U. S. NUCLEAR REGULATORY COMMISSION REGION I
OPERATOR LICENSING EXAMINATION REPORT

EXAMINATION REPORT NO. 50-333/84-07

FACILITY DOCKET NO. 50-333

FACILITY LICENSE NO. DPR-59

LICENSEE: Power Authority of the State of New York
P. O. Box 41
Lycoming, NY 13093

FACILITY: James A. FitzPatrick Nuclear Power Plant

DATES: March 20-23, 1984

CHIEF EXAMINER: John A. Berry — 4-30-84 Date

APPROVED BY: Chief, Project Section 1D — 5/2/84 Date

SUMMARY: Written and oral examinations were administered to four ROs, four SROs, and one instructor candidate. All candidates passed these examinations.

REPORT DETAILS

TYPE OF EXAMS: Initial ____ Replacement X Requalification ____

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail	Inst. Cert Pass/Fail	Fuel Handler Pass/Fail
Written Exam	4/0	4/0	1/0	/
Oral Exam	4/0	4/0	1/0	/
Simulator Exam	/	/	/	/
Overall	4/0	4/0	1/0	/

1. CHIEF EXAMINER AT SITE: D. N. Graves, EG&G Idaho, Inc.

2. OTHER EXAMINERS: T. L. Morgan, EG&G Idaho, Inc

3. PERSONS EXAMINED

RO Candidates

J. H. Brown
W. R. Hendrick
B. R. Horning
R. H. Morris

SRO Candidates

A. E. Curran, Jr.
W. Fernandez
C. K. Walker
W. W. Daczkowski

Instructor Candidate

J. W. Henderson

1. Summary of generic strengths or deficiencies noted on oral exams:

   Examiner's noted that candidates were very well prepared for examinations. No generic weaknesses were noted.

2. Summary of generic strengths or deficiencies noted from grading of written exams:

   No generic weaknesses were noted on the written exams. Overall grades were very good.

3. Comments on availability and candidate familiarization with plant reference material:

   Both availability and familiarization were good

4. Comments on availability and candidate familiarization with plant design, procedure, T. S. changes and LERs:

   Both availability and familiarization were good.

5. Comments on interface effectiveness with plant training staff and plant operations staff during exam period.

   The plant staff was very cooperative with all phases of the examination process.

6. Improvements noted in training programs as a result of prior operator licensing examinations/suggestions, etc:

   Not applicable

7. Personnel Present at Exit Meeting:

<u>NRC Personnel</u>
L. Doerflein, SRI, FitzPatrick

<u>NRC Contractor Personnel</u>

D. N. Graves, EG&G Idaho, Inc.
T. L. Morgan, EG&G Idaho, Inc.

<u>Facility Personnel</u>
C. McNeill, JAFNPP, Resident Manager
D. Simpson, JAFNPP, Training Coordinator
M. Curling, JAFNPP, Training Manager
F. Catella, JAFNPP, Supervisor of Operations Training

8. Summary of NRC Comments made at exit interview:

At the conclusion of the site visit, the examiners met with representatives of the plant staff to discuss the results of the examinations. They were informed that all candidates passed the operating portion of the examinations.

No generic weaknesses were noted or reported to the facility.

The examiners felt that the candidates were well prepared for the examinations.

Examiner's told facility that they felt the facility was extremely clean and accessible.

9. Summary of facility comments and commitments made at exit interview:

None

10. Changes made to written exam

At the conclusion of the written examinations, the examiners met with Douglas Lindsey, M. H. Curling, G. J. Vargo, J. S. Romanowski, F. J. Catella, and D. F. Simpson of the Operations and Training Departments to review the written examinations and answer keys. The facility's comments and our resolution of these comments are enclosed.

Attachment:

Writ*en Examination(s) and Answer Key(s) (SRO/RO)

Attached is a list of the comments noted during the review of the RO and SRO examinations. The following is our resolution of those comments.

RO Examination Review Comments

1.03(b) Comment noted and accepted.

1.04(a) Comment accepted and incorporated into answer key. Reference provided.

1.06 Candidates were informed during the exam as to orientation of axes.

1.07 Question and answer stands as written.

1.09(a) 4 - added b to make answer "e and b". Same reference.
(b) Radical sign originally omitted on answer key. Was incorporated.

1.10(a) Candidates response would be evaluated to determine if sufficient knowledge was displayed. Comment was taken into account during grading.

2.01(b) Accepted. 110# to 120# was not included in original answer key.

2.03(a) Accepted

2.04(b) Question and answer stands as written.

2.07(a) Accepted (Reference: System Description #33, Condensate System)

2.08(e) Accepted

2.09(a) Accepted. Responses were graded using P&ID in OP where candidates listed specific loads.

3.01(b) Accepted

3.02(a) Accepted "bypass RWM"
(c) Accepted values ranging between Tech. Spec. valve of 20% and OP setpoints (in answer key) which are nominal valves.

3.04(b) Deleted "unless level drops to 182" from the answer key.
(c) Accepted per System Description 021 Recirculation Flow Control.

3.05(c) Added flow bias to trips in effect when not in RUN.

3.06(a) Accepted

4.04 Accepted

4.07(b) Accepted. No candidates responded this way. This level instrument mentioned in the comment would be used only if level was very low.

SRO Examination Review Comments

5.04(c) Examiners disagree with comment. Question and answer key stand as written.

5.05(c) J.A.F. does not have a governor control switch. Candidates were informed during the examination that it should be "load selector".

5.08 No utility comments. Examiner added possible alternate answer pertaining to heat retention in the fuel pellet. See answer key.

6.04(e) Same as 2.08(e).

6.06(a) and (c) Same as 3.02(a) and (c).

6.08(b) and (c) Same as 3.04(b) and (c).

7.01(b) Accepted

7.04(b) Disagree with recommended comment and graded question using answer as written.

7.06(b) Same as 4.07(b).

8.03 Accepted-phrase sited in answer key not critical to answering question correctly.

JAF RO EXAM COMMENTS

1.03 (b) Doppler will slow rate of change of power increase but will not turn power.
Ref: NEDO-10806

1.04 (a) Need to look at GE Beta handout - rather than less likely to leak - less likely to be resonantly absorbed.

1.06 With exception of timer axis being backward from FSAR

1.07 Fuel densification is not strongly considered w/all 8 x 8 fuel since MAPLHHR limit increases with initial exposure. Densification is not as strong as the radial gap cracking and pellet grain boundary reorientation allowing on initial MAPLHGR increase.

1.09 (a) 4. e and b

(b) Velocity head converted to pressure head for the venturi explanation.

$$VFR = K \sqrt{\Delta P}$$

1.10 (a) Decay heat may not be broken down into two (2) components as indicated in key.
Ref: G.E. Degraded Core Cooling text

2.01 (b) Loading and unloading 110# - 120#
May see 90# for service air isolations - Check Annunicator Response procedures for variations against procedure setpoints.

2.03 (a) May get other responses as indicated in SP-6 under automatic station response.

2.04 (b) At FitzPatrick the CRD flow control valve has been in manual for years due to hunting. Candidate should know correct response.

2.07 (a) Also - holdup time for N^{16}

2.08 (e) Alarm only (SDIV Ref. Mod 82-18)

2.09 (a) For RBC low pressure start, some SW loads will be supplied if ESW pressure is >SW pressure because of the check valve arrangement bvetween ESW/SW.
Ref: ESW, SW and RBC operating procedures

3.01 (b) May not discuss FW flow since there is no difference from a.

3.02 (a) Substitute rod position is inserted by the Rx Analyst group not RO duty. Other acceptable answer would be bypass RWM and have second license perform function of RWM.

(c) Key answers are nominal values. Acceptable answers include 20 - 22%.
Ref: Technical Specifications

3.04 (b) FW flow for recirc
Runback comes from RFP suction flow, not feed flow. Last part of key is N/A.

(c) Candidates will use 26% vise 30%.

3.05 (c) Flow biased trip is never bypassed.
Ref: GE drawing to be provided later

3.06 (a) Mech. vacuum pump (Hoggers)
Suction valve closure initiates the pump trip.

4.04 Unmonitored release - no automatic isolation.
Ref: Off Gas System operating procedure (OP-24A)

4.07 (b) Candidates may also respond with a discussion of fuel zone yarway which ref leg is outside containment. Answer is dependent upon where vessel level is.

JAF SRO EXAM COMMENTS

5.04 (c) This question is beyond the scope of SRO.

ANSWER: Possibly be in accordance with analyst direction.

5.05 Governor control switch -

ANSWER: Should have been labelled load selector.

6.06 (c) When are RWM & RSCS auto bypassed....

ANSWER: TS reference for RWM & RSCS operability
3.3.b.3.a & 3.b

6.08 (c) Recirculation pump minimum speed

ANSWER: Pumps run back to minimum speed (#1 speed limiter) or
26% or 22% speed limiter

7.01 (b)

ANSWER: May respond in accordance with E-Plan IAP-1/IAP-2 with
respect to notification.

7.04 (b)

ANSWER: temperature <110°F
AOP-1

7.06 (b) Which type of level instrumentation to be used (GEMAC or
YARWAY) in case of rapid depressurization.

ANSWER: Fuel zone yarway is best since its reference leg is almost
entirely outside the drywell.

8.03

ANSWER: Delete "As measured by atomic wipe".

MASTER COPY

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: _JAF________________

REACTOR TYPE: _BWR________________

DATE ADMINISTERED: _84/03/20__________

EXAMINER: _GRAVES, D.________

APPLICANT: ____________________

INSTRUCTIONS TO APPLICANT:

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	APPLICANT'S SCORE	% OF CATEGORY VALUE		CATEGORY
25.00	25.00	________	________	1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00	25.00	________	________	2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
25.00	25.00	________	________	3.	INSTRUMENTS AND CONTROLS
25.00	25.00	________	________	4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
100.00	100.00	________	________		TOTALS

FINAL GRADE _________________%

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

____
APPLICANT'S SIGNATURE

QUESTION 1.01 (3.00)

a. Why is the core orificed? (1.5)
b. At 100% power and flow, what percentage of total flow is core bypass flow and HOW can this affect LPRM accuracy? (1.5)

QUESTION 1.02 (1.50)

In a reactor fueled with U-235 and U-238:

a. Which nuclide(s) may fission upon absorbing a fast neutron? (0.5)

b. What fissile nuclide can U-238 be converted into? (0.5)

c. At the Middle of Core Life (MOL), which 2 nuclides may absorb a thermal neutron and fission? (0.5)

QUESTION 1.03 (2.00)

a. A change in WHAT PARAMETER causes Doppler Broadening? (0.5)
b. How does the Doppler effect contribute to the inherent stability of the reactor? (1.5)

QUESTION 1.04 (3.00)

a. Delayed neutrons are born at lower energies than prompt neutrons. HOW or WHY (2 reasons required) does this cause BETA to be different from BETA EFFECTIVE? (2.0)
b. Indicate the direction and magnitude of the effect that delayed neutrons have on total neutron generation time. (1.0)

QUESTION 1.05 (3.00)

The reactor is shutdown by 5% dk/K and the SRM's indicate 100 cps. If Keff of the reactor is increased to .98, what should the new approximate count rate be? SHOW ALL WORK. (3.0)

QUESTION 1.06 (4.00)

The reactor is operating at 100% power when both recirculation pumps trip. On the attached sheet of plant parameter responses, explain why the trace behaves as it does at each of the labeled points below. NOTE: the trace intervals are in 1 minute increments beginning at time=0. The transient begins at approximately t=1 min.

a. Reactor vessel level (1.0)

b. Total feedwater flow (1.0)

c. APRM (1.0)

d. Core flow (1.0)

QUESTION 1.07 (1.00)

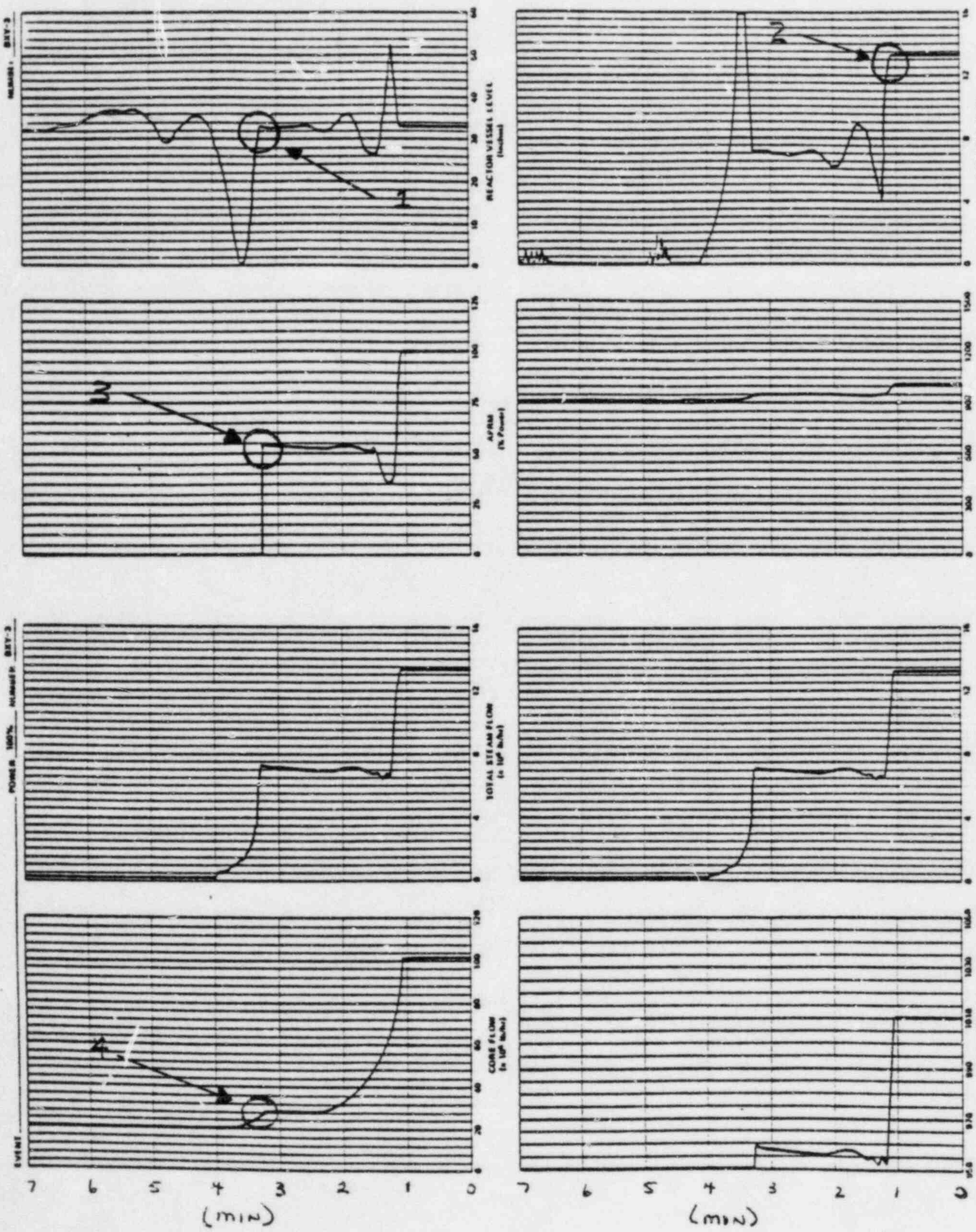
All of the below are possible effects of ___?___.

o Local power spikes due to axial gap formation
o Increase in LHGR due to pellet length shortening
o Creep collapse of the cladding due to axial gap formation
o Changes in stored energy due to decreased pellet-cladding thermal conductance resulting from increased radial gap size (1.0)

QUESTION 1.08 (3.00)

Following a normal reduction in power from 90% to 70% with recirculation flow, how will the following change (increase, decrease, or remain the same) AND why:

A. Pressure difference between reactor and turbine inlet (1.0)
B. Condensate depression (1.0)
C. Feed water temperature (1.0)



REACTOR VESSEL LEVEL
TOTAL F.W. FLOW
APRM
REACTOR PRESSURE
TOTAL STEAM FLOW
TURBINE STEAM FLOW
CORE FLOW
REACTOR PRESSURE
1
2
3
4
7 6 5 4 3 2 1 0
(MIN)
7 6 5 4 3 2 1 0
(MIN)

QUESTION 1.09 (3.00)

A. For each of the types of instruments listed in column 1, match to it the application(s) in column 2. (Items in column 2 may be used more than once or may not be used at all. Instruments may have more than one application.) (1.0)

COLUMN 1	COLUMN 2
1. liquid manometer	a. fluid velocity
2. pitot tube	b. moderate or low liquid pressure
3. piezometer	c. nuclear reactions
4. bourdon tube	d. low pressure differentials
5. venturi tube	e. high pressures or vacuums
	f. mass flow rate
	g. high speed rpm

B. Briefly explain the operation of a pitot tube OR a venturi tube. (a working sketch may be used to assist in your explanation) (2.0)

QUESTION 1.10 (1.50)

A. What is decay heat AND how is it produced ? (1.0)

B. What percent of energy liberated from fission is attributable to decay energy ? (0.5)

QUESTION 2.01 (3.00)

The Breathing, Service, and Instrument Air Systems are in a normal lineup.

a. What is the normal configuration of the station air compressors? (1.0)

b. What THREE AUTOMATIC actions would occur IN THE AIR SYSTEMS on a decreasing air header pressure to maintain header pressure? INCLUDE SETPOINTS as applicable. (2.0)

QUESTION 2.02 (3.00)

a. Why are Standby Liquid Control System lines heat traced? (0.5)
b. Other than the control room annunciator, list TWO other indications that would indicate a loss of continuity to the SBLC squib valves. (1.0)
c. How does the system respond if started from the:
   1. Control Room?
   2. Local Panel?
   NOTE: Include components actuated (1.5)

QUESTION 2.03 (1.50)

a. What are two METHODS of DETECTION used to provide indication that a Safety/Relief Valve has opened automatically? (1.0)
b. Once the ADS system has initiated, when will the ADS valves shut assuming NO OPERATOR ACTION? (0.5)

QUESTION 2.04 (3.00)

a. When a scram signal occurs at power, describe IN DETAIL how the Control Rod Drive and its associated Hydraulic Control Unit function to insert the control rod. Include which components open, close, energize, deenergize, and motive force for the entire rod travel as a MINIMUM in your answer. (2.0)
b. Explain HOW the Flow Control Valve in the CRD Hydraulic System responds during a scram and WHY. (1.0)

QUESTION 2.05 (3.00)

Explain HOW and WHY a loss of the Uninterruptible Power Supply affects each of the following items. If the loss has no effect, explain what prevents the loss from having an effect.

a. EHC (1.0)
b. Reactor Feed Pump Control (1.0)
c. Reactor Vessel Level (1.0)

QUESTION 2.06 (3.00)

An automatic RCIC initiation has occurred. Subsequently, RCIC injection was automatically terminated due to high reactor water level.

a. What component in the RCIC system functioned to automatically terminate the injection? (0.5)

b. Assuming no operator action, how will RCIC respond to a subsequent decreasing water level? (1.0)

c. If a RCIC "Turbine Test" had been in progress when the initial automatic initiation signal had been received, how would the system have responded? (1.0)

d. If, following the initiation, the RCIC turbine had tripped on overspeed, could it be reset from the Control Room? (0.5)

QUESTION 2.07 (2.50)

a. What are two reasons for maintaining condenser hotwell level within a given range? (1.0)
b. Briefly describe how the hotwell level controller functions to maintain hotwell level. (1.5)

QUESTION 2.08 (3.00)

For EACH of the following conditions, state whether a scram, half-scram, rod block, or no action is generated. For conditions that produce more than one action, state the more limiting action (i.e. half-scram is more limiting than a rod block).

a. Loss of one RPS MG set
b. Turbine trip at 20% power
c. Two main steam lines isolated, Mode switch in RUN
d. APRM B downscale, Mode switch in RUN
e. Scram discharge volume level is at 19 gallons
f. Load reject at 50% power (3.0)

QUESTION 2.09 (3.00)

a. Two conditions may cause the Emergency Service Water System to start automatically. What are these two conditions, and how does the ESW line up in each case (which pumps start, what loads are directly supplied)? (2.34)
b. How is the automatic initiation terminated and what condition(s) must be met? (0.66)

QUESTION 3.01 (3.00)

The plant is operating at 85% power with the Feedwater Level Control System in THREE ELEMENT control. An inadvertent HPCI injection occurs. Assume NO reactor scram occurs.

a. Describe the response of the Feedwater Level Control System to the HPCI injection. Discuss changes in reactor water level and feed pump speed and flow, JUSTIFYING EACH. Continue your discussion to a stable condition with HPCI injecting at rated flow. (2.0)

b. Briefly explain how the response and final conditions would be different had the Feedwater Level Control System been in SINGLE ELEMENT control instead of THREE ELEMENT. (1.0)

QUESTION 3.02 (3.00)

a. With regard to the Rod Worth Minimizer, what two features are available to clear or bypass rod blocks that occur as a result of position sensor failures? (1.0)
b. How does the Rod Sequence Control System allow clearing rod blocks applied due to failure of position indicators? (0.5)
c. When are the RWM and RSCS systems automatically bypassed, and in each case, what parameter is used to initiate the bypass action (include setpoints)? (1.5)

QUESTION 3.03 (3.00)

What parameter will be indicated on the Rod Block Monitor meter with the meter switch in each of the following positions:

a. Input
b. Count
c. Reference
d. Block
e. Flow
f. Average (3.0)

3.03

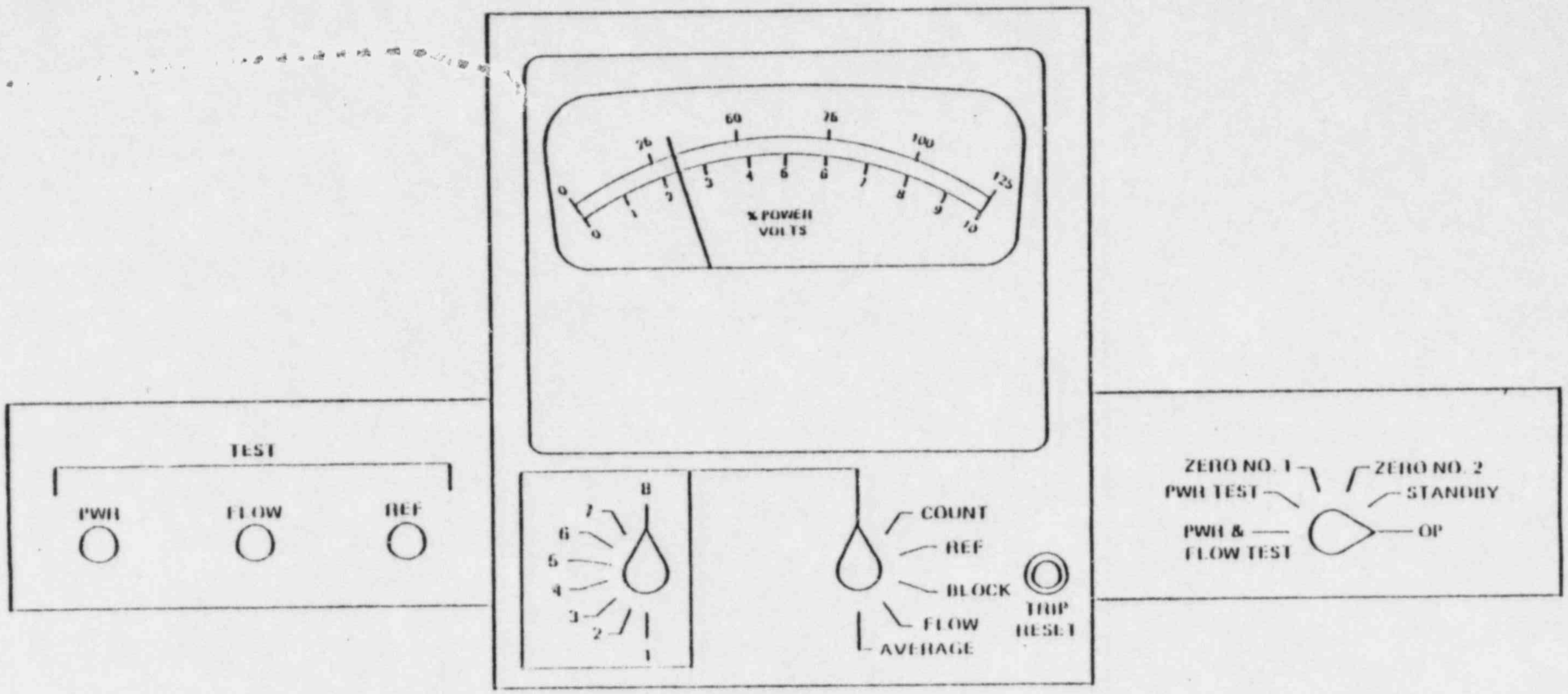


Figure 8. RBM Meter and Test Switches

QUESTION 3.04 (4.00)

The reactor is operating at 100% power with recirculation flow control in master manual. What will be the effect on BOTH recirculation pumps A and B speed due to each of the following conditions or events and EXPLAIN what the failure does to the recirculation flow control system.

a. Master Controller output fails LOW (1.0)
b. One feed flow detector (of two) fails to 0 lbm/hr (1.0)
c. Full open indicator on recirculation pump A discharge valve fails and indication is lost (1.0)
d. Signal to recirculation MG set B scoop tube fails to 0 (1.0)

QUESTION 3.05 (3.00)

a. The APRM receives input signals from what TWO sources? (0.5)
b. With the exception of meters, recorders, and the RPS, what are three systems that receive APRM power level or trip signals? (1.0)
c. Identify which APRM UPSCALE TRIPS are in effect for the various Reactor Mode Switch positions. (1.5)

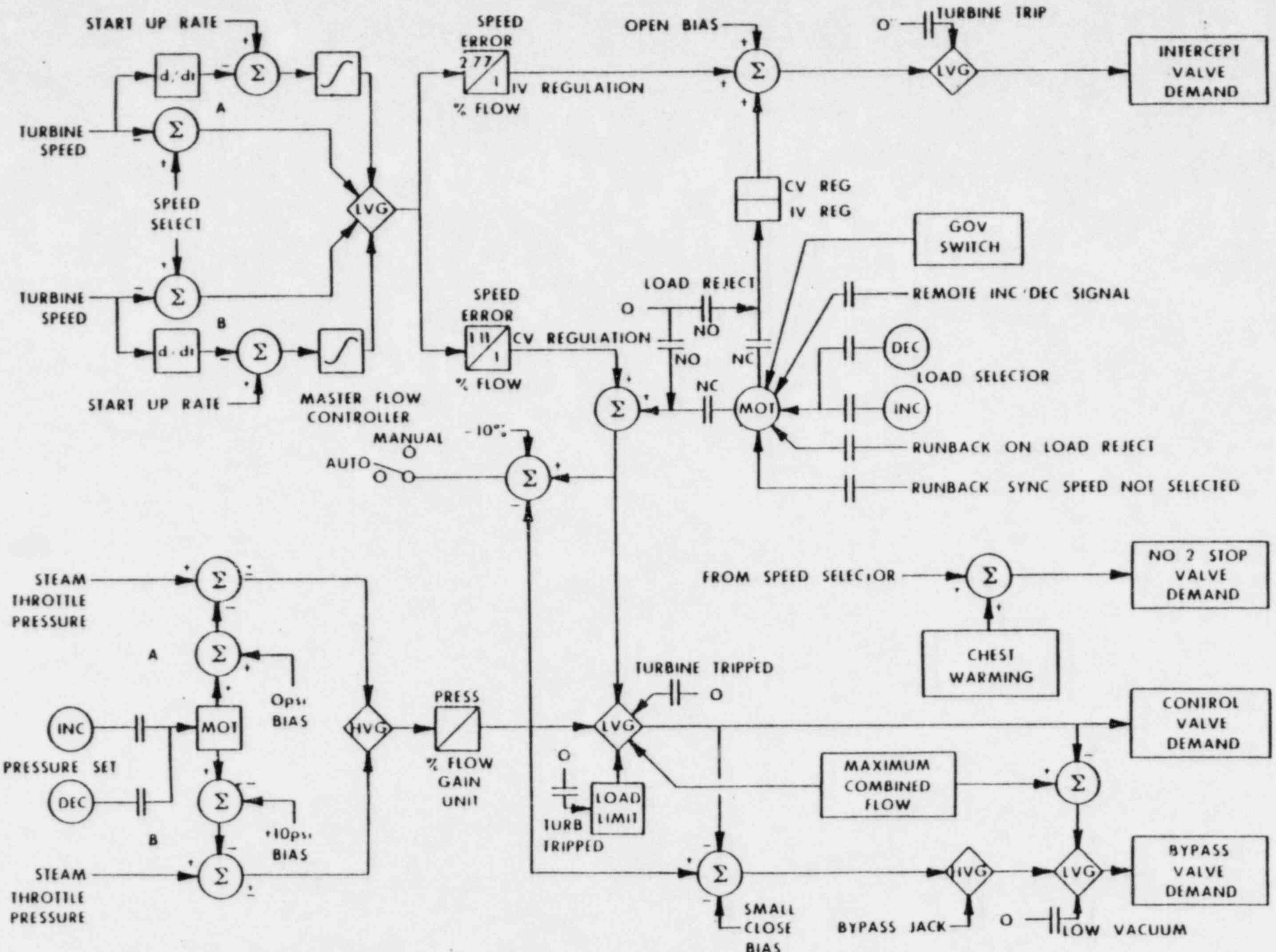
QUESTION 3.06 (3.00)

For each of the Radiation Monitoring Systems below, indicate what TYPE OF RADIATION DETECTOR is used and what AUTOMATIC ACTIONS occur, if any, on a trip of the system. Exclude alarms and annunciators.

a. Main Steam Line Radiation Monitor
b. RBCLCW Radiaton Monitor (3.0)
c. Reactor Building Ventilation Exhaust Radiation Monitoring

QUESTION 3.07 (2.00)

The Unit 1 Reactor is operating at 100% power. EHC pressure set is 920 psig. The Load Limit is set at 100%. The Maximum Combined Flow is set at 110%. The Bypass Jack control is slowly adjusted to 100% inadvertantly. EXPLAIN what will happen to total steam flow, reactor power, CV position, BPV position and WHY. A diagram of the EHC system is attached. (2.0)



SDLP - 94C
Figure 6.

QUESTION 3.08 (4.00)

a. List the initiation signals, including setpoints, for the HPCI system. (1.0)

b. With a complete break in the low pressure line of the HPCI flow dp cell, will the system inject to the vessel at rated flow upon receipt of a valid initiation signal? EXPLAIN your answer. (2.0)

c. What prevents draining the CST to the suppression pool through the HPCI minimum flow valve following a turbine trip? (1.0)

QUESTION 4.01 (2.50)

Answer the following with regard to "Controlling Reactor Pressure Following Reactor Isolation":

a. What system(s) provide(s) the PREFERRED method of pressure control? (1.0)

b. When reactor pressure approaches the safety/relief valve (SRV) setpoint, take manual control of a SRV and reduce pressure to approximately ___?___. (0.5)

c. If manual SRV actuation is required subsequent to a prior SRV actuation, WHAT DETERMINES which SRV(s) should be operated and WHY? (1.0)

QUESTION 4.02 (3.00)

a. What are the critical speeds for your turbine generator? (1.0)
b. It is imperative that the turbine generator NOT be held at speeds < ___?___ RPM for periods exceeding ___?___ minutes. (1.0)
c. If conditions become abnormal during turbine roll, what TWO actions are required? (1.0)

QUESTION 4.03 (2.50)

When operating the RHR System in the Shutdown Cooling Mode and a loss of flow occurs, EXPLAIN WHY reactor level should be raised to 234.5". Include TWO potential problems that could occur if the level was not increased. (2.5)

QUESTION 4.04 (1.00)

When operating the reactor at power, give TWO reasons why the vacuum pumps SHOULD NOT be used in an effort to MAINTAIN condenser vacuum. (1.0)

QUESTION 4.05 (3.00)

A reactor scram has occurred. Four adjacent control rods have failed to insert past position 06.

A. Match the following sets of indications with the appropriate potential problem type. (1.5)

1. 3 RPS white lights are ON
2. All RPS white lights are OFF, 4 blue lights on the full core display are NOT ON
3. All RPS white lights are OFF, all blue lights on the full core display are ON

a. Air problem
b. Hydraulic problem
c. Electrical problem

B. With a number of control rods immovable, such as above, what further criteria needs to be met, per F-AOP-1 Reactor Scram, to warrant initiating Standby Liquid Control? (1.5)

QUESTION 4.06 (4.00)

F-EOP-28, Plant Shutdown From Outside the Control Room, lists two specific actions that should be performed prior to leaving the control room. These are actions that change the status or position of a component or system. WHAT are these TWO actions performed in the control room, and HOW may they also be performed from OUTSIDE the control room if necessary? (4.0)

QUESTION 4.07 (3.00)

a. What are the FOUR BASIC OBJECTIVES the operator is to achieve in the event of a pipe break with respect to the core and containment (F-EOP-33)? (2.0)
b. Which type of level instrument (GEMAC or YARWAY) should the operator use for level indication during rapid vessel depressurization, particularly below 500 psig? What makes the OTHER type UNDESIRABLE? (1.0)

QUESTION 4.08 (3.00)

When operating the Reactor Water Cleanup (RWCU) System in the blowdown mode:

a. What are the TWO possible discharge points for the rejected water? (1.0)

b. If the reactor temperature is >212 degrees F, why should the reactor head vent be open when rejecting water? (1.0)

c. What potential problem exists if all RWCU flow is diverted to the blowdown path? (1.0)

QUESTION 4.09 (3.00)

a. What are the whole body radiation exposure GUIDES at James A. FitzPatrick Nuclear Power Plant? (2.0)

b. What are the whole body radiation exposure LIMITS for radiation workers per 10 CFR 20? (1.0)

EQUATION SHEET

$f = ma$

$v = s/t$

Cycle efficiency = (Net work out)/(Energy in)

$w = mg$

$s = V_o t + 1/2\ at^2$

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N$

$A = A_o e^{-\lambda t}$

$PE = mgh$

$V_f = V_o + at$

$w = \theta/t$

$\lambda = \ln 2/t_{1/2} = 0.693/t_{1/2}$

$t_{1/2}eff = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$W = v\ \Delta P$

$A = \frac{\pi D^2}{4}$

$\Delta E = 931\ \Delta m$

$\dot{m} = V_{av} A \rho$

$I = I_o e^{-\Sigma x}$

$\dot{Q} = \dot{m} Cp \Delta t$

$\dot{Q} = UA \Delta T$

$Pwr = W_f \Delta h$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$P = P_o 10^{sur(t)}$

$P = P_o e^{t/T}$

$SUR = 26.06/T$

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

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

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

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$\rho = [(\ell^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$I_1 d_1 = I_2 d_2$

$I_1 d_1{}^2 = I_2 d_2{}^2$

$P = (\Sigma\phi V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$R/hr = (0.5\ CE)/d^2 (meters)$

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 1.01 (3.00)

a. The core is orificed to minimize the undesirable effect of quality increase on bundle flow. Without core orificing, the higher powered bundles create more flow resistance with greater two-phase flow when they actually need more flow, directing more flow to the lowere powered bundles. The orificing ensures the higher powered bundles receive sufficient flow. (1.5)

b. 11.5% + or - 1%(0.5). To little bypass flow causes excessive voiding in the bypass region which results in overheating of the detector OR loss of moderator for the detector(1.0). ~~(1.0)~~ (1.5)

REFERENCE
GE Heat Transfer and Fluid Flow pg 9-53, 9-59 DNG157

ANSWER 1.02 (1.50)

a. U-235, U-238(0.25 each) (0.5)
b. Pu-239 (0.5)
c. U-235, Pu-239(0.25 each) (0.5)

REFERENCE
NUS Reactor Operations 12.2-6 DNG158

ANSWER 1.03 (2.00)

a. Increase in fuel temperature (0.5)
b. As the temperature of the fuel rises due to the power increase, the number of neutrons lost by resonance capture increases(0.75). This tends to stop the neutron multiplication thus stopping the power rise(0.75). (1.5)

REFERENCE
NUS Reactor Operation 13.4-1 DNG159

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 1.04 (3.00)

Less likely to be resonantly absorbed per attached reference

a. 1. Due to the lower birth energy of delayed neutrons, they are less likely to cause fast fission(1.0).
   2. Due to the lower birth energy of delayed neutrons, they are less likely to leak out of the system(1.0). (2.0)

b. Delayed neutrons cause the total generation time to be 1000 times greater than the prompt neutron generation time. (1.0)

REFERENCE
NUS Reactor Theory 5.4-4. 5.3-4 DNG160
GE-TVA Simulator material

ANSWER 1.05 (3.00)

Determine original Keff:
dk=(Keff-1)/Keff
-.05=(Keff-1)/Keff
-.05 Keff=Keff-1
1=1.05Keff
Keff=1/1.05=.952 (1.5)

Determine new count rate:
CR1(1-Keff1)=CR2(1-Keff2)
100(1-.952)=CR2(1-.98)
CR2=100(1-.952)/1-.98
CR2=4.8/.02
CR2=240 (1.5) (3.0)

REFERENCE
NUS Reactor Theory 6.1 DNG161

ANSWER 1.06 (4.00)

a. The sharp drop in level is from the collapse of voids in the core due to the scram. (1.0)
b. Feedwater flow initially decreases because of level swell and steam flow decrease after the recirculation pumps tripped. (1.0)
c. APRM rapidly dropped due to a scram on APRM Hi-Hi due to loss of feed heating. (1.0)
d. Core flow was steady on natural circulation, then decreased further with the reactor scram. (1.0)

REFERENCE
GE Transient Analysis DNG162

ANSWER 1.07 (1.00)

fuel densification (1.0)

REFERENCE
General Electric HTX & FF pg 9-107 DNG163

ANSWER 1.08 (3.00)

A. Decreases (0.25), There is less steam flow, therefore less pressure drop through the main steam lines. (0.75) (1.0)

B. Increases (0.25), with the same amount of cooling water through the condenser & now less of a heat load, condensate depression will increase. (0.75) (1.0)

C. Decreases (0.25), due to less extraction steam from turbine to heat the feedwater. (0.75) (1.0)

REFERENCE
EHC system description, G.E. HT&FF, Main Turbine System Description DNG164

ANSWER 1.09 (3.00)

A. 1. d
2. a,f
3. b
4. e and b
5. f (0.2 ea) (1.0)

B. The pitot tube faces upstream and the height to which the liquid rises in the tube is equal to the stagnation pressure in the stream. The side holes in the outer tube measure static head. The difference in the liquid column heights then represents that part of the pressure due to velocity head. The flow velocity can then be related to the pressure through an energy balance.

OR

The meter consists of an elongated tube with a constriction near the midlength. The constriction causes the fluid velocity to increase. From the Bernoulli principle (where the velocity is high the pressure is low), we see that a gage at the constriction will give a lower reading than a gage placed elsewhere. A D/P cell is used between gages to indicate this pressure difference. The pressure differential is then correlated to the volume flow rate by the following equation:

$VFR = K\sqrt{P1-P2}$ (eq. not required) (2.0)

REFERENCE
GE HTX & FF Chapter 7 DNG165

ANSWER 1.10 (1.50)

A. Decay heat is the heat produced from that part of the fission energy released at some time after the fission event (0.5) by radioactive decay of the fission products (0.5) (1.0)

B. 6% to 7% (0.5)

REFERENCE
GE Reactor Fundamentals DNG166

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 2.01 (3.00)

a. Two compressors will be operated continuously and the third compressor will be in standby. (1.0)
b. Loading and unloading of operating compressors (115-120 psig)
Standby compressor starts at 100 psig
Service Air isolates at 95 psig
Breathing Air isolates at 85 psig
(3 required at 0.5 for each action, 0.16 for each setpoint) (2.0)

REFERENCE
F-OP-39 Breathing, Instrument, and Service Air Systems pg 6,8
F-AOP-12 Loss of Instrument Air pg 2 DNG140

ANSWER 2.02 (3.00)

a. To ensure the boron stays in solution (0.5)
b. Ready lights indicating continuity go OUT(0.5)
Two milliammeters in the back of the 9-3 panel(0.5) (1.0)
c. 1. The selected pump will start(0.5) and both injection valves fire(0.5).
2. The selected pump starts(0.5). The squib valves do not fire. (1.5)

REFERENCE
F-OP-17 Standby Liquid Control System DNG141

ANSWER 2.03 (1.50)

a. Acoustic monitors(0.5) and temperature detectors(0.5) on the discharge of each SRV. (1.0)
b. The valves will shut when system pressure decreases to approximately 50 psig. (0.5)

REFERENCE
F-SP-6 Inadvertent Relief Valve Opening DNG142

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 2.04 (3.00)

a. A scram signal deenergizes the scram pilot valves(0.33), venting air from the scram inlet and outlet valves, allowing them to open(0.33). This vents water from the overpiston area of the CRD to the SDV(0.33) and applies HCU accumulator water to the underpiston area of the CRD(0.33). This dp provides the initial motive force for the rod(0.33). As accumulator pressure drops below reactor pressure, a ball check valve in the CRD opens to apply reactor pressure to the CRD to complete the scram stroke(0.33). (2.0)

b. As accumulator pressure decreases during the scram, charging water flow to the accumulator increases(0.5). As flow to the charging header increases, the flow sensed by the flow control valve's detector increases causing the flow control valve to throttle to its minimum position(0.5). (1.0)

REFERENCE
CRD Hydraulics Lesson Plan
CRD Mechanism Lesson Plan DNG143

ANSWER 2.05 (3.00)

a. No effect(0.5). The EHC system has a permanent magnet generator on the turbine which would continue to provide power(0.5). (1.0)
b. Reactor feed pump controls lock up(0.5) due to loss of power to the Motor Gear Units(0.5). (1.0)
c. Vessel level increases(0.5) rapidly due to the steam flow/feed flow mismatch which occurred due to the recirc pumps running back on loss of feed flow circuitry(0.5) (1.0)

REFERENCE
F-AOP-21 Loss of UPS DNG144

ANSWER 2.06 (3.00)

a. The Turbine Steam Inlet Valve or 13-MOV-131 (0.5)
b. When level decreases to the initiation level of 126.5", the 131 valve will reopen. (1.0)
c. The turbine test circuitry would be automatically bypassed and the flow controller would control normally. (1.0)
d. No (0.5)

REFERENCE
F-OP-19 RCIC System DNG145

ANSWER 2.07 (2.50)

Holdup time for N16
a. Maintain optimum deaeration of the condensate
Maintain NPSH for the condensate pumps
Prevent covering the condenser tubes
(2 at 0.5 each) (1.0)
b. Level transmitters provide signals to control the operation of the level control valves; one to allow hotwell level makeup from the CST, and the other to regulate the discharge of condensate back to the CST. (1.5)

REFERENCE
General Electric Heat Thermodynamics, Heat Transfer, and Fluid Flow DNG145
Condensate System Description

ANSWER 2.08 (3.00)

a. half-scram
b. no action
c. half scram
d. rod block
e. ~~rod block~~ No action (alarm only)
f. scram
(0.5 each) (3.0)

REFERENCE
RPS Lesson Plan, RMCS Lesson Plan DNG147
Mod 82-18

ANSWER 2.09 (3.00)

a. EDG starting(0.39) and RBC low pressure(0.39). On a D/G start, the associated ESW pump starts(0.39) and supplies water to the started D/G(0.39).
On a RBC low pressure start, both ESW pumps start(0.39) and inject into the RBC system(0.39). (2.34)
b. ESW initiation is manually terminated(0.33) only after any initiation signal is cleared(0.33). (0.66)

REFERENCE
F-OP-21 Emergency Service Water System DNG148

ANSWER 3.01 (3.00)

a. RPV level would increase due to the extra HPCI injection flow(0.4). This flow is not sensed by the FWLCS so the RFP will not immediately decrease speed(0.4). As RPV level increases, a level error signal will develop which results in RFP speed decreasing(0.4). Level will stabilize at a point high enough where the level error signal compensates for the HPCI injection flow(0.4). Total feedwater flow will decrease by the amount of HPCI injection flow(0.4). (2.0)
b. As soon as level deviates from the setpoint, the FWLCS will decrease RFP speed to maintain level(0.33). Final level will remain the same(0.33). Total feedwater flow will decrease by the amount of HPCI injection flow(0.33). (1.0)

REFERENCE
Feedwater Level Control Lesson Plan
BWR-4 Transients DNG149

ANSWER 3.02 (3.00)

a. *Bypass RWM* alternate rod insertion and withdrawal limits(0.5) substitute rod positions(0.5) (1.0)
b. The full out-full in reed switches may be bypassed (0.5)
c. The RSCS is bypassed at 30% power(0.5) as sensed by first stage turbine pressure(0.25). The RWM is bypassed at 25% power(0.5) as sensed by steam flow(0.25). (1.5)
Accepted values between T.S. value (20%) and OP values (above)

REFERENCE
F-OP-64 Rod Worth Minimizer
F-OP-69 Rod Sequence Control System DNG150

ANSWER 3.03 (3.00)

a. Input: Any of the LPRM inputs
b. Count: The number of LPRM inputs which are operable
c. Reference: The reference APRM input
d. Block: The trip level reference
e. Flow: The flow input to the slope and bias circuit
f. Average: The RBM channel output
(0.5 each) (3.0)

REFERENCE
RBM Lesson Plan DNG151

ANSWER 3.04 (4.00)

a. Both recirculation pumps run back to 44%(0.5) as limited by the dual limiter on the output of the mastar controller(0.5). (1.0)
b. Both recirculation pumps remain at their original speed ~~unless level drops to < 182".~~ (1.0)
c. Recirculation pump A runs back to 30%(0.5) due to the discharge valve not full open bypass around the 30% limiter not met(0.25). Recirculation pump B speed unaffected(0.25). (1.0)
d. Recirculation pump speeds remain the same(0.5). The scoop tube on the B MG set locks up(0.5). (1.0)

REFERENCE
Reactor Recirculation System Lesson Plan
F-OP-27 Recirculation System DNG152

ANSWER 3.05 (3.00)

a. Recirculation loop flow(0.25)
LPRM(0.25) (0.5)
b. Process computer RBM
RMCS
(0.33 each) (1.0)
c. With the Mode Switch in Run, the flow biased thermal trip and the fixed 120% flux trip are in effect(1.0). With the Mode Switch in any other position, the fixed 15% flux trip is in effect(0.5). Flow biased trip always active (1.5)

REFERENCE
Neutron Monitoring Lesson Plan DNG153

ANSWER 3.06 (3.00)

a. Ion chamber(0.33). Initiates a reactor scram(0.25), MSIV closure(0.25), mechanical vacuum pump stops(0.25), and mechanical vacuum pump line valves shut(0.25)
b. Scintillation detector(0.33). No automatic actions(0.25).
c. G-M detector(0.33). Initiates SBGT(0.25), closes primary containment sample valves(0.25), isolation valves in the RB exhaust ventilation system shut(0.25). (3.0)

REFERENCE
F-OP-31 Process Radiation Monitors DNG154

ANSWER 3.07 (2.00)

The BPV's will start to open (0.25) causing throttle pressure to decrease (0.25). As pressure decreases, the CV will start to close (0.25) to try and maintain pressure. With the BPV's fully open, the control valves will stop ~75% open (0.25). Final steam flow 100% (0.25). CV position 75% open (0.25). BPV position 100% open or 25% total steam flow (0.25). (2.0)

REFERENCE
EHC Lesson Plan DNG155

ANSWER 3.08 (4.00)

a. Reactor level of 126.5"(0.5)
Drywell pressure of 2.7 psig(0.5) (1.0)
b. No(0.25). With the low pressure side of the dp cell always low, a larger dp would always be sensed, indicating higher than actual flow. The HPCI flow controller would see higher than actual flow and keep turbine rpm lower than that required to inject at full rated flow(1.75). (2.0)
c. The minimum flow valve shuts on a turbine trip (1.0)

REFERENCE
F-OP-15 High Pressure Coolant Injection System DNG156

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 4.01 (2.50)

a. HPCI and/or RCIC (both required for full credit) (1.0)
b. 900 psig (accept + or - 50 psig) (0.5)
c. Select a SRV that discharges to the torus as far from the first SRV discharge as possible(0.5) to minimize local heating of the torus water(0.5). (1.0)

REFERENCE
F-OP-1 Main Steam System pg 15 DNG121

ANSWER 4.02 (3.00)

a. 800-900 RPM(0.5)
1100-1200 RPM(0.5) (1.0)
b. 800 RPM(0.5)
5 minutes(0.5) (1.0)
c. Trip the turbine OR select "All Valves Closed"(0.5)
Place on turning gear(0.5) (1.0)

REFERENCE
F-OP-9 Main Turbine pg 7,8 DNG122

ANSWER 4.03 (2.50)

Raising reactor level assures adequate coolant mixing through natural circulation(1.0). Potential problems include temperature stratification, loss of valid temperature indication, boiling in the vessel, or vessel pressurization(Any 2 at 0.75 each). (2.5)

REFERENCE
F-OP-13 RHR System pg 13 DNG123

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 4.04 (1.00)

The vacuum pumps exhaust to the 1.75 minute holdup volume which:
1. is not designed for explosion pressure
2. does not contain particulate filters
3. provides inadequate holdup time for offgas decay
(2 required at 0.5 each) (1.0)
4. also unmonitored - no automatic isolation

REFERENCE
F-OP-24C Condenser Air removal pg 8 DNG124

ANSWER 4.05 (3.00)

A. 1. c
2. a
3. b
(0.5 each) (1.5)
B. Reactor cannot be kept subcritical(0.5) AND
Reactor water level cannot be maintained(0.5) OR
Suppression pool temperature > 110 deg F(0.5) (1.5)

REFERENCE
F-AOP-1 Reactor Scram pg 5,6 DNG125

ANSWER 4.06 (4.00)

Insert a manual scram(1.0) and trip the main turbine(1.0) prior to leaving the control room. If necessary, trip the turbine from the front standard(0.5), deenergize the RPS from the distribution panels in the relay room(0.5), open the RPS MG set supply or output breakers(0.5), and isolate and vent the scram air header(0.5). (4.0)

REFERENCE
F-EOP-28 Plant Shutdown from Outside the Control Room pg 2 DNG126

ANSWERS -- JAF -- 84/03/20 -- GRAVES, D.

ANSWER 4.07 (3.00)

a. Maintain core cooling
Limit off-site radiation release
Place the reactor in a safe, stable condition
Keep the torus bulk temperature below 120 deg F
(0.5 each) (2.0)

b. GEMAC(0.5). YARWAY's are more susceptible to reference leg flashing(0.5). (1.0)
Fuel Zone Yarway would have been acceptable. Its reference leg is outside containment.

REFERENCE
F-EOP-33 Small Break Accident pg 2,4 DNG127

ANSWER 4.08 (3.00)

a. Rad Waste(0.5)
Man Condenser(0.5) (1.0)

b. Prevent drawing vacuum in the reactor (1.0)

c. With no cooling for the RHX, the inlet temperature limit for the filter/demins could be exceeded. (1.0)

REFERENCE
F-OP-28 Reactor Water Cleanup System pg 20 DNG128

ANSWER 4.09 (3.00)

a. 200 mRem(0.25) per TLD period or ~ 15 days(0.25)
1000 mRem(0.25) per calendar quarter(0.25)
4000 mRem(0.25) per year(0.25)
500 mRem(0.25) for a gestation period(0.25) (2.0)

b. 3 Rem(0.25) per quarter(0.25), not to exceed 5 times N-18(0.25), with an NRC Form 4(0.25) (1.0)

REFERENCE
Radiation Protection Procedures Section 2.7 Radiation Guides and Limits DNG129

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

MASTER COPY

FACILITY: JAF

REACTOR TYPE: BWR

DATE ADMINISTERED: 84/03/20

EXAMINER: MORGAN, T.

APPLICANT: ____________

INSTRUCTIONS TO APPLICANT:

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	APPLICANT'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	100.00	________	________	TOTALS

FINAL GRADE ________________%

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

____
APPLICANT'S SIGNATURE

QUESTION 5.01 (1.50)

A. Explain how the thermal time constant affects the response of the reactor during normal AND transient operations. (1.0)

B. For the 8 X 8 fuel in your core, how long is the thermal time constant? (0.5)

QUESTION 5.02 (1.50)

A. For the following terms of the heat balance equation, indicate if the term is an energy INPUT or OUTPUT.

1. Q RWCU
2. Q Feedwater
3. Q Recirculation pump
4. Q Ambient-Radiative
5. Q CRD Cooling flow
6. Q Steam (0.9)

B. Explain why a heat balance is performed? (0.6)

QUESTION 5.03 (3.50)

Not all of the total coolant flowing through the core region passes the fuel rods in the fuel channel. A portion of the flow is core bypass flow.

A. Name FIVE paths of core bypass flow. (2.5)

B. Why is an adequate amount of bypass flow important? (1.0)

QUESTION 5.04 (3.00)

A. Briefly explain how the phenomenon called PELLET CLAD INTERACTION functions to increase the potential for fuel rod failure. (1.0)

B. Concerning PCIOMR, what is the purpose of the twelve (12) hour soak period at the final power level? (1.0)

C. Starting with the fuel at a threshold of 11.0 kw/ft, a maximum ramp increase is begun at time 0000 and the final desired power level of 13.0 kw/ft is achieved at 2000. The required soak is performed until 0300, at which time the load dispatcher directs a power reduction that takes nodal power down to 12.0 kw/ft. WHAT is the valid preconditioned value for this mode, and HOW (including time) would power be returned to 13.0 kw/ft? ASSUME an allowable nodal power increase rate of .10 kw/ft per hour. (1.0)

QUESTION 5.05 (4.00)

The plant has been at extended 100% power operation when the ~~governor control switch~~ Load Select fails to zero. On the attached sheet is the response of several plant parameters to this transient. For each of the numbered points on the transient sheet, briefly explain why the trace is behaving as it does.

NOTE: 1. The intervals on each trace are one minute intervals
2. The traces begin at time = 0 and the transient begins at time = 1 minute
3. Also attach is an EHC logic diagram, behind the transient sheet.

QUESTION 5.06 (2.50)

A. What is meant by the term BETA with regard to delayed neutrons? (1.0)

B. When comparing the individual BETA's from thermal fission of U-235, Pu-239 and fast fission of U-238, which BETA is largest? (0.5)

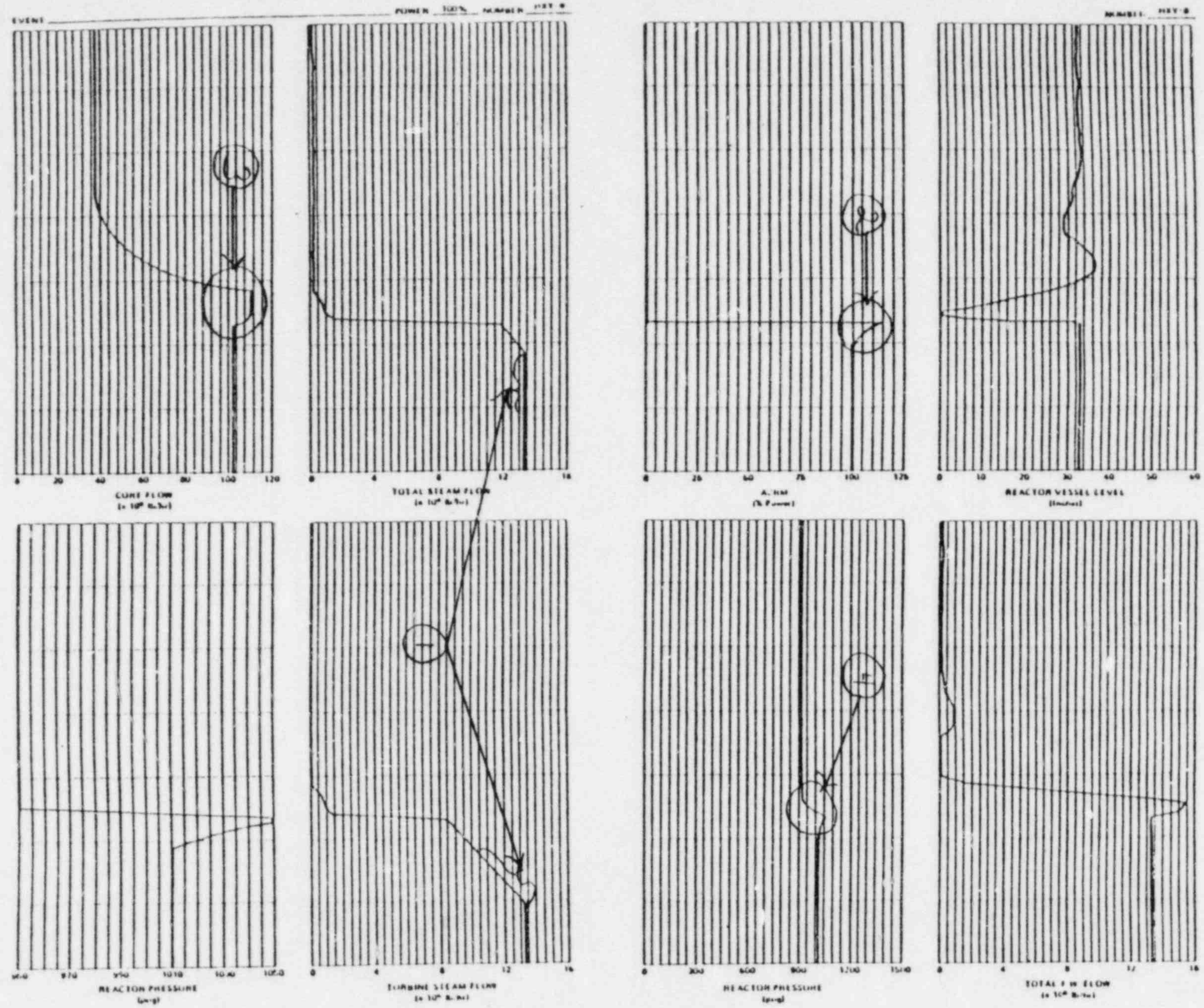
C. From BOL to EOL, does the core average beta INCREASE, DECREASE or REMAIN THE SAME? EXPLAIN your answer. (1.0)

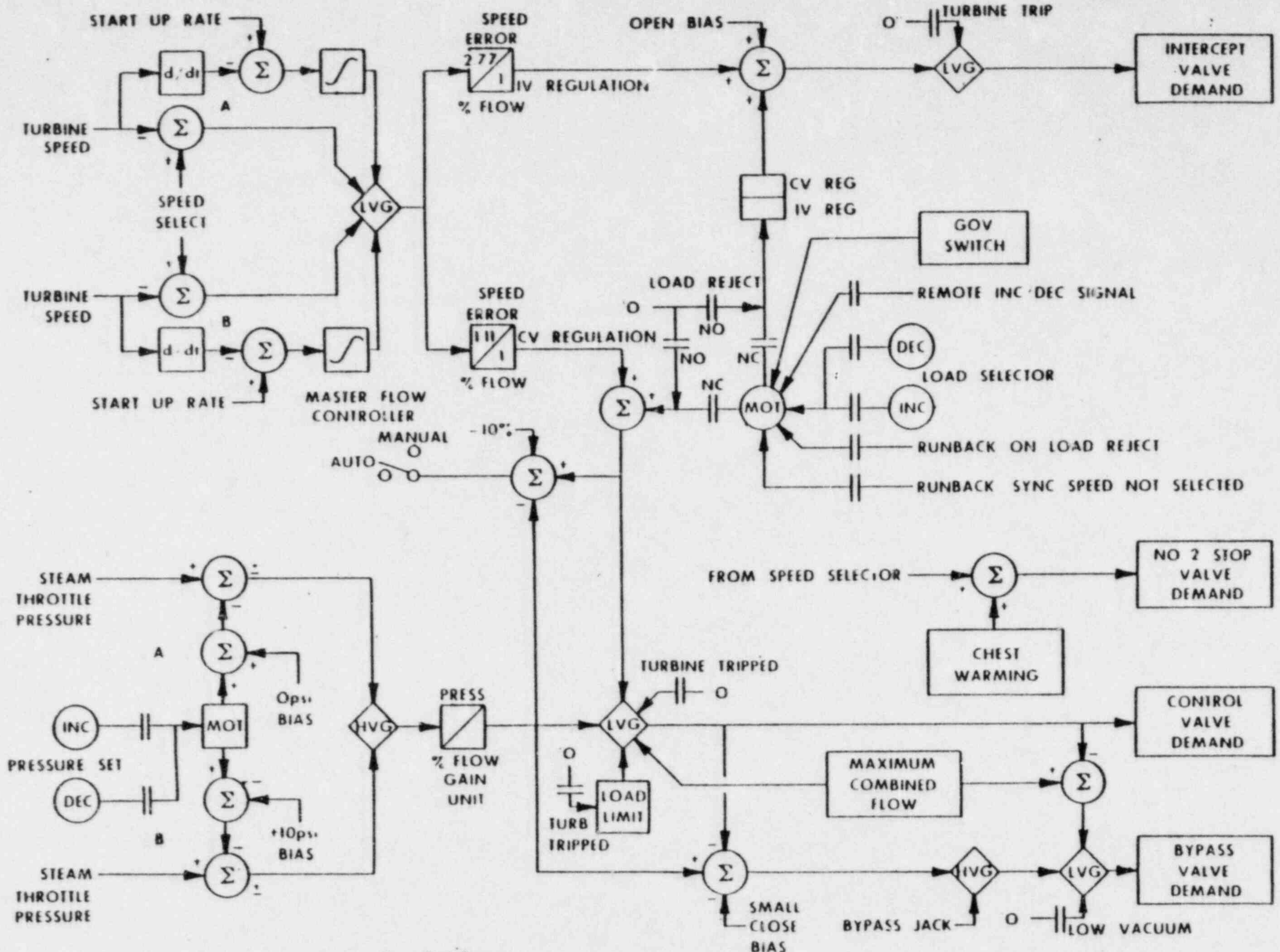
QUESTION 5.07 (2.00)

The nuclear reaction inside the control rod threatens the usable lifetime of the control rod in TWO ways. Identify AND briefly explain BOTH ways.

QUESTION 5.08 (2.00)

UO-2 is a poor conductor of heat. Is this a good or bad characteristic during a NUCLEAR excursion of a power reactor? EXPLAIN your choice.


EVENT
POWER 100%
NUMBER
CORE FLOW
TOTAL STEAM FLOW
REACTOR VESSEL LEVEL
REACTOR PRESSURE
TURBINE STEAM FLOW
REACTOR PRESSURE



SDLP - 94C
Figure 6.

QUESTION 5.09 (3.00)

A. What basic control room data would need to be given to an on-line computer in order for it to keep track of the core Xenon concentration? (0.5)

B. Describe how a RADIAL XENON OSCILLATION can occur. (1.5)

C. The equilibrium Xenon concentration at 100% power will be double the concentration at 50% power.(TRUE or FALSE) Explain your answer. (1.0)

QUESTION 5.10 (2.00)

Assume your reactor has a power coefficient of -2.8 X 10 E-5 dK/K per Mwt and a fuel depletion rate of -6 X 10 E-4 dK/K per day. How long would COASTDOWN last from the end of fuel cycle if 70% was the minimum acceptable power generation?
NOTE: Show all work used in your calculation.

QUESTION 6.01 (3.00)

A. Why are Standby Liquid Control System lines heat traced? (0.5)
B. Other than the control room annunciator, list TWO other indications that would indicate a loss of continuity to the SBLC squib valves. (1.0)
C. How does the system respond if started from the:
   1. Control Room?
   2. Local Panel?
   NOTE: Include components actuated (1.5)

QUESTION 6.02 (3.00)

A. When a scram signal occurs at power, describe IN DETAIL how the Control Rod Drive and its associated Hydraulic Control Unit function to insert the control rod. Include which components open, close, energize, deenergize, and motive force for the entire rod travel as a MINIMUM in your answer. (2.0)
B. Explain HOW the Flow Control Valve in the CRD Hydraulic System responds during a scram and WHY. (1.0)

QUESTION 6.03 (3.00)

An automatic RCIC initiation has occurred. Subsequently, RCIC injection was automatically terminated due to high reactor water level.

A. What component in the RCIC system functioned to automatically terminate the injection? (0.5)

B. Assuming no operator action, how will RCIC respond to a subsequent decreasing water level? (1.0)

C. If a RCIC "Turbine Test" had been in progress when the initial automatic initiation signal had been received, how would the system have responded? (1.0)

D. If, following the initiation, the RCIC turbine had tripped on overspeed, could it be reset from the Control Room? (0.5)

QUESTION 6.04 (3.00)

For EACH of the following conditions, state whether a scram, half-scram, rod block, or no action is generated. For conditions that produce more than one action, state the more limiting action (i.e. half-scram is more limiting than a rod block).

a. Loss of one RPS MG set
b. Turbine trip at 20% power
c. Two main steam lines isolated, Mode switch in RUN
d. APRM B downscale, Mode switch in RUN
e. Scram discharge volume level is at 19 gallons
f. Load reject at 50% power (3.0)

QUESTION 6.05 (3.00)

The plant is operating at 85% power with the Feedwater Level Control System in THREE ELEMENT control. An inadvertent HPCI injection occurs. Assume NO Reactor Scram occurs.

A. Describe the response of the Feedwater Level Control System to the HPCI injection. Discuss changes in reactor water level and feed pump speed and flow, JUSTIFYING EACH. Continue your discussion to a stable condition with HPCI injecting at rated flow. (2.0)

B. Briefly explain how the response and final conditions would be different had the Feedwater Level Control System been in SINGLE ELEMENT control instead of THREE ELEMENT. (1.0)

QUESTION 6.06 (3.00)

A. With regard to the Rod Worth Minimizer (RWM), what two features are available to clear or bypass rod blocks that occur as a result of a position sensor failures? (1.0)

B. How does the Rod Sequence Control System allow for the clearing or bypassing of a failed position indicators? (0.5)

C. When are the RWM and RSCS systems automatically bypassed, and in each case, what parameter is used to initiate the bypass action (include setpoints)? (1.5)

QUESTION 6.07 (3.00)

What parameters will be indicated on the Rod Block Monitor meter with the meter switch in each of the following positions:

a. Input
b. Count
c. Reference
d. Block
e. Flow
f. Average

QUESTION 6.08 (4.00)

The reactor is operating at 100% power with recirculation flow control in master manual. What will be the effect on BOTH recirculation pumps A and B speed due to each of the following conditions or events and EXPLAIN what the failure does to the recirculation flow control system.

a. Master Controller output fails LOW (1.0)
b. One feed flow detector (of two) fails to 0 lbm/hr (1.0)
c. Full open indication on recirculation pump A discharge valve is lost at the valve. (Assume bypass valves are open.) (1.0)
d. Signal to recirculaton MG set B scoop tube fails to 0 (1.0)

QUESTION 7.01 (3.50)

When a fire has been reported to the Control Room:

A. WHAT actions are required by the NCO when the person finding the fire reports to the Main Control Room? (2.5)

B. WHAT actions are required of the Shift Supervisor/Emergency Director? (1.0)

QUESTION 7.02 (2.00)

While controlling reactor pressure following a reactor isolation (MSIV closure), HOW is the next safety-relief valve that will be used determined and why is this procedure used?

QUESTION 7.03 (2.50)

When operating the RHR System in the Shutdown Cooling Mode and a loss of flow occurs, EXPLAIN WHY reactor level should be raised to 234.5". Include TWO potential problems that could occur if the level was not increased.

QUESTION 7.04 (3.00)

A reactor scram has occurred. Four adjacent control rods have failed to insert past position 06.

A. Match the following sets of indications with the appropriate potential problem type. (1.5)

1. 3 RPS white lights are ON
2. All RPS white lights are OFF, 4 blue lights, on the full core display, are NOT ON
3. All RPS white lights are OFF, all blue lights, on the full core display are ON

a. Air problem
b. Hydraulic problem
c. Electrical problem

B. With a number of control rods immovable, such as above, what further criteria needs to be met, per F-AOP-1 Reactor Scram, to warrant initiating Standby Liquid Control? (1.5)

QUESTION 7.05 (4.00)

F-EOP-28, Plant Shutdown From Outside the Control Room, lists two specific actions that should be performed prior to leaving the control room. These are actions that change the status or position of a component or system. WHAT are these two (2) actions performed in the Control Room AND how may they also be performed from outside the Control Room if necessary?

QUESTION 7.06 (3.00)

A. What are the FOUR BASIC OBJECTIVES the operator is to achieve in the event of a pipe break with respect to the core and containment (F-EOP-33)? (2.0)

B. Which type of level instrument (GEMAC or YARWAY) should the operator use for level indication during rapid vessel depressurization, particularly below 500 psig? What makes the OTHER type UNDESIRABLE? (1.0)

QUESTION 7.07 (3.00)

While performing a normal shutdown, per procedure F-OP-65;

A. Why does the procedure have you remove the 'C' condensate and 'C' booster pump from service first vis the 'A' or the 'B' pumps? (1.0)

B. There is a caution note stating to continue to insert control rods to hold power down. WHY is power increasing? (0.5)

C. When inserting IRM's at what power level are they inserted AND what is done to insert them? (1.5)

QUESTION 7.08 (2.00)

A feedwater flow control system failure occurs which results in maximum feedwater flow. The plant is operating at 75% and all systems are in their normal at power lineups.
WHAT are the required immediate operator actions in accordance with procedure F-SP-11?

QUESTION 7.09 (2.00)

How would the following parameters change on a failed jet pump?

a. Reactor Power and Generator Output
b. Indicated total core flow
c. Core plate differential pressure
d. Loop flow on affected side

QUESTION 8.01 (2.50)

According to the Technical Specifications definitions, WHAT does Primary Containment Integrity mean?

QUESTION 8.02 (3.00)

What are four (4) of the five (5) conditions that constitues an inoperable Control Rod, according to the JAFNPP Technical Specifications?

QUESTION 8.03 (3.00)

What are the six (6) conditions which require a Radiation Work Permit (RWP) to be issued?

QUESTION 8.04 (2.50)

What is the purpose of administering Potassium Iodine (KI) to individuals during a release of radioactivity to the environment?

QUESTION 8.05 (2.00)

If the High Pressure Coolant Injection (HPCI) system is found to be inoperable, what are the requirements for continued reactor operation?

QUESTION 8.06 (3.00)

What is required to make a temporary change, which does not change the intent of the procedure, to a procedure which is required to be reviewed by the Plant Operations Review Committee (PORC) AND how is a PORC review requirement identified?

QUESTION 8.07 (2.00)

According to the JAFNPP Technical Specification the minimum downcomer submergence is 51.5" which results in a minimum suppression chamber water volume of 105,600 ft3. WHAT is the bases for this minimum submergence?

QUESTION 8.08 (3.00)

A. What are the whole body radiation exposure GUIDES at James A. FitzPatrick Nuclear Power Plant? (2.0)
B. What are the whole body radiation exposure LIMITS for radiation workers per 10 CFR 20? (1.0)

QUESTION 8.09 (2.00)

What would be the reporting requirements for the following conditions:

A. The plant is in a condition not covered by operating and emergency procedures. (0.5)
B. The loss of the offsite notification system. (0.5)
C. A valid automatic initiation of the Reactor Protection System (RPS). (0.5)
D. A shutdown was commenced because the plant was in violation of the Technical Specifications. (0.5)

QUESTION 8.10 (2.00)

With regard to a surveillance item that is scheduled every 30 days and is due on the 15th of the month;

A. Today is the 20th of the month and the surveillance has not been performed. Is this a Tech Spec violation? [YES or NO] Explain why or why not. (1.0)
B. When would the next months surveillance be due AND if that surveillance date could be exceeded? EXPLAIN. (1.0)

EQUATION SHEET

$f = ma$

$v = s/t$

Cycle efficiency = (Net work out)/(Energy in)

$w = mg$

$s = V_o t + 1/2\ at^2$

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N$

$A = A_o e^{-\lambda t}$

$PE = mgh$

$V_f = V_o + at$

$w = \theta/t$

$\lambda = \ln 2/t_{1/2} = 0.693/t_{1/2}$

$t_{1/2}eff = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$W = v\ \Delta P$

$A = \frac{\pi D^2}{4}$

$\Delta E = 931\ \Delta m$

$\dot{m} = V_{av} A \rho$

$I = I_o e^{-\Sigma x}$

$\dot{Q} = \dot{m} Cp \Delta t$

$\dot{Q} = UA \Delta T$

$Pwr = W_f \Delta h$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$P = P_o 10^{sur(t)}$

$P = P_o e^{t/T}$

$SUR = 26.06/T$

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

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - k_{eff2})$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

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

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1\ \text{seconds}^{-1}$

$\rho = [(\ell^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$I_1 d_1 = I_2 d_2$

$I_1 d_1{}^2 = I_2 d_2{}^2$

$P = (\Sigma\phi V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$R/hr = (0.5\ CE)/d^2 (\text{meters})$

$R/hr = 6\ CE/d^2\ (\text{feet})$

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- JAF -- 84/03/20 -- MORGAN, T.

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ANSWER 5.01 (1.50)

A. This results in a time lag between power change and heat dissipation and lag time for moderator temperature and void coefficients to effect power but this causes doppler to have more of an effect. (1.0)
B. 5-6 seconds (0.5)

REFERENCE
Generl Electric Heat Transfer and Fluid Flow pg 9-102

ANSWER 5.02 (1.50)

A. 1. Out 4. Out
2. In 5. In
3. In 6. Out (6@ 0.15 ea) (0.9)
B. Heat balances are performed to insure the accuracy of the nuclear instrumentation. (0.6)

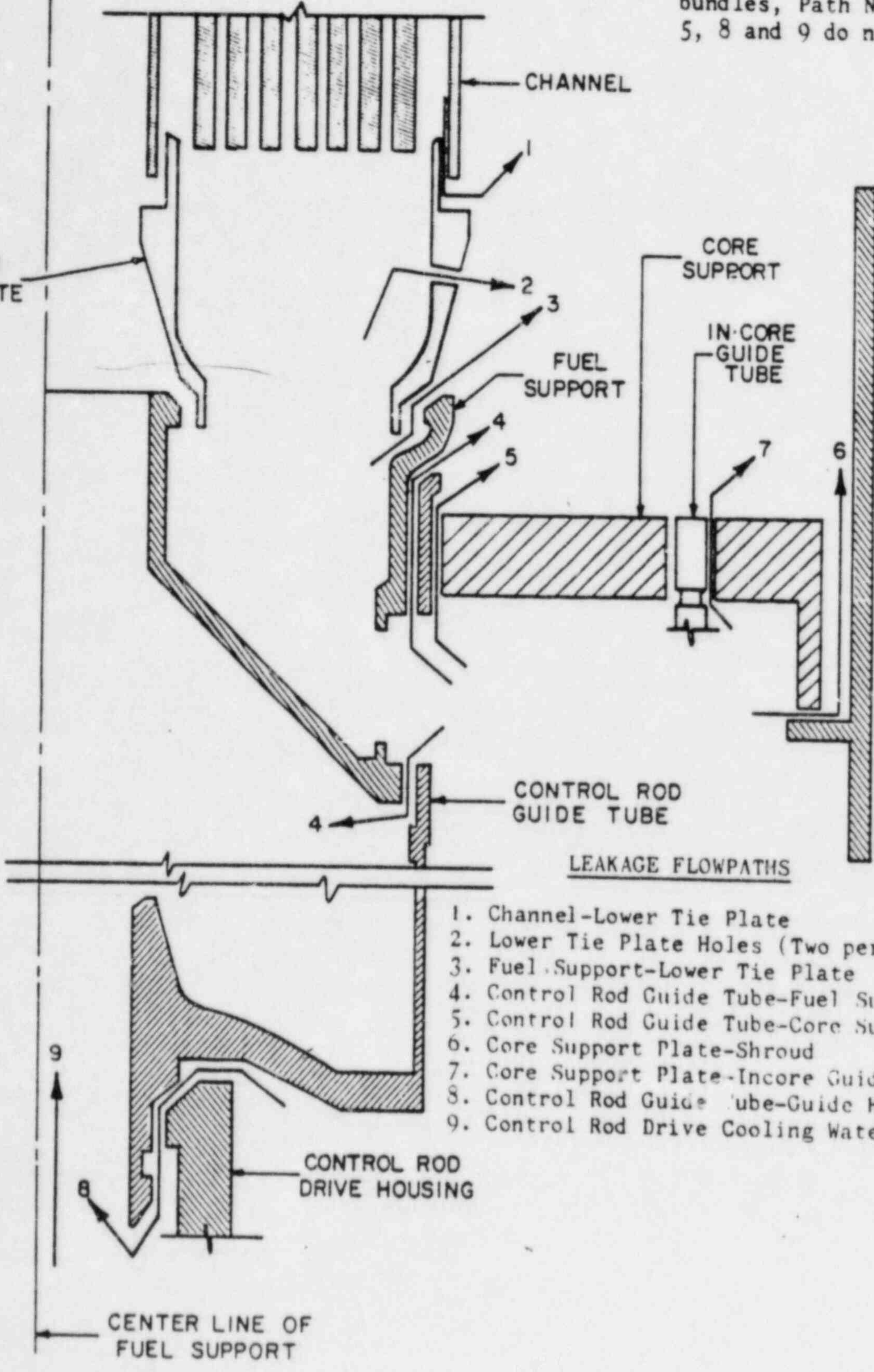
REFERENCE
General Electric Heat Transfer and Fluid Flow pg 8-91

ANSWER 5.03 (3.50)

A. See attached Figure 9-26
(5 at 0.5 each) (2.5)
B. Bypass flow is important to prevent excessive voiding[0.33] due to convective heat input and direct gamma and neutron heating in the bypass region[0.33] and cool the nuclear instrumentation detectors [0.33] (1.0)

REFERENCE
General Electric Heat Transfer and Fluid Flow pg 9-56, Figure 9-26

NOTE: Peripheral fuel supports are welded into the Core Support Plate. For these bundles, Path Numbers 4, 5, 8 and 9 do not exist.



LEAKAGE FLOWPATHS

1. Channel-Lower Tie Plate
2. Lower Tie Plate Holes (Two per Assembly)
3. Fuel Support-Lower Tie Plate
4. Control Rod Guide Tube-Fuel Support
5. Control Rod Guide Tube-Core Support Plate
6. Core Support Plate-Shroud
7. Core Support Plate-Incore Guide Tube
8. Control Rod Guide Tube-Guide Housing
9. Control Rod Drive Cooling Water

Figure 9-26 Core Bypass Flowpaths

ANSWERS -- JAF -- 84/03/20 -- MORGAN, T.

ANSWER 5.04 (3.00)

A. Rapid power increases cause the fuel pellet to expand faster than the fuel rod (clad) (0.5) thereby causing contact with the fuel and exerting a highly localized stress on the clad (0.5). (1.0)

B. The soak period allows the fuel rod (clad) time to expand elastically to accomadate the stress exerted on it by the pellet. (1.0)

C. Final time 12 hrs prior to reduction : 0300 - 12 hrs = 1500. Final nodal power at 1500: 11.0 kw/ft + (15 hrs x .10 kw/ft) = 12.5 kw/ft. Power was >/= 12.5 kw/ft for 12 hours so this becomes the valid preconditioned value for this mode (0.5). Power can be returned to 13.0 kw/ft at .10 kw/ft/hr which would take 5 hours (0.5). (1.0)
(Guide lines to be followed in accordance with analyst direction)

REFERENCE
PCIOMR Section, General Electric Heat Transfer and Fluid Flow pg 9-107 through 9-110

ANSWER 5.05 (4.00)

1. Total steam flow remains constant although turbine steam flow is decreasing because the bypass valves open. (1.0)
2. APRM reading increases as pressure increases and then sharply drops as the reactor scrams on high pressure. (1.0)
3. Core flow increases after the scram due to the change in two-phase flow resistance and then decreses as the recirculation pumps run back to minimum flow when feedwater flow < 20%. (1.0)
4. Pressure increases to the scram setpoint, and then decreases after the scram to ~ 920 psig where the bypass valves control pressure after the control valves fully close. (1.0)

REFERENCE
General Electric Transient Analysis

ANSWER 5.06 (2.50)

A. The delayed neutron fraction is the percentage of fission neutrons that are born delayed. (1.0)
B. U-238 (0.5)
C. Decrease (0.25) As Pu-239 production increases (0.25), and U-235 decreases (0.25) the core average will decrease due to Pu-239's Beta being so much smaller (0.25). (1.0)

REFERENCE
NUS Reactor Theory section 11.3

ANSWER 5.07 (2.00)

1. Boron depletion(0.5). Boron absorbs a neutron and is lost for neutron absorbing purposes(0.5). (1.0)
2. Pressurization of the control rod(0.5). Helium production from the neutron absorption(0.5) will eventually pressurize the control rod and could lead to swelling of the control rod. (1.0)

REFERENCE
NUS Theory 15.3-3

ANSWER 5.08 (2.00)

The fact that UO-2 is a poor conductor of heat is a good characteristic [0.5] during the excursion since the high buildup of heat in the fuel [0.5] causes a larger insertion of negative reactivity [0.5] which tends to limit the magnitude of the excursion. [0.5] (2.0)
or is a bad characteristic if looked at from a heat dissipation view point.

REFERENCE
NUS Reactor Operation 8.2-5

ANSWER 5.09 (3.00)

A. Power level and time at that level OR simply power history. (0.5)
B. A radial xenon oscillation could occur by increasing power in the center of the core. As the xenon burns out, positive reactivity would be added to the center of the core, causing power to increase more in the center of the core. [0.75] If total power is held constant, the fringe power decreases, reducing the xenon burnout in that area. As xenon concentration begins to increase in the center of the core, the flux would be shifted to the outer regions of the core causing more xenon burnout in the outer regions. This may continue for several days.[0.75] (1.5)
C. False [0.25] The Xenon production rate is directly proportional to power level, but removal rate is proportional to Xenon concentration and it contains a power dependant term, thermal neutron flux. Since flux is directly proportional to power level the burnout becomes less significant. This results in an equilibrium Xenon value which is higher than the original equilibrium value but less than twice that of the original concentration.[0.75] (1.0)

REFERENCE
NUS Reactor Operation 10.4-6

ANSWER 5.10 (2.00)

Loss = depletion coefficient/power coefficient
= -6 X 10 E-4 dK/K per day/-2.8 X 10 E-5 dK/K per MWt
= 21.4 MWt/day

End of Operating Cycle = 2436 MWt X .3 = 731 MWt

Time = power lost/loss rate = 731 MWt/21.4 MWt per day = 34.1 days (2.0)

REFERENCE
NUS Reactor Operation 14.1-5,6

ANSWER 6.01 (3.00)

A. To ensure the boron stays in solution (0.5)
B. Ready lights indicating continuity go OUT(0.5)
Two milliammeters in the back of the 9-3 panel(0.5) (1.0)
C. 1. The selected pump will start(0.5) and both injection valves fire(0.5).
2. The selected pump starts(0.5). The squib valves do not fire. (1.5)

REFERENCE
F-OP-17 Standby Liquid Control System

ANSWER 6.02 (3.00)

A. A scram signal deenergizes the scram pilot valves(0.33), venting air from the scram inlet and outlet valves, allowing them to open(0.33). This vents water from the overpiston area of the CRD to the SDV(0.33) and applies HCU accumulator water to the underpiston area of the CRD(0.33). This dp provides the initial motive force for the rod(0.33). As accumulator pressure drops below reactor pressure, a ball check valve in the CRD opens to apply reactor pressure to the CRD to complete the scram stroke(0.33). (2.0)
B. As accumulator pressure decreases during the scram, charging water flow to the accumulator increases(0.5). As flow to the charging header increases, the flow sensed by the flow control valve's detector increases causing the flow control valve to throttle to its minimum position(0.5). (1.0)

REFERENCE
CRD Hydraulics Lesson Plan
CRD Mechanism Lesson Plan

ANSWER 6.03 (3.00)

A. The Turbine Steam Inlet Valve or 13-MOV-131 (0.5)
B. When level decreases to the initiation level of 126.5", the 131 valve will reopen. (1.0)
C. The turbine test circuitry would be automatically bypassed and the flow controller would control normally. (1.0)
D. The mechanical overspeed must be reset locally. (NO) (0.5)

REFERENCE
F-OP-19 RCIC System

ANSWERS -- JAF -- 84/03/20 -- MORGAN, T.

ANSWER 6.04 (3.00)

a. half-scram
b. no action
c. half scram
d. rod block
e. ~~rod block~~ no action see RD comments
f. scram (6 @ 0.5 ea) (3.0)

REFERENCE
RPS Lesson Plan, RMCS Lesson Plan

ANSWER 6.05 (3.00)

A. RPV level would increase due to the extra HPCI injection flow(0.4). This flow is not sensed by the FWLCS so the RFP will not immediately decrease speed(0.4). As RPV level increases, a level error signal will develop which results in RFP speed decreasing(0.4). Level will stabilize at a point high enough where the level error signal compensates for the HPCI injection flow(0.4). Total feedwater flow will decrease by the amount of HPCI injection flow(0.4). (2.0)
B. As soon as level deviates from the setpoint, the FWLCS will decrease RFP speed to maintain level(0.33). Final level will remain the same(0.33). Total feedwater flow will decrease by the amount of HPCI injection flow(0.33). (1.0)

REFERENCE
Feedwater Level Control Lesson Plan
BWR-4 Transients

ANSWER 6.06 (3.00)

A. alternate rod insertion and withdrawal limits(0.5) or Bypass RWM
substitute rod positions(0.5) (1.0)
B. The full out-full in reed switches may be bypassed (0.5)
C. The RSCS is bypassed at 30% power(0.5) as sensed by first stage turbine pressure(0.25). The RWM is bypassed at 25% power(0.5) as sensed by steam flow(0.25). (1.5)
~~(old facilities 20%)~~ (IAW T.S. bypassed when > 20% power)

REFERENCE
F-OP-64 Rod Worth Minimizer
F-OP-69 Rod Sequence Control System
T.S. 3.3B 3a & 3.b

ANSWER 6.07 (3.00)

a. Input: Any of the LPRM inputs
b. Count: The number of LPRM inputs which are operable
c. Reference: The reference APRM input
d. Block: The trip level reference
e. Flow: The flow input to the slope and bias circuit
f. Average: The RBM channel output (6 @ 0.5 ea) (3.0)

REFERENCE
RBM Lesson Plan

ANSWER 6.08 (4.00)

a. Both recirculation pumps run back to 44%(0.5) as limited by the dual limiter on the output of the master controller(0.5). (1.0)
b. Both recirculation pumps remain at their original speed unless level drops to < 182". (24±2% speed limiter) (1.0)
c. Recirculation pump A runs back to ~~30%~~(0.5) due to the discharge valve not full open bypass around the 30% limiter not met(0.25). Recirculation pump B speed unaffected(0.25). (1.0)
d. Recirculation pump speeds remain the same(0.5). The scoop tube on the B MG set locks up(0.5). (1.0)

REFERENCE
Reactor Recirculation System Lesson Plan
F-OP-27 Recirculation System

ANSWER 7.01 (3.50)

A. 1. Ask the person reporting the fire and determine the following:
   a. Location of the fire
   b. Extent of the fire
   c. Type of fire (1.0)
2. Sound the fire alarm twice for about 10 sec each and then make the following announcement twice over the P.A.: "Attention, Attention; There is a fire (location). The fire brigade shall report to (location) immediately. All other personnel remain clear of that area." (1.0)
3. Provide information to the Fire Brigade Leader and S.S. (0.5)

B. 1. Notify the Plant Fire Protection Supervisor of the conditions. (0.5)
2. Initiate search and rescue operations if necesary. (0.5)

Eplan IAP 2/EAP-1 for response

REFERENCE
JAFNPP EAP-3 pg 2 & 3

ANSWER 7.02 (2.00)

By using the chart provided in the procedure to determine the widest seperation of discharge points in the torus. (1.0)
This minimizes the number of cycles on each safety-relief and minimizes the local heating of pressure suppression pool water. (1.0)

REFERENCE
JAFNPP F-OP-1 sec 5 pg 15 & 16

ANSWER 7.03 (2.50)

Raising reactor level assures adequate coolant mixing through natural circulation(1.0). Potential problems include temperature stratification, loss of valid temperature indication, boiling in the vessel, or vessel pressurization(Any 2 at 0.75 each). (2.5)

REFERENCE
F-OP-13 RHR System pg 13

ANSWERS -- JAF -- 84/03/20 -- MORGAN, T.

ANSWER 7.04 (3.00)

A. 1. c
2. a
3. b (3 @ 0.5 ea) (1.5)

B. Reactor cannot be kept subcritical(0.5) AND
Reactor water level cannot be maintained(0.5) OR
Suppression pool temperature $\geq$ 110 deg F(0.5) (1.5)

REFERENCE
F-AOP-1 Reactor Scram pg 5,6

ANSWER 7.05 (4.00)

Insert a manual scram(1.0) and trip the main turbine(1.0) prior to leaving the control room. If necessary, trip the turbine from the front standard(0.5), deenergize the RPS from the distribution panels in the relay room(0.5), open the RPS MG set supply or output breakers(0.5), and isolate and vent the scram air header(0.5). (4.0)

REFERENCE
F-EOP-28 Plant Shutdown from Outside the Control Room pg 2

ANSWER 7.06 (3.00)

A. 1. Maintain core cooling
2. Limit off-site radiation release
3. Place the reactor in a safe, stable condition
4. Keep the torus bulk temperature below 120 F (4 @ 0.5 ea) (2.0)

B. GEMAC(0.5). YARWAY's are more susceptible to reference leg flashing(0.5). (fuel zone yarway) (because reference leg is almost entirely outside of drywell)(cooler) (1.0)

REFERENCE
F-EOP-33 Small Break Accident pg 2,4

ANSWERS -- JAF -- 84/03/20 -- MORGAN, T.

ANSWER 7.07 (3.00)

A. The 'C' pumps are powered from the 10700 bus which is lost when the station generator is taken off the line. (1.0)
B. Feedwater heating is decreasing. (0.5)
C. At ~10% power [0.5]
1. Check at least 3 IRM channels per scram channel are operative.
2. Position all range switches to the least sensitive.
3. Insert all IRM's
4. Adjust switch so IRM's read on scale and perform F-ST-5C. [4 @ 0.25 ea] (1.5)

REFERENCE
JAFNPP F-OP-65 Normal Startup and Shutdown Procedure

ANSWER 7.08 (2.00)

1. Place feedwater controller in manual and attempt to reduce feed flow, and maintain normal level.
2. If level reaches 222.6", verify main and feed pump turbines trip. Trip them mainually if not done automatically.
3. If turbine trip occurs, verify turbine bypass valves open.
4. If turbine trip occurs, follow F-OP-2 (Turbine and/or Generator Trip) also follow F-AOP-1 (Reactor Scram). (4 @ 0.5 ea) (2.0)

REFERENCE
JAFNPP F-SP-11 pg 2

ANSWER 7.09 (2.00)

a. decrease
b. increase
c. decrease
d. increase [4 @ 0.5 ea] (2.0)

REFERENCE
JAFNPP F-AOP-29 pg 2

ANSWER 8.01 (2.50)

Primary Containment Integrity means that the drywell and pressure suppression chamber are intact and all of the following conditions are satisfied: (0.5)

1. All manual containment isolation valves on lines connected to the Reactor Coolant System or containment which are not required to be open during plant accident conditions are closed. (0.5)
2. At least one door in each airlock is closed and sealed. (0.5)
3. All automatic containment isolation valves are operable or de-activated in the isolated position. (0.5)
4. All blind flanges and manways are closed. (0.5)

REFERENCE
JAFNPP Tech Spec Sec 1.0.M pg 4 & 5

ANSWER 8.02 (3.00)

1. A control rod which cannot be moved with control rod drive pressure.
2. A control rod has a cracked collet housing.
3. A control rod with scram times greater than those permitted by Tech Specs.
4. A control rod with inoperable accumulator.
5. A control rod whose position cannot be positively determined.

[4 @ 0.75 ea] (3.0)

REFERENCE
JAFNPP Tech Spec 3.3.A.2.a,c and e. pg 89 & 90

ANSWER 8.03 (3.00)

1. [C] Contamination levels greater than 10,000 dpm/100 cm2 (or 10,000 cpm/ft2) ~~as measured by an atomic whip.~~ (0.5)
2. [A] Airborne radioactivity requiring the use of respiratory protection equipment. (0.5)
3. [N] Neutron radiation exposure >5 mrem/hr. (0.5)
4. [H] High Radiation Area entries. (0.5)
5. [U] Unknown conditions in an area to be entered. (0.5)
6. [M] Maintance of equipment, controls or instrumentation in areas where the radiation level is >5 mrem/hr. (0.5)

REFERENCE
JAFNPP Rad Protection Procedure 2.2.3 pg 12

ANSWER 8.04 (2.50)

The purpose of using Potassium Iodine is to saturate the Thyroid gland with stable inodine [1.25] so radioactive iodine will be "blocked" or prevented from collecting in the thyroid gland. [1.25] (2.5)

REFERENCE
JAFNPP EAP-19 pg 1

ANSWER 8.05 (2.00)

To insure all active components of the following are operable
1. ADS
2. CSS
3. LPCIS
4. RCICS (4 @ 0.5 ea) (2.0)

REFERENCE
JAFNPP Tech Spec 3.5.C.1.a pg 118

ANSWER 8.06 (3.00)

The temporary change can be made provided it is approved by two (2) members of the plant staff, at least one (1) of whom shall hold a SRO licenses. (1.5) Within one (1) working day, the temporary change shall be reviewed by the oppropiate department superintent if he was not one of the originators. (1.0)
The procedures whose title is followed by an asterisk (*). (0.5)

REFERENCE
JAFNPP Admin Procedure 1.4 pg 3 & 5

ANSWER 8.07 (2.00)

The majority of the Bodega tests (9) were run with a submerged length of 4 ft and with complete condensation. Thus with respect to downcomer submergence, this specification is adequate.

REFERENCE
JAFNPP Tech Spec 3.7 Bases pg 188

ANSWER   8.08   (3.00)

A. 200 mRem[0.25] per TLD period or ~ 15 days[0.25]
1000 mRem[0.25] per calendar quarter[0.25]
4000 mRem[0.25] per year[0.25]
500 mRem[0.25] for a gestation period[0.25] (2.0)

B. 3 Rem[0.25] per quarter[0.25], not to exceed 5 times N-18[0.25] and with an NRC form 4 [0.25] (1.0)

REFERENCE
Radiation Protection Procedures Section 2.7 Radiation Guides and Limits

ANSWER   8.09   (2.00)

A. 1 hour
B. 1 hour
C. 4 hours
D. 1 hour

REFERENCE
10 CFR 50.72

ANSWER   8.10   (2.00)

A. NO because of the +/- 25% allowance or 7.5 days (1.0)
B. The 15th of the month with a maximum of 7.5 days (1.0)

REFERENCE
JAFNPP Tech Spec 1.0.T pg 5 & 6