS Pump to the operator actions. Limit your discussion to diesel and pump responses to the electrical signals/control manipulations AND the reasons for those responses. (2.0)

ANSWER 6.02 (2.00)

The HPCS D/G would start and tie to the Div 3 bus [0.5] due to LOCA [0.25] and undervoltage signals [0.25]. The HPCS pump would not auto start [0.5] , taking the control switch to the trip position (breaks the auto start signal) puts the pump in manual override. [0.5]

REFERENCE
RBS, HLO-019-1 LO 2 & 4, LOTM-18-2 P. 12
HLO-075-1 LO 5, LOTM-59-2 P. 10
(3.8/3.8, 2.4/2.4)
209002K104 209002K107 ...(KA'S)

QUESTION 6.03 (1.00)

The LPCS system piping inside the reactor vessel is monitored for integrity by the measurement of the pressure differential between the LPCS injection piping inside the drywell and: (1.0)

a. the A RHR system injection piping inside the drywell.

b. the above core plate pressure tap inside the drywell.

c. the HPCS injection piping inside the drywell.

d. the SLC injection line below core plate pressure tap inside the drywell.

ANSWER 6.03 (1.00)

a [1.0]

REFERENCE
RBS, HLO-020-1 LO 1, LOTM-17-2 P. 4
GGNS, OP-LO-SYS-LP-E21, LO 3.b, P. 8
(3.0/3.2)
209001K404 ...(KA'S)

QUESTION 6.04 (1.00)

List FOUR conditions which allow retraction of the SRM detector without actuating a rod withdrawal block. [INCLUDE ANY APPLICABLE SETPOINTS] (1.0)

ANSWER 6.04 (1.00)

1. The SRM is indicating greater than 100 counts.

2. IRMs are on range 3 or above.

3. The reactor mode switch is in run.

4. The SRM is manually bypassed.
[4 @ 0.25 each]

REFERENCE
RBS, HLO-051-1 LO 12, LOTM-9-2, P. 20
GGNS, OP-LO-SYS-LP-C51-1-03, LO 4a, PP. 13-15
SD-C51-1/REV 2, P. 11
(2.8/2.9, 3.7/3.7, 3.2/3.2)
215004K401 215004K404 215004K406 ...(KA'S)

QUESTION 6.05 (2.50)

List FIVE controls available to the control room operator which would stop Recirculation Flow Control Valve movement if the valve starts to ramp open while operating in Loop Manual Control. Refer to Figure 1 for a drawing of the H13-P614 Controls and Indications. (2.5)

ANSWER 6.05 (2.50)

1. Shutdown HPU using manual pushbutton at H13-P680 [0.5]

2. Shutdown HPU using the SHUTDOWN pushbutton at at H13-P614 [0.5]

3. Shutdown HPU at H13-P614 by placing both subloops in Maintenance [0.5]

4. Shut Drywell isolation valves at H13-P808. [0.5]

5. Depress the Drywell Pressure Test pushbutton at H13-P614. [0.5]
k l m n o p q r s t u v w x y6. Depress the CRVICS SOP pushbuttons on the P680 panel [0.5]

(5 required at 0.5 each)

REFERENCE
RBS, HLO-058-2 LO3 & 4, LOTM-8-2 PP 5-8 & Figure 4
(3.8/3.5, 2.6*/2.6*, 2.8/2.8)
2020026009 ...(KA'S)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.06 (2.00)

Given the following data for APRM channel C:

LPRM level:	A	B	C	D
LPRMs assigned:	4	4	4	4
LPRMs bypassed:	1	3	1	0

a. If APRM Channel Selector Switch on the local instrument is placed to the COUNT position, what would be the expected meter reading? Describe HOW you arrived at your answer. (1.0)

b. Based on the above information, is APRM C operable? Answer YES or NO and EXPLAIN WHY. (1.0)

ANSWER 6.06 (2.00)

a. (11 operable channels)(5% per operable channel) = 55%

OR

(55/125)(10v) = 4.4V
Either percentage or voltage is acceptable (1.0)

b. No (Inoperable) (0.5) due to < 2 LPRMs per level (0.5)

REFERENCE
RBS Technical Specifications 3.3.1, pg 3/4 3-5
LOTM-12-2, pg 4
(3.6/3.6, 3.2/3.4, 3.4/4.1
215005A208 215005G011 215005K104 ...(KA'S)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.07 (3.00)

With the unit operating at 75% power, with recirc control in Flux Manual, an electrical fault causes the maximum combined flow setpoint to drop to its minimum output. How will the following parameters respond after the fault and why? Refer to Figure 2 and limit your discussion to response within one minute of the fault. Assume no operator action.

a. Turbine control valve position.

b. Bypass valve position.

c. Rx power and pressure.

ANSWER 6.07 (3.00)

a. TCV's will close to minimum (30%) steam flow (0.5). The TCV LVG passes a MCF signal of 30% rather than the higher signal from the pressure controller (0.5). Value not required.

b. The BPV's will remain closed through the transient. [0.5] The MCF summer will send a zero signal to the BPV LVG. [0.5]

c. (Rx power and pressure will rapidly increase following the fault.) The reactor will scram on high flux/or high pressure due to TCV closure [0.5]. Reactor pressure will be controlled by the TBV's. [0.5]

REFERENCE
RBS, HLO-059-1 L06, LOTM-27-2 pp. 70-71 and Figure 5
(4.1/4.1, 4.2*4.3*, 4.1*/4.1, 3.7/3.7)
241000K301 241000K302 241000K306 241000K308 ...(KA'S)

QUESTION 6.08 (1.50)

a. What are FOUR parameters monitored by the instruments mounted on the meteorological tower? (1.0)

b. What is the emergency power supply for the meteorological tower instrumentation? (0.5)

ANSWER 6.08 (1.50)

a. 1. Temperature
2. Wind Speed
3. Wind Direction
4. Dewpoint
5. Precipitation
(4 @ 0.25)

b. Emergency generator at the Met tower [0.5].

REFERENCE
RBS, HLO-070-1 LO3, LOTM-74-2 p. 1
(2.5/3.8, 3.8/4.3*)
262001K101 295017A205 ...(KA'S)

QUESTION 6.09 (2.50)

List TEN (10) Balance of Plant (BOP) systems which penetrate primary containment and receive isolation signals from CRVICS on low reactor water level at -45" or high drywell pressure at 1.69 psig. (2.5)

ANSWER 6.09 (2.50)

Any 10 of the following:

1. Instrument Air
2. Service Air
3. Fire Protection
4. Service Water
5. Floor Drains
6. Equipment Drains
7. RPCCW
8. Hydrogen Mixing
9. Fuel Pool Cooling and Cleanup
10. Chilled Water
11. Condensate Makeup
12. Containment and Drywell Purge
13. Reactor Plant Sampling
14. Annulus Pressure Control
(10 required at 0.25 each)

REFERENCE
RBS, HLO-062-1 LO 7 & 8, LOTM-51-2 pp. 51 & 52
(3.1/3.2, 2.8/3.1, 2.7/2.9, 3.6/3.7)
223002G004 223002K110 223002K114 223002K119 ...(KA'S)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE ** **)

QUESTION 6.10 (2.00)

Answer the following questions concerning the Reactor Recirculation System:

a. While MANUALLY transferring Recirculation pumps from fast speed to slow speed, CB-5A opens but CB-5B does not. Explain the response of the control system including the final expected condition of the two pumps. (1.0)

b. List FOUR signals, including setpoints, which will cause the Recirculation Pumps to AUTOMATICALLY transfer from fast speed to slow speed. (1.0)

ANSWER 6.10 (2.00)

a. Pump A will transfer to LFMG) [0.25]. The INCOMPLETE SEQUENCE RELAY will operate [0.25] (after the 40 sec time delay) and trip CB-5B [0.25]. Pump B will then coast to a stop [0.25].

b. 1. FW flow less than 30% for 15 seconds. [0.25]
2. RPV Level III. [0.25]
3. Steam dome to recirc suction at less than 8 degrees F for 15 seconds. [0.25]
4. EOC-RPT turbine stop valve or control valve closure with power greater than 40%. [0.25]

REFERENCE
RBS, HLO-005-2, LO 4 & 15, LOTM-7-2, pp. 18 & 19
(3.3/3.6, 3.1/3.2)
202001K402 202001K416 ...(KA'S)

QUESTION 6.11 (3.00)

List the THREE vessel thermal shock interlocks and explain the purpose of each including vessel and system components each is designed to protect.

ANSWER 6.11 (3.00)

1. RPV bottom head drain/steam dome delta T must be less than or equal to 100 degrees F [0.5] to prevent thermal shock to the bottom head (due to stratification at low flow conditions) [0.5].

2. Steam dome/recirc pump suction delta T must be less than or equal to 50 degrees F [0.5] to prevent thermal stress on the pump, piping, and vessel riser nozzles [0.5].

3. Loop suction differential temperature between A and B loops must be less than or equal to 50 degrees F [0.5] to protect the pump from thermal stress (excessive heatup rate) and prevent damage to the bearings and seals. [0.5]

REFERENCE
RBS, HLO-005-2, LO 10, LOTM-7-2, pp. 13 & 14
(3.1/3.3, 3.2/3.5)
202001K117 202001K412 ...(KA'S)

QUESTION 6.12 (2.00)

List FOUR expected automatic actions that occur on a loss of the flow reference signal to APRMs A & E with the reactor at rated power. (2.0)

ANSWER 6.12 (2.00)

Any 4 of the following at 0.5 each:

1. APRM A or E upscale trip or INOP alarm/console light.
2. RPS trip on affected channel.
3. Rod withdrawal block.
4. APRM Recirc flow upscale alarm.
5. Flow reference upscale console light.
6. Neutron Monitoring System alarm.

REFERENCE
RBS, HLO-054-1, LO 6, LOTM-12-2, pp. 6, 7, & 13
ARP-680-06, pp. 3, 4, & 14
(3.4/3.5, 3.3/3.4)
202001K123 215005K116 ...(KA'S)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.13 (1.00)

State the difference between control rod insertions using the IN-TIMER SKIP and the INSERT pushbuttons. (1.0)

ANSWER 6.13 (1.00)

The IN-TIMER SKIP pushbutton bypasses the timer circuit thereby eliminating the settle function (1.0).

REFERENCE
RBS, HLO-057-1 LO 12, LOTM-6-2 P. 28
(3.2/3.2)
201002K408 ...(KA'S)

(***** END OF CATEGORY 06 *****)

QUESTION 7.01 (1.00)

According to FHP-0003, Refueling Platform Operation, what action(s) should the platform operator take if pool level begins to drop with a fuel bundle suspended from the grapple? Be specific. (1.0)

ANSWER 7.01 (1.00)

Immediately place the bundle in a fuel rack or in the reactor vessel (whichever is closer) [1.0]

REFERENCE
RBS, HLO-227-1 LO 2, FHP-0003 REV 2 P. 2
(3.1*/3.5*)
234000G014 ...(KA'S)

QUESTION 7.02 (1.50)

The Plant Startup procedure, GOP-0001, requires all turbine bypass valves to be fully closed when withdrawing control rods with reactor power above the Low Power Setpoint. What is the basis for this requirement? (1.5)

ANSWER 7.02 (1.50)

The Rx power input for rod control is determined from first stage pressure [0.5]. With the bypass valves open, the RCS senses Rx power as less than actual and the potential exist for a non-conservative rod withdrawal.[1.0]

REFERENCE
RBS, HLO-500-0 LO 4, GOP-0001 P. 3
(3.8/3.9, 3.7*/3.8*)
241000K101 241000K405 ...(KA'S)

QUESTION 7.03 (2.00)

During Cold Shutdown conditions with the RPV head in place, what are TWO CONDITIONS that shall be met to minimize temperature stratification which may cause coolant temperatures to exceed 212 deg F and inadvertent RPV pressurization? (2.0)

ANSWER 7.03 (2.00)

1. At least one shutdown cooling loop should be in operation. (Forced circulation maintained.)

2. RPV water level shall be maintained greater than 75" (using Shutdown Level Instrumentation when RR pumps are secured).

3. In the event forced circulation is unavailable (RR pumps off) and water level is at or below the Minimum Natural Circulation Level for any reason, then periodic monitoring of vessel metal temperatures above and below the intended water level should be initiated. (2 required at 1.0 each)

REFERENCE
RBS, HLO-021-1, SOP-0031 Rev 5 P. 4
(2.8/3.1, 3.1/3.2, 3.6/3.6)
205000K503 205000K603 205000K604 ...(KA'S)

QUESTION 7.04 (1.00)

During initial startup of an RHR pump in the Shutdown Cooling mode, the operator is cautioned to establish greater than 750 gpm within 8 seconds of pump start. Why is this important? (1.0)

ANSWER 7.04 (1.00)

(If greater than 750 gpm is not established within 8 seconds), the pump minimum flow valve to Suppression Pool (1E12-F064A/B) will open [0.5] dumping reactor water to the suppression pool. [0.5]

REFERENCE
RBS, HLO-021-1 LO 10, SOP-0031 p. 16
(2.7/2.8, 3.6/3.2)
205000G013 205000K407 ...(KA'S)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.05 (3.00)

Answer the following questions in accordance with AOP-0009, Loss of Normal Service Water.

a. When is an immediate manual reactor scram NOT required? (1.0)

b. If header pressure drops to 76 psig, non-essential service water loads will be isolated. List EIGHT non-essential loads isolated. (2.0)

ANSWER 7.05 (3.00)

a. If turbine is not on the line [0.5] and bypass valves are not being used to control reactor pressure [0.5].

b. Any 8 of the following @ 0.25 each:

1. Turbine lube oil coolers.
2. Generator hydrogen coolers.
3. Generator alternator cooler.
4. CCS heat exchangers.
5. Turbine building chillers.
6. Radwaste building chillers.
7. Steam bypass HPU coolers.
8. Turbine EHC coolers.
9. Turbine sample room chiller.
10. SJAE intercoolers.

REFERENCE
RBS, HLO-510-0 L03 & 4, AOP-0009 pp. 2 & 4
(3.3/3.4, 3.4/3.6, 3.3/3.4)
295018K201 295018K202 295018K302 ...(KA'S)

QUESTION 7.06 (2.00)

Excluding control room annunciators and condenser vacuum, what are FOUR (4) symptoms of a loss of main condenser vacuum? (2.0)

ANSWER 7.06 (2.00)

Any 4 of the following at 0.5 each:

1. Circulating Water Pumps or fans Tripped.
2. Loss of Gland Seal Steam pressure.
3. Increasing Off Gas System Flow (increased air inleakage).
4. Blockage in Off Gas System.
5. Circulating Water rupture in Turbine Bldg.
6. Generator load decrease
7. Turbine trip
8. MSIV or TBV closure

REFERENCE
RBS, HLO-510-0 LO2, AOP-0005 p. 2
(3.7/3.8)
2950026011 ...(KA'S)

QUESTION 7.07 (1.00)

Why does AOP-0004, Loss of Offsite Power, caution the operators to refill the fuel oil storage tanks on a staggered basis for a power outage expected to exceed 24 hours? (1.0)

ANSWER 7.07 (1.00)

Prevent loss of more than one diesel if contaminated fuel oil is used (to refill the tanks) (1.0).

REFERENCE
RBS, HLO-510-1 LO5, AOP-0004 p. 8
(3.2/3.6)
2950036007 ...(KA'S)

QUESTION 7.08 (1.00)

SOP-0007, Condensate System procedure, cautions the operators that the manual Startup Bypass valves (1CNM-V142 and V143) used to preheat the LP heater string must be closed after the LP Heater Inlet Isolation Valves (1CNM-MOV33A and 33B) are opened during startup. What are the potential consequences of failing to close V142 and V143? (1.0)

ANSWER 7.08 (1.00)

Heater string will not be isolated on heater high level [0.5] and water induction into the turbine may occur [0.5].

REFERENCE
RBS, HLO-046-1 L09, SOP-0007 p. 2
(3.2/3.2, 2.6/2.6, 3.1/2.0)
256000G010 256000K301 .. (KA'S)

QUESTION 7.09 (2.00)

List TWO Secondary Containment conditions which require emergency depressurization of the Reactor Pressure Vessel per EOP-1. (2.0)

ANSWER 7.09 (2.00)

1. If a primary system is discharging into secondary containment, any area temperature, radiation level, or water level is exceeding its maximum safe operating value (from Table 6 of EOP3) (1.0).

2. Offsite radioactivity release rates requiring a general emergency with a primary system discharging outside primary and secondary containment (1.0)

REFERENCE
RBS, EOP-1
(3.6/3.9, 3.6/4.5*, 3.3/3.5, 3.5/3.8, 2.6/2.8)
295032K301 295033K301 295036K301 295038K301 295038K304
...(KA'S)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.10 (1.50)

Answer the following questions concerning ALARA and radiological controls at River Bend TRUE or FALSE: (1.5)

a. The ALARA concept has been applied if, instead of reaching dose limits during the first week of a quarter, a worker reaches his dose limit on the last day of the quarter.

b. Personnel who enter the RCA on an Access RWP are issued a color coded sticker by RP that indicates they have the proper training and dosimetry requirements for entry.

c. Shift Supervisor's approval is not required for RWP revisions.

ANSWER 7.10 (1.50)

a. False [0.5]

b. True [0.5]

c. True [0.5]

REFERENCE
RBS, General Employee Training, pp. 7-43
RSP-0200 pp. 18 and 22
(3.3/3.8, 3.3/3.6)
294001K103 294001K104 ...(KA'S)

QUESTION 7.11 (1.00)

Determine if the following statements concerning SOP-0092, Offgas System, are TRUE or FALSE. (1.0)

a. The charcoal beds are bypassed during initial system startup to prevent radioactive isotope releases due to high system air flows.

b. Glycol systems are potentially contaminated and any leakage should be routed to the nearest floor drain for collection in Radwaste.

ANSWER 7.11 (1.00)

a. False [0.5]

b. False [0.5]

REFERENCE
RBS, HLO-047-1 LO 7, SOP-0092 Rev. 4 P. 3
(2.6/2.8, 3.1/3.2, 2.3/2.5)
268000K115 271000G010 271000K511 ...(KA'S)

QUESTION 7.12 (2.00)

SOP-0052, HPCS Diesel Generator, cautions the operator to depress the "STOP" pushbutton on the engine panel or P601 after the diesel has tripped automatically. What function does depressing the stop button perform and why is this action necessary? (2.0)

ANSWER 7.12 (2.00)

Start relay (K1) seals in on diesel start and depressing "STOP" deenergizes this relay. [1.0] Failure to do so results in an automatic restart of the engine when the trip condition clears. [1.0]

REFERENCE
RBS, HLO-052-1 LO 10, SOP-0052 Rev. 4 p. 3
(3.8/3.7, 3.2/3.6)
264000G010 264000K408 ...(KA'S)

QUESTION 7.13 (2.00)

EOP-0001, RPV Control Emergency Procedure, contains an enclosure which provides for alternate injection paths for sodium pentaborate should Standby Liquid fail to inject. Briefly describe how boron is injected via this method including plant systems which can be utilized. (2.0)

ANSWER 7.13 (2.00)

Sodium pentaborate is mixed in a drum [0.5] and pumped into an injecting ECCS system vent [0.5] using a portable hydro pump [0.5]. Systems that can be used are RHR A, RHR B, RHR C, LPCS, OR HPCS [5 @ 0.1 EACH].

REFERENCE
RBS, EOP-0001 REV 7, PP. 65-66
(3.4/4.1)
295037K213 ...(KA'S)

QUESTION 7.14 (2.50)

List the entry conditions (including setpoints) for EOP-0002, Primary Containment Control Emergency Procedure. (2.5)

ANSWER 7.14 (2.50)

1. Drywell/Containment differential pressure above 1.68 psid.

2. Containment pressure above 15.7 psia.

3. Suppression Pool level not between -0.25 ft. and +0.25 ft.

4. Primary Containment hydrogen concentration above 0.5%.

5. Drywell hydrogen concentration above 0.5%.

[5 @ 0.5 each]

REFERENCE
RBS, EOP-0002 REV 6, P. 2
(4.1*/4.3*, 4.2*/4.5*, 4.2*/4.5*, 4.3*/4.5*)
295007G011 2950100011 295029G011 295030G011 ...(KA'S)

QUESTION 7.15 (1.50)

a. Explain the basis for the Heat Capacity Temperature Limit graph which is part of the EOP flow charts. (1.0)

b. What suppression pool level is assumed as the basis for this graph? (0.5)

ANSWER 7.15 (1.50)

a. The line on the graph represents the maximum suppression pool temperature at which actuation of ADS will not result in either unstable steam condensation at or near the SRV discharge devices [0.5] or a suppression pool temperature in excess of the containment air space design temperature while the RPV is above the shutdown cooling interlocks. [0.5]

b. At the low level LCO. [0.5]

REFERENCE
EOP Bases Documents
(4.3*/4.6*)
295027G012 ...(KA'S)

(***** END OF CATEGORY 07 *****)

QUESTION 8.01 (3.00)

Given the below listed facility conditions,

Reactor power = 85%
Reactor Flow = 90%
12th day of operation at these conditions.
One ADS valve (1B21*RVF051G) has failed. The SS has declared it inoperable because he/she does not believe it will function properly.

a. List the Technical Specification LCO(s) exceeded and the appropriate Action statement(s) allowing continued plant operation. (2.0)

b. During this period of operation, the Maintenance Supervisor brings to your attention the load test surveillance for diesel 1C was not performed and the grace period has expired. List the Technical Specification LCO(s) exceeded and the appropriate Action statement(s) allowing continued plant operation. (1.0)

ANSWER 8.01 (3.00)

a. 3.5.1.a.3 (0.25)
3.5.1.b.2 (0.25)
Action e.1 (0.5)
3.4.2.2 (0.5)
Action a. (0.5)

b. 3.8.1.1.b (0.5)
Action d (0.5)

REFERENCE
River Bend Station, Technical Specifications
River Bend Station, HLO-406-0, Lesson objective #2
K3.01 = 4.4; SG = 4.1; ADS-SG = 4.3

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.02 (1.50)

Answer the following with regard to the River Bend Emergency Plan Implementing Procedures dose calculation requirements:

a. Who is responsible for the initial and follow-up offsite dose calculations (at least until relieved by personnel in the TSC)? (0.5)

b. A determination has been made that offsite dose calculations are necessary.

1. When should the initial assessment be completed? (0.5)

2. When should follow-up calculations be completed? (0.5)

ANSWER 8.02 (1.50)

a. Shift Foreman (0.5)

b. 1. Initial assessment should be completed within approximately 15 minutes of the declaration (0.5).

2. Follow- calculations should be performed approximately every 30 minute. ollowing initial projections (0.25), or sooner if release rates change significantly (0.25).

REFERENCE
RBS, EIP-2-025 Rev 2 PP. 2 & 3
(2.9*/4.7*, 3.8*/4.3*)
294001A116 295017K102 ...(KA'S)

QUESTION 8.03 (2.50)

Answer the following questions pertaining to the River Bend Emergency Implementing procedures Protective Action Recommendation Guidelines.

a. If a General Emergency is declared, what offsite protective actions shall be recommended immediately, unless other, more extensive, protective actions have already been recommended? (2.0)

b. When should protective actions less stringent than those recommended by the Protective Action Recommendation Guideline Procedure, EIP-2-007, be recommended by the Emergency Director? (0.5)

ANSWER 8.03 (2.50)

a. 1. Shelter to the 2 mile radius around the station (1.0)
2. Shelter to the 5 mile radius in the downwind and adjacent sectors(1.0)

b. Only if constraints (time available, traffic congestion, weather hazards, etc) make the required actions a greater hazard to public health (0.5).

REFERENCE
RBS, EIP-2-005, Rev 4, pg 6
EIP-2-007, Rev 5, pg 2
(2.9*/4.7*, 4.2*/4.4*)
294001A116 295038K102 ...(KA'S)

QUESTION 8.04 (2.00)

Answer the following questions in accordance with Technical Specifications requirements.

a. What is the operator's responsibility when the Limiting Condition for Operation (LCO) cannot be met? (0.5)

b. When is the operator allowed to enter an operating condition where an LCO cannot be met without relying on provisions of an action statement (two required)? (1.0)

c. What is Non-Compliance with a Technical Specification with regard to Section 3 of the Technical Specifications? (0.5)

ANSWER 8.04 (2.00)

a. To comply with the ACTION STATEMENT [0.5]

b. When it is required to change modes to meet an action statement (0.5), or TS 3.04 is specified as N/A (0.5).

c. LCO's not met (0.25) and action statements not complied with within the specified time interval (0.25).

REFERENCE
RBS, HLO-400-0 LO 3 & 4, T.S. Sect. 3 P. 3/4 0-1
(3.7/3.7)
2010016001 ...(KA'S)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.05 (2.00)

Answer the following with regard to Temporary Change Notices (TCNs):

a. What is the maximum number of TCNs that can be active against a single procedure? (0.5)

b. How would the next TCN be written against a procedure that already had the maximum number of TCNs allowed written against it? (1.0)

c. How long are "One Time Only" TCNs effective (maximum)? (0.5)

ANSWER 8.05 (2.00)

a. 3 (0.5)

b. The next TCN would have to supersede one of the previous TCNs in its entirety or it would not be allowed (1.0).

c. 14 days (0.5)

REFERENCE
RBS, HLO-202-2 LO 5 & 6, ADM-0003 Rev 14 P.11
(2.9/3.4)
294001A101 ...(KA'S)

QUESTION 8.06 (2.50)

Technical Specification defines the composition of the site fire brigade in Section 6.

a. What is the minimum number of fire brigade members required on site at all times? (0.5)

b. List FOUR shift personnel who are specifically excluded from being on the fire brigade. (2.0)

ANSWER 8.06 (2.50)

a. 5 [0.5]

b. Any 4 @ 0.5 each;

1. Shift Supervisor
2. Shift Technical Advisor
3. Control Operating Foreman
4. At-the-controls Operator
5. 1 Nuclear Equipment Operator

NOTE: Two members of the minimum shift manning required for safe shutdown of the plant, i. e. NCO, NEO (answers 4 and 5 above)

REFERENCE
RBS, HLO-415-0 L06, T.S. 6.2.2.e P. 6-1
ADM-022 Rev. 10, P. 11
(3.5/3.8)
294001K116 ...(KA'S)

QUESTION 8.07 (2.00)

For each of the following situations, determine if a Condition Report is required to be submitted by ADM-0019. Answer Yes or No for each situation.

a. Removal of plant equipment from service which constitutes a voluntary entry into an LCO action statement.

b. Fire in a clean trash container.

c. An individual with significant internal contamination.

d. Failure of a component which has failed three times within the last month.

ANSWER 8.07 (2.00)

a. No [0.5]

b. Yes [0.5]

c. Yes [0.5]

d. Yes [0.5]

REFERENCE
RBS, HLO-205-0 LO 3, ADM-0019 Rev. 6 PP. 12-14
(2.7/3.7)
294001A103 ...(KA'S)

QUESTION 8.08 (3.00)

Answer the following questions pertaining to Surveillance Test Procedures.

a. What are THREE methods available to correct a Surveillance Test Procedure (STP) which is incorrect as written and cannot be performed? (1.5)

b. What actions should be performed if a typographical error is detected during the performance of an STP if the step is otherwise correct and acceptance criteria is not affected? (1.5)

ANSWER 8.08 (3.00)

a. 1. Temporary Change Notice [0.5]
2. Preliminary Change Notice [0.5]
3. Procedure Revision [0.5]

b. 1. Obtain concurrence from on shift SS/COF (0.5)
2. Note the typo in the comments section of the procedure (0.5)
3. Initiate a comment control form and place it in the history folder [0.5]

REFERENCE
RBS, HLO-221-1 L05, HLO-202-2 L06, Rev. 11, P. 10 & 12
(2.7/3.7)
294001K103 ...(KA'S)

QUESTION 8.09 (1.00)

In order to depressurize the vessel under some plant conditions, it will be necessary to defeat isolation interlocks in accordance with approved EOPs or AOPs.

a. Where are the jumpers for bypassing these interlocks maintained? (0.5)

b. Who controls the issuance of these jumpers? (0.5)

ANSWER 8.09 (1.00)

a. Locked storage in the Main Control Room [0.5]

b. Shift Supervisor [0.5]

REFERENCE
RBS, ADM-0022 Rev. 10 P. 18
(2.7/3.7)
294001A103 ...(KA'S)

QUESTION 8.10 (1.50)

Fill in the requirements (a) - (c) in each of the following statements describing Technical Specification requirements if a safety limit is violated.

a. The NRC operations center shall be notified by telephone as soon as possible and in all cases within (a). (0.5)

b. The Senior Vice-President RBNG and the NRB chairman shall be notified within (b). (0.5)

c. A Safety Limit Violation Report shall be submitted to the Commission, the NRB, and the Senior Vice-President - RBNG within (c) of the violation. (0.5)

ANSWER 8.10 (1.50)

a. 1 hour [0.5]

b. 24 hours [0.5]

c. 14 days [0.5]

REFERENCE
RBS, HLO-415-0 LO 11, T.S. 6.7.1 P. 6-13
(3.4*/4.5*)
2120006003 ...(KA'S)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.11 (1.00)

Define each of the following per Technical Specifications:

a. Limiting Control Rod Pattern (0.5)

b. Identified Leakage (0.5)

ANSWER 8.11 (1.00)

a. A pattern which results in the core being on a thermal hydraulic limit (0.5).

b. 1. Leakage into collection systems (such as pump seal or valve packing leaks) that is captured and conducted to a sump or collecting tank (0.25), or

2. Leakage into the drywell atmosphere from sources that are specifically located and known not to interfere with the operation of the leakage detection systems (0.125) or to be Pressure Boundary Leakage (0.125).

REFERENCE
RBS, HLO-400-0 LO 1d & 1e, T.S. Section 2.0
(2.9/3.5, 3.3/4.1)
201001G002 223001G005 ...(KA'S)

QUESTION 8.12 (2.00)

What are the limits on recirculation loop flow mismatch and what is the basis for the limits? (2.0)

ANSWER 8.12 (2.00)

Mismatch shall be within:
a. 5% with core flow greater than or equal to 70% of rated [0.5]

b. 10% with core flow less than 70% of rated [0.5]

(Maintaining mismatch within limits will) ensure an adequate core flow coastdown from either recirc loop following a LOCA [1.0]

REFERENCE
RBS, HLO-405-0 LO 6 & 1, T.S. 3.4.1.3
(2.6*/3.7, 3.3/4.0)
2020026005 2020026006 ...(KA'S)

QUESTION 8.13 (1.00)

Until the new computer is installed for Emergency Notification, how does the Shift Supervisor actuate (or cause to be actuated) the emergency sirens? (1.0)

ANSWER 8.13 (1.00)

Shift clerk calls Security Shift Supervisor who dispatches personnel to the EOF (Training Center) to enable the siren system (1.0).

REFERENCE
RBS, Standing Order #60 dated 4/26/88
(2.9*/4.7*)
294001A116 ...(KA'S)

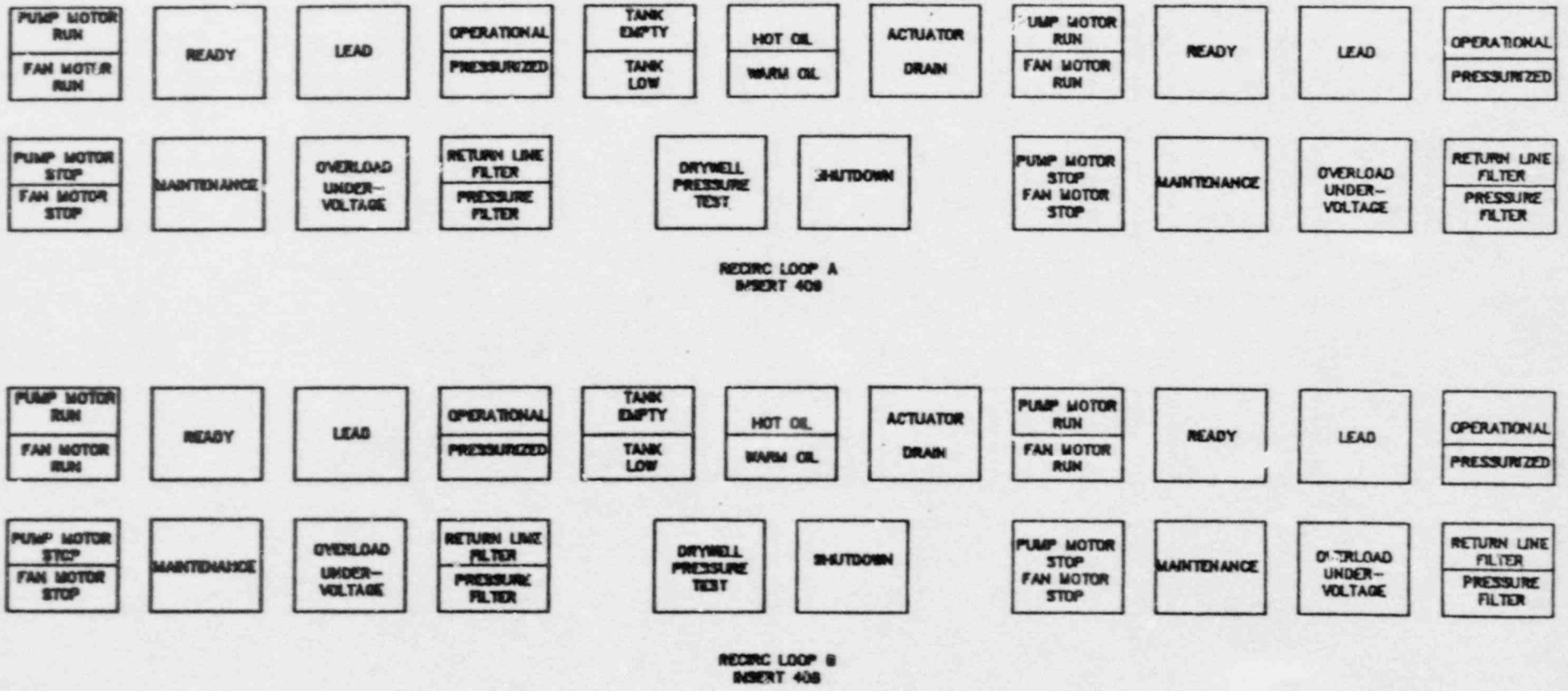
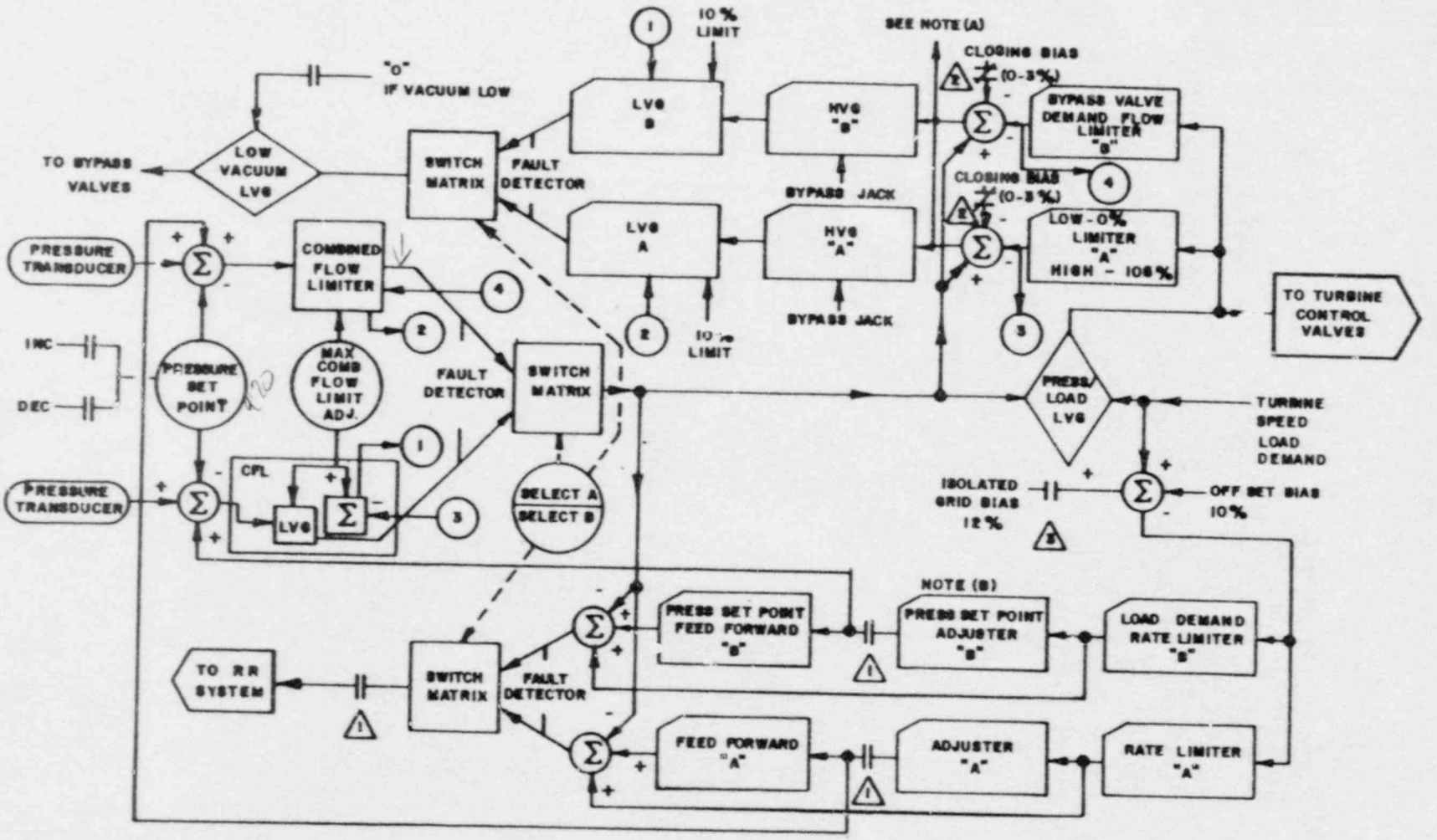


Figure 1

RECIRCULATION FLOW CONTROL SYSTEM INDICATIONS: PANEL P614



1 CLOSED WHEN RR IN AUTO

2 OPEN IN ISOL GRID

3 CLOSE IN ISOL GRID

NOTES:

(A) SIGNAL TO PRESSURE CONTROL CABINET TO INITIATE FAST-OPENING SIGNAL TO BYPASS VALVES IF DEMAND EXCEEDS

(B) PROVIDES AN OUTPUT PROP RTION TO CHANGE OF INPUT

PRESSURE CONTROL DIAGRAM

FIG. SD-113-5

Figure 2

NRC LICENSE EXAMINATION HANDOUT

EQUATIONS, CONSTANTS, AND CONVERSIONS

$\dot{Q} = \dot{m} * C_p * \text{deltaT}$ $\dot{Q} = U * A * \text{deltaT}$

$P = P_o * 10^{sur*(t)}$ $P = P_o * e^{t/T}$ $SUR = 26/T$

$T = l^*/\rho + (\beta-\rho)/\bar{\lambda}\rho$ $T = l/(\rho-\beta)$ $T = (\beta-\rho)/\bar{\lambda}\rho$

$\rho = (K_{eff}-1)/K_{eff} = \text{deltaK}_{eff}/K_{eff}$ $\rho = l^*/TK_{eff} + \bar{\beta}_{eff}/(1+\bar{\lambda}T)$

$\lambda = \ln 2/t_{\frac{1}{2}} = 0.693/t_{\frac{1}{2}}$ $\bar{\lambda} = 0.1 \text{ seconds}^{-1}$

$I = I_o * e^{-ux}$

$CR = S/(1-K_{eff})$

$R/hr = 6*CE/d^2$ feet

Water Parameters

1 gallon = 8.345 lb_m = 3.87 liters
1 ft^3 = 7.48 gallons
Density @ STP = 62.4 lb_m/ft^3 = 1 gm/cm^3
Heat of vaporization = 970 Btu/lb_m
Heat of fusion = 144 Btu/lb_m
1 atmosphere = 14.7 psia = 29.9 inches Hg.

Miscellaneous Conversions

1 curie = 3.7×10^{10} disintegrations per second
1 kilogram = 2.21 lb_m
1 horsepower = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 inch = 2.54 centimeters
degrees F = 9/5 degrees C + 32
degrees C = 5/9 (degrees F - 32)
1 Btu = 778 $ft\text{-}lb_f$

RIVER BEND STATION
FACILITY COMMENTS ON NRC EXAM GIVEN JULY 12, 1988

5.07 Request additional correct answer to be: not to exceed 1% plastic strain of the cladding.

Ref.: River Bend Station, LOTM-TH-4.9.2 pg. 5 of 5

6.05 Request additional correct answer to be: Depress CRVICS BOP isolation pushbuttons on the P680 panel.

Ref.: River Bend Station LOTM-51-2, Table 2, pg. 29 & 31

6.09 Request additional correct answer to be:

1. Containment and drywell purge systems
2. Rx plant sampling systems
3. Annulus pressure control system

Ref.: River Bend Station LOTM-51-2, Table 2

6.10 Part a.

Pump A will downshift to the LFMG. On depressing the Transfer switches, CB 2A opens immediately and CB-1A closes. CB-2A will then close when its permissives are met.

Ref.: River Bend Station LOTM-7-2, pg. 18 #9

7.06 Question does not specify reference to any procedure. Answer addresses causes rather than symptoms of a loss of main condenser vacuum. Request question be deleted or acceptance of the following answer:

1. Generator load decrease
2. Turbine trip
3. Bypass valve closure
4. Main Steam isolation valve closure

Ref.: River Bend Station LOTM 29-2, Table 2 and pg. 1

8.06 Part b

Question addresses T.S. specifically, answer to part b references ADM-022 personnel requirements. Answer should include 2 members of the minimum shift manning who are required for safe shutdown of the plant, i.e. NCO, NEO.

Ref.: River Bend T.S. Sect. 6.2.2.E

8.13 Request training center be included in answer as location of siren actuation system. EOF is located in Training Center.

Ref.: Standing Order #60 dated 4/26/88