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

EXAMINATION REPORT NO. 50-244/85-23 (OL)

FACILITY DOCKET NO. 50-244

FACILITY LICENSE NO. DPR-18

LICENSEE: Rochester Gas and Electric Corporation
89 East Avenue
Rochester, New York 14649

FACILITY: R. E. Ginna

EXAMINATION DATES: November 12 - 15, 1985

CHIEF EXAMINER: D. H. Coe 1/7/86
D. H. Coe, Reactor Engineer (Examiner) Date

REVIEWED BY: RM Keller 1/7/86
Robert M. Keller, Chief, Projects Section 1C Date

APPROVED BY: HB Kister 1/8/86
Harry B. Kister, Chief, Date
Projects Branch No. 1

SUMMARY: Written and oral examinations were administered to the following candidates: Four Reactor Operators, three Senior Reactor Operators (Upgrade), and two Senior Reactor Operators (Instant). All candidates passed both the written and oral portions of the examination.

REPORT DETAILS

TYPE OF EXAMS: Replacement

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	4/0	5/0
Oral Exam	4/0	5/0
Overall	4/0	5/0

1. CHIEF EXAMINER AT SITE: D. H. Coe

2. OTHER EXAMINER: R. M. Keller, NRC

1. Summary of generic deficiencies noted on oral exams:

   Reactor Operators had difficulty locating the procedure for natural circulation.

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

   None

3. Interface with plant staff during exam period:

   The plant training staff was helpful in providing the necessary administrative support during the conduct of the examination.

4. Personnel present at Exit Interview:

   NRC Per onnel

   D. Coe, Chief Examiner
   W. Cook, Resident Inspector
   T. Kim, Resident Trainee

   Facility Personnel

   T. Schuler, Operations Manger
   R. Morrill, Training Manager
   L. Smith, Operations Supervisor
   B. Carroll, Assistant Training Coordinator
   J. Wayland, Assistant Training Coordinator

5. Summary of NRC Comments made at exit interview:

   The candidates' overall performance in the oral exam ranged from very good to marginal. No specific preliminary results were presented.

   The quality of the reference material provided to NRC examiners in Region I was poor. A combined total of seven written exam questions required change or, in one case, deletion because reference material was not correct, or current. This material should be up-graded prior to the next NRC exam.

6. At the conclusion of the written examinations, the facility was provided a copy of the examination and the answer key. The licensee reviewed the questions and answers to identify any inappropriate questions relative to plant specific design, and to ensure that the questions will elicit the answers in the key and that they reflect the most current plant conditions. The following licensee representative discussed the results of this review with the chief examiner prior to the exit meeting:

   J. Wayland

Attachments:

1. RO Written Examination and Answer Key
2. SRO Written Examination and Answer Key
3. Facility Comments on Written Examinations made after Exam Review

MASTER

Attachment 1

U.S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

Facility: GINNA
Reactor Type: PWR-WEC 2
Date Administered: 11/11/85
Examiner: O.W. Burke
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
25.0	25.0			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
25.0	25.0			2. Plant Design Including Safety and Emergency Systems
~~25.0~~	25.0			3. Instruments and Controls
25.0	25.0			4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
100.0				TOTALS

Final Grade ________%

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

____
Candidate's Signature

1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow (25.00)

Question 1.01 (2.25)

An estimated critical position (ECP) has been calculated for a reactor startup that is to be performed 6 hours after a trip from a 60 day full power run. How would each of the following events or conditions (independently) affect the actual critical rod position compared to the ECP? In your answer, select whether the actual rod position would be: higher than ECP, lower than ECP, or no significant difference.

a. The startup is delayed for approximately two hours. (0.75)

b. The steam dump pressure setpoint is increased by 100 psi above that used in the ECP calculation. (0.75)

c. A new boron sample shows a boron concentration 20 ppm higher than that used in the ECP calculation. (0.75)

Question 1.02 (1.50)

Calculate the stable startup rate (SUR) of a reactor whose power is doubling every 45 seconds. Show all work.

Question 1.03 (2.00)

a. How is the isothermal temperature coefficient of reactivity defined? (0.5)
During what plant condition(s) is it of interest? (0.50)

b. How is the (total) power coefficient defined? (0.50). During what plant condition(s) is it of interest? (0.50)

Question 1.04 (2.00)

Prior to startups after the initial startup, the secondary source must cause at least two counts per second above background on the source range detectors. Give two reasons for this requirement.

Question 1.05 (2.00)

Give two reasons why it is desirable to have the control rods in an ALL RODS OUT (ARO) configuration during full power operation.

Ginna Category 1 questions continued on next page.

Question 1.06 (1.50)

For the following cases, state whether the moderator coefficient of reactivity becomes more negative, becomes less negative, or stays the same.

a. The moderator temperature is increased from 547° to 570° with a constant boron concentration of 900 ppm.

b. The boron concentration is decreased from 1100 ppm to 900 ppm with the moderator temperature held constant at 547°F.

c. We advance from BOL and approach EOL in the normal manner.

Question 1.07 (2.75)

During a reactor startup, the operator stops rod pull no. 10 at 160 steps on Bank C. The source range monitor (SRM) count rate levels off at 2000 CPS. The initial SRM count rate was 200 CPS at zero steps withdrawn on Control Bank A with Keff = 0.95.

a. Calculate the 1/M value for this control rod position. (1.00)

b. Determine, by calculation, whether the reactor is subcritical, critical or supercritical at this control rod position. Show all work. (1.75)

Question 1.08 (1.00)

Figure 1.1 shows the xenon concentration history of a reactor operating over the last 200 hours after startup from a clean, xenon free condition. The power is at the 50% level during the first time span (approx. 50 hours). Estimate the steady power levels that must have existed during time spans A through D.

Question 1.09 (2.00)

What would the temperature and phase of the fluid downstream of the pressurizer PORV be if it should stick open at normal operating conditions (at power) in the pressurizer with a 500 psia back pressure in the pipe downstream of the PORV?

Ginna Category 1 questions continued on next page.

Question 1.10 (2.00)

Describe the principle of operation of the device used to measure the rate of flow in the reactor coolant system.

Question 1.11 (2.00)

List four ways that could be used to increase the NPSH provided to a pump.

Question 1.12 (2.00)

Assuming that you are operating at 85% power, indicate how the following changes in plant conditions would affect DNBR (increase, decrease, or no effect). Consider each case separately.

1. The operator manually withdraws control rods without changing turbine load. (0.50)

2. A steam generator PORV fails open. (0.50)

3. The pressurizer heaters are inadvertently left on. (0.50)

4. The reactor coolant pump speed decreases. (0.50)

Question 1.13 (2.00)

Refer to figure 1.2.

With both pumps operating and with all valves fully open, determine the following:

a. The total system flow rate. (1.00)

b. The flow rate through heat exchanger number 4. (1.00)

End of Ginna Category 1 questions.

U.S. NUCLEAR REGULATORY COMMISSION

XENON HISTORY FOR 200 HOURS OF OPERATION AFTER STARTUP
FROM A XENON - FREE CONDITION

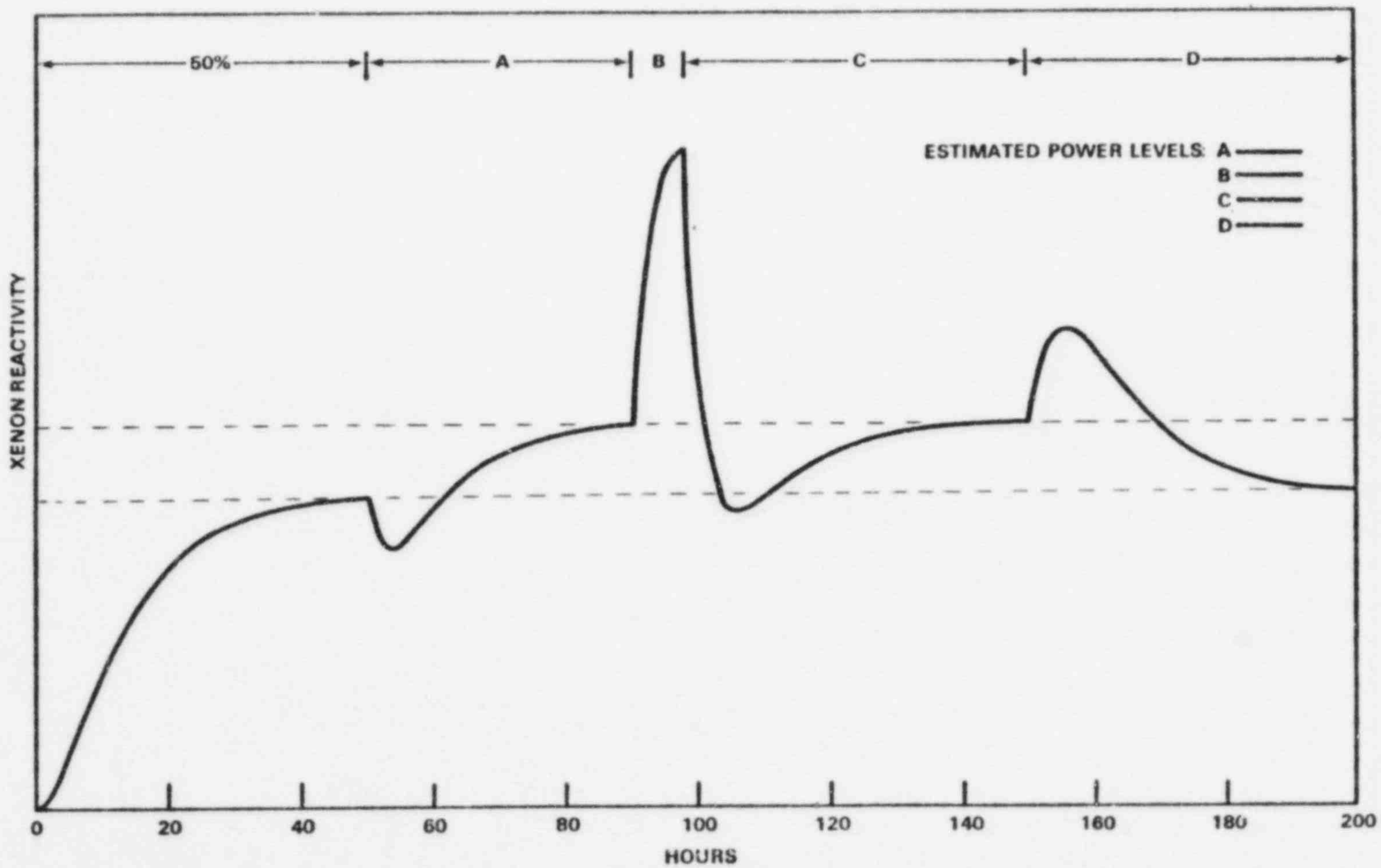
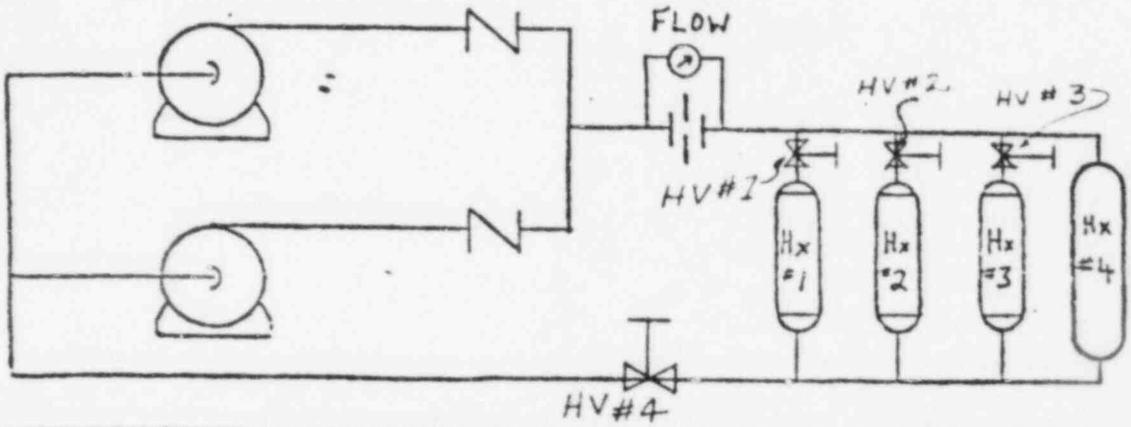


FIGURE 1.1

ASSUMPTIONS: 1. The two pumps are identical, centrifugal, constant speed pumps.
2. The friction pressure losses through the lines, open valves, check valves, and flow meter are negligible.
3. Heat exchangers numbers 1, 2, and 3 are identical.



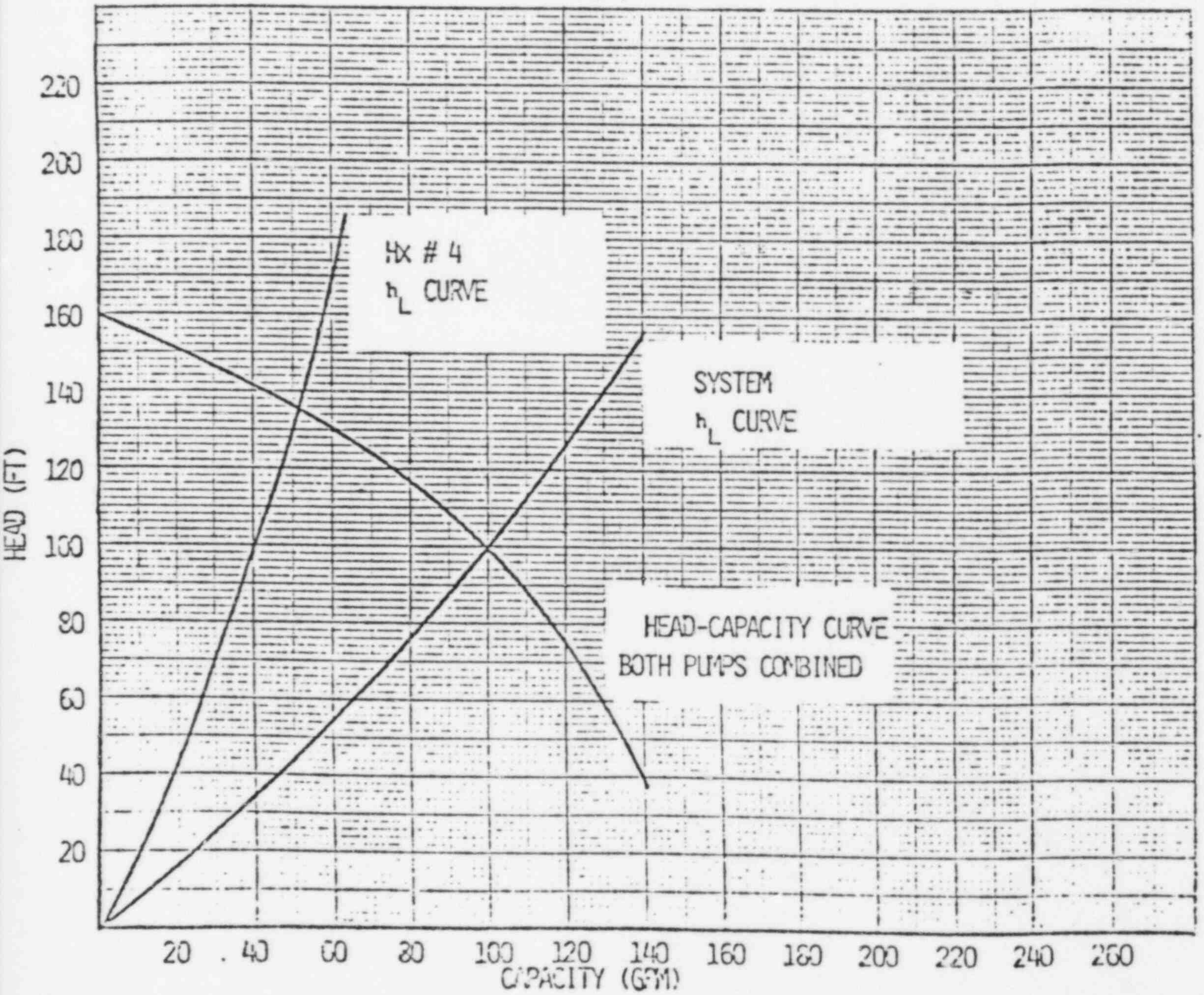


FIGURE 1.2

2. Plant Design, Including Safety and Emergency Systems (25.00)

Question 2.01 (1.5)

List three signals that will cause automatic main steamline isolation.

Question 2.02 (1.5)

The hydrogen overpressure in the VCT serves what three purposes?

Question 2.03 (1.5)

a. In order for the operator to manually close the letdown isolation valve (AOV-427) from the MCB, all letdown orifice isolation valves must be closed. What is the reason for this interlock? (1.0)

b. What interlocks, if any, will prevent the operator from closing the letdown orifice isolation valves (AOV-200A, B, and 202) from the MCB? (0.5)

Question 2.04 (2.0)

Give two functions of letdown control valve PCV-135.

Question 2.05 (2.0)

a. What chemical is used in the containment spray additive tank? (0.5)

b. Why is this chemical added to the spray (i.e., what gets accomplished that would not be accomplished by a borated water spray alone?)? (0.5)

c. How does this chemical enter the spray stream? (0.5)

d. What will initiate containment spray (include setpoint and coincidences)? (0.5)

Question 2.06 (1.0)

What protective features will trip an emergency diesel engine when it is running with a SI signal present?

Question 2.07 (2.0)

Explain how two safety related requirements are satisfied by delaying the main generator trip 60 seconds after a turbine trip.

Ginna Category 2 questions continued on next page.

Question 2.08 (3.0)

What Ginna system or systems provide cooling for the following:

a. SI pumps (with motors) (0.6)
b. Boric acid recycle evaporator. (0.6)
c. Spent fuel pit heat exchanger. (0.6)
d. Charging pumps (with motors) (0.6)
e. Pressurizer relief tank. (0.6)

Question 2.09 (2.0)

What four accidents form the design basis for the emergency core cooling system (ECCS)?

Question 2.10 (2.0)

With an SI signal present, what two different signals will open the SI pump suction valves from the RWST (MOV825A and B)?

Question 2.11 (2.5)

Answer the following questions regarding the design of the Main Steam system.

a. What design feature of the S/G limits steam flow during a main steam piping rupture upstream of the MSIV? (0.5)

b. List two purposes of the S/G atmospheric relief valves. (1.0)

c. What motive force is used to open the Main Steam Isolation Valves? What motive force shuts them? (1.0)

Question 2.12 (1.5)

What position does an atmospheric steam dump assume if, while it is open, the operating air supply is lost? Explain.

Question 2.13 (2.00)

Answer the following questions concerning the <u>Standby</u> Auxiliary Feedwater System.

a. List all sources of water available to the pump suctions. ~~(1.2)~~ (1.0)

b. What interlocks or conditions can prevent starting a pump? Do not include malfunctions or lack of electrical power. ~~(1.6)~~ (1.0)

Ginna Category 2 questions continued on next page.

Question 2.14 (0.5)

What protective turbine trip is blocked by use of the TURBINE LATCH pushbutton during plant startup?

End of Ginna Category 2 questions.

3. Instruments and Controls (25.0)

Question 3.01 (2.00)

Answer the questions below regarding the SGWLC system,

a. How is the volumetric main steam flow rate converted to a mass flow rate? (0.5)

b. If the steam flow signal were to fail 'as is' and turbine load were increased, what would be the effect on the corresponding steam generator water level (higher and stable, lower and stable, higher and constantly rising, lower and constantly decreasing, same)? Briefly explain why. (1.5)

Question 3.02 (3.0)

Suppose that following a turbine trip the condenser steam dumps have cooled the primary coolant to 547°F and the dump valves have closed.

a. What operator action should be taken at this time pertaining to the steam dump system? (1.0)

b. Describe two methods of operation of the condenser steam dumps that the operator could use to cool the system down below 547°F. (2.0)

Question 3.03 (2.5)

One of the main steam turbine protective trip devices is a solenoid trip device. List the five signals that will energize the solenoid and thus cause a turbine trip.

Question 3.04 (3.0)

For each of the following situations, indicate the initial direction of travel for the feedwater regulating valve FCV-466 (answer either OPEN or CLOSE). Assume that the plant is initially at steady state full power and that FCV-466 is in AUTO.

a. The turbine trips.

b. An inadvertent SIS actuation.

c. Controlling first stage pressure transmitter fails low.

d. Controlling steam generator pressure transmitter fails low.

e. Controlling feed flow transmitter fails high.

f. Steam generator level transmitter (LT-461) fails low.

Ginna Category 3 questions continued on next page.

Question 3.05 (2.5)

During a situation that renders the main control room "inaccessible," the Ginna plant controls required to safely shut the plant down can be operated by stationing operating personnel at various local control stations. Several key components have local control stations for use in this situation. List five of these components.

Question 3.06 (3.0)

Using a simple sketch and a brief description, explain how the GINNA RHR system, when operating in cooldown mode, meets the two objectives of maintaining a constant flow rate through the RCS and controlling the RCS cooldown rate.

Question 3.07 (2.5)

List five control interlocks (including coincidences) that will stop automatic rod withdrawal. Do not include "urgent failures."

Question 3.08 (1.0)

Question Deleted

~~The incore thermocouple system contains reference junction boxes that are normally maintained at 160°F. Answer the following questions assuming that the reference junction box temperatures fail to ambient.~~

~~a. The multi-point precision indicator (in the control room) will indicate readings that are higher than/lower than/or the same as the readings that were taken before the malfunction. (0.5)~~

~~b. The plant computer readout will indicate readings that are higher than/lower than/or the same as the readings that were taken before the malfunction. (0.5)~~

Question 3.09 (1.0)

What feature of the pressurizer power operated relief valve's control system prevents <u>sustained</u> <u>inadvertent</u> operation of the valve in the open position as a result of a pressure transmitter failing high?

Question 3.10 (2.0)

Answer the following questions regarding the Main Feed and Condensate systems:

a. What automatic action should occur in response to a low feed pump suction pressure alarm? (0.5)

b. List four conditions which will trip an individual main feed pump but which will not trip both main feed pumps simultaneously. (1.0)

c. What automatic action(s) should occur immediately following a single main feed pump trip? Do not include any reactor protective actions. (0.5)

Ginna Category 3 questions continued on next page.

Ginna Category 3 questions continued.

Question 3.11 (2.5)

What are five of the interlocks that must be satisfied before a main feedwater pump will start?

End of Ginna Category 3 questions.

4. Procedures - Normal, Abnormal, Emergency, and Radiological Control (25.0)

Question 4.01 (2.0)

According to procedure E-5: CONTROL ROOM INACCESSIBILITY, list the first immediate action that should be taken after the control room has been declared inaccessible and give three ways that this action may be accomplished.

Question 4.02 (2.0)

a. List two automatic actions that should always be initiated when one RCCA drops.

b. What is the intent of the immediate operator actions of procedure E-7, DROP OF A ROD CLUSTER CONTROL ASSEMBLY, in response to the dropping of one RCCA?

Question 4.03 (5.0)

a. In accordance with procedure E-20, IMMEDIATE BORATION, list five conditions or symptoms that require immediate boration. (2.5)

b. List the five immediate operator actions required in procedure E-20. (2.5)

Question 4.04 (3.0)

What are the required immediate operator actions in procedure E26.2, REACTOR TRIP-TURBINE LATCHED?

Question 4.05 (3.0)

Document 10 CFR 20 provides regulations for radiation exposure at Ginna Station. Answer the following questions in accordance with 10 CFR 20.

a. What is the initial QUARTERLY Whole Body exposure limit for an individual in a restricted area who has never before recieved occupational radiation exposure? (0.75)

b. What TWO criteria must be satisfied in order to exceed the above limit under NON-EMERGENCY conditions and what maximum quarterly exposure may be recieved under these conditions? (2.25)

Ginna Category 4 questions continued on next page.

Question 4.06 (2.0)

Answer the following questions regarding procedure O-1.1 PLANT HEATUP FROM COLD SHUTDOWN TO HOT SHUTDOWN>

a. A note indicates care should be taken if demineralizers are switched, particularly when placing a new mixed bed in service. Why is this a concern? (0.5)

b. Step 5.9 requires checking the "temperature profile between the RCS and the S/G's" prior to starting a RCP when RCS temperature is less than or equal to 330 degrees F and pressurizer level is greater than 38%. Why is this a concern? (0.5)

c. During pressurizer bubble formation, RCS pressure will increase and a subsequent increase in letdown flow will be noted. What is the maximum allowable letdown flow and why is this limit set? (1.0)

Question 4.07 (1.0)

During a startup, what minimum count rate is required before a source range nuclear instrument is considered operable?

Question 4.08 (1.0)

Operating procedure O-1.1, PLANT HEATUP FROM COLD SHUTDOWN TO HOT SHUTDOWN, requires you to verify that secondary side steam pressure is greater than 514 psig before reaching 2000 psig pressure on the primary side. Why is this necessary?

Question 4.09 (2.0)

What are four prerequisites for making a radioactive liquid release from the R. E. Ginna plant?

Question 4.10 (3.0)

Emergency procedure E-23 lists symptoms for RCP seal malfunctions. For each of the seals below, give one symptom that would indicate a <u>complete</u> failure of the seal (consider each one separately).

a. Number 1 seal.

b. Number 2 seal.

c. Number 3 seal.

Ginna Category 4 questions continued on next page.

Question 4.11 (1.0)

The steam generator tube rupture procedure (E-1.4) has three major objectives as follows:

1. Begin a rapid cooldown of the RCS to approximately 490°F.

2. Isolate the affected S/G.

3. Begin a depressurization of the RCS to a pressure equal to the faulted S/G steam pressure.

Indicate the sequence in which the above actions should be done (i.e., 1, 2, 3; 3, 2, 1; etc.).

End of Ginna Category 4 questions.

$1Ci = 3.7 \times 10^{10} d/s$

$\alpha_D = -1 \times 10^{-5} \frac{\Delta K}{K}/°F$

$\alpha_V = -1 \times 10^{-3} \frac{\Delta K}{K}/\%$ voids

$\alpha_M = -1.0 \times 10^{-4} \frac{\Delta K}{K}/\%°F$

$\alpha_P = -4.5 \times 10^{-4} \frac{\Delta K}{K}/\%$ power

$I(t) = Io\ e^{-\lambda t}$

$T1/2 = \ln(2)/\lambda$

$Cp = (CP_{base})(Ks)(K_A)$

$$\frac{\rho_1}{\gamma} + Zi + \frac{V_1^2}{2g} + ha - hr - h_L = \frac{P^2}{\delta} + Z_2 + \frac{V_2^2}{2g}$$

$$\frac{V_2}{V^1} = \left(\frac{\Delta P_2}{\Delta p_1}\right)^{1/2}$$

$\dot{Q} = MCp\ \Delta t$

$\Delta\rho = f \frac{L}{D} \frac{\rho V^2}{2g_c}$

$f = 64/Re$

$\rho = \frac{k(eff) - 1}{K(eff)}$

$\frac{1}{M} = \frac{CR1}{CR2} = \frac{1-K(eff)2}{1-K(eff)1}$

$\dot{Q} = M\Delta h$

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

$\lambda = 0.1$

$h_L = km\dot{V}^2$

$P = P_o\ 10^{SUR(t)}$

$SUR = \frac{26.06}{\tau}$

$P = P_o\ e^{t/\tau}$

$A(x) = A_o e^{-\mu x}$

$M = 1/(1-k) = \frac{CR_1}{CR_0}$

$N(t) = No\ e^{-\lambda T}$

$\alpha_r \propto (L_f + L_s) \frac{(\phi rod)^2}{(\phi avg)}$

$n = \nu/(1 + d)$

$P = \Sigma\ \phi\ \nu/(3.7 \times 10^{10})$

$\tau = (\beta - \rho)/\lambda\rho$

$\tau = \bar{\ell}/\rho + (\beta - \rho)/\lambda\rho$

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

$v = v_f + xv_{fg}$

$H = xh_g + (1-x)\ h_f$

$S = xS_g + (1-x)\ S_f$

1 in = 2.54 cm

1 gal. = 3.785 liters

1 kg = 2.205 lb

$N = \rho A_0/A$

17.58 watts = 1 BTU/min
1psi = 6.895 Pa
1psi = 2.036 " H_g (@ 0C)
1psi = 27.68 " H^2O (@ 4C)

$\bar{\beta} = .0071$

$\bar{\ell} = 2 \times 10^{-5}$ sec

$\ell d = 12.5$

$RR = \Sigma_f \phi_{th}$

$SCR = \frac{S}{1-Keff}$

$\rho = \frac{\beta}{\lambda\tau + 1}$

Reactor thermal power = $(h_2 - h_1)$ x steam flow rate

$K = \frac{1}{1 - \rho}$

1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow (25.00)
Answers - Ginna - 11/11/85 - Burke, O. W.

Answer 1.01 (2.25)

a. higher than ECP. (0.75)

b. higher than ECP. (0.75)

c. higher than ECP. (0.75)

Ref. Ginna Procedure No. 0-1.2.2, CRITICAL ROD POSITION CALCULATION.

Answer 1.02 (1.50)

$P = P(o)10^{SUR(t)}$ (0.25)

$P = 2P(o)$ when power doubles (0.25)

$2P(o) = P(o)10^{SUR(0.75)}$ (0.25)

$2 = 10^{SUR(0.75)}$

$\log 2 = SUR(0.75)$ (0.25)

$SUR = \frac{\log 2}{0.75} = \frac{(0.301)}{0.75} = \underline{0.401\ DPM}$ (0.50)

Ref. Ginna Reactor Theory Book, page 4-29.

Answer 1.03 (2.00)

a. The isothermal temperature coefficient is defined as the change in reactivity for a unit change in moderator, clad, and fuel temperatures. Therefore, it is simply the sum of reactivity changes for a given 1 degree temperature change. (0.5)
It is of interest during reactor startup when the core materials are uniformly heated (by other means than reactor power) and there is effectively a single temperature everywhere in the core. (0.50)

Ginna Category 1 answers continued on next page.

Answer 1.03 continued

b. The (total) power coefficient is a measure of the change in reactivity of the core for a unit change in reactor power, when operating on programmed average moderator temperature. It is the sum of the doppler-only power coefficient and the moderator-only power coefficient. (0.50) It is of interest during reactor operation at power, or during power changes, when fuel temperatures are much higher than moderator temperatures. (0.50)

Ref. Ginna Reactor Theory Book, Chapter 5, pages 58 and 61.

Answer 1.04 (2.00)

1. To assure the operator that the source range detectors are operating properly. (1.00)

2. It will allow for monitoring the core's subcritical neutron level. (1.00)

Ref. Ginna Reactor Theory Book, Section 4, page 53.

Answer 1.05 (2.00)

1. Provide reserve reactivity for adequate shut down margin. (1.00)

2. Avoidance of local power peaking problems. (1.00)

Ref. Ginna Reactor Theory Book, Section 5, page 3.

Answer 1.06 (1.50)

a. more negative (0.50)

b. more negative (0.50)

c. more negative (0.50)

Ref. Ginna Reactor Theory Book, Section 5, pages 20-32.

Ginna Category 1 answers continued on next page.

Answer 1.07 (3.00)

a. 1/M = CR1/CR2

= 200/2000

= 0.100 (1.00)

b. Calculate Keff after rod pull no. 10.

1/M = (1 - Keff2)/(1-Keff1)

0.100 = (1-Keff10)/(1-0.95)

Keff10 = 0.995 (1.0)

Since Keff is less than 1, the reactor is subcritical. (0.75)

Ref. Ginna Reactor Theory Book, Section4, page 61.

Answer 1.08 (1.00)

A - 100%
B - 0% (tripped)
C - 100%
D - 50%

Note: A tolerance of plus or minus 10% will be permitted on A, B, and D.

Ref. Ginna Reactor Theory Book, Section 6, page 12.

Answer 1.09 (2.00)

Since this is a throttling process, the enthalpy will be constant. On the Mollier diagram, we find the point of intersection of the 2250 psia line with the saturation line. From this point we follow the constant enthalpy line to its intersection with the 500 psia line. We are in the wet vapor phase at this point. (1.0)

From the steam tables, we find the saturation temperature corresponding to 500 psia to be 467°F. (1.00)

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 5, page 27; also the Mollier diagram and the steam tables.

Ginna Category 1 answers continued on next page.

Answer 1.10 (2.00)

A pipe elbow is used for this measurement. The principle of operation is that as the fluid flows around the bend in the elbow a centrifugal force is felt on the outside of the radius which results in an increase in the pressure at the outside and a decreased pressure at the inside of the radius. The pressure difference (P outside to inside) is dependent on the flow rate. The volume flow rate is proportional to the square root of the pressure difference.

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 5, page 13.

Answer 1.11 (2.00)

(Any four of the following at 0.5 points each)

1. Increasing suction pressure.
2. Pressurizing the entire system.
3. Subcooling or lowering the temperature of the fluid entering the pump.
4. Increasing the height of fluid above the pump suction.
5. Reducing the volume flow rate of the pump.

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 6, pages 38-44.

Answer 1.12 (2.00)

1. DNBR decreases (0.50)
2. DNBR decreases (0.50)
3. DNBR increases (0.50)
4. DNBR decreases (0.50)

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 9, pages 32-39.

Ginna Category 1 answers continued on next page.

Ginna Category 1 answers continued.

Answer 1.13 (2.00)

a. On figure 1.2, read 100gpm at the intersection of the pumps head-capacity curve and the system head loss curve (system operating point).

b. From the system operating point as found in part a, we find that the pump head is 100 ft. With a pump head of 100 ft. we see that the flow rate through heat exchanger number 4 is 40gpm.

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 6, page 35, and Section 7, page 5.

End of Ginna Category 1 answers.

2. Plant Design, Including Safety and Emergency Systems (25.00)

Answer 2.01 (1.5)

1. High-high steam flow coincident with an SI signal. (0.5)
2. High steam flow and low Tavg coincident with an SI signal. (0.5)
3. High-high containment pressure of 18 psig. (0.5)

Ref. RGE-21, page 11.

Answer 2.02 (1.5)

1. It removes oxygen from the coolant. (0.5)
2. It provides a minimum suction pressure for the charging pumps. (0.5)
3. It provides the proper back pressure on the coolant pumps' number 1 seal. This back pressure also causes flow to the number 2 seal. (0.5)

Ref. RGE-16, page 4.

Answer 2.03 (1.5)

a. To insure that the regenerative heat exchanger is always at RCS pressure to prevent steam flashing and possible damage to its tubes. (1.0)

b. There are no interlocks to prevent the operator from manually closing the orifice isolation valves. (0.5)

Ref. RGE-16, pages 5-7.

Answer 2.04 (2.0)

1. During normal operation PCV-135 maintains a backpressure in the letdown line to prevent the liquid from flashing to steam as it passes through the orifice valves. (1.0)

2. During solid plant operations, PCV-135 maintains the pressure of the RCS to the desired value. (1.0)

Ref. RGE-16, page 9.

Ginna Category 2 answers continued on next page.

Answer 2.05 (2.0)

a. Sodium hydroxide (NaOH). (0.5)

b. Helps remove iodine from the containment atmosphere. (0.5)

c. Spray additive tank discharge valves open and allow jet educators to draw NaOH out of the tank and mix it with spray water. The eductor is supplied from the spray pump discharge and returns to the pump suction. (0.5)

d. 2/3 detectors on 2/2 channels equal to or greater than 28 psig containment pressure. (0.5)

Ref. RGE-24, pages 12 and 13.

Answer 2.06 (1.0)

1. Diesel engine overspeed. (0.5)

2. Low lube oil pressure. (0.5)

Ref. RGE-8, page 19.

Answer 2.07 (2.0)

1. An immediate turbine trip-generator trip coincident with a failure of automatic bus transfer of electrical buses could result in a loss of forced reactor coolant flow if the reactor trips due to overpower, overtemperature, or low pressure conditions. This loss of flow could make the consequences of the accident more severe than that reported in the FSAR. However, if pumping power is lost with a time delayed generator trip, the loss of flow is not considered serious because the reactor has been shut down for a period of time. (1.0)

2. On a major LOCA, as the coolant rushes out of the break, the RCP can overspeed. This RCP overspeed can be minimized with the generator trip time delay by locking the RCP's at approximately a 60 HZ frequency. RCP overspeed could result in flywheel destruction, resulting in missiles which could damage the containment liner or the ECCS components within the containment. (1.0)

Ref. RGE-5, pages 10 and 11.

Ginna Category 2 answers continued on next page.

Answer 2.08 (3.0)

a. service water and component cooling water (0.6)

b. component cooling water (0.6)

c. service water (0.6)

d. ~~service water~~ Charging pump room fan cooler (0.6)

e. reactor makeup water (0.6)

Ref. (a) RGE-51, pg. 7, RGE-28, pg. 4 (b) RGE-28 pg. 4 (c) RGE-36 pg. 4 (d) RGE-51, page 7; (e) RGE-14, page 9.
→ P&ID 33013-1250

Answer 2.09 (2.0)

1. The loss of coolant (LOCA). (0.5)

2. The rod ejection accident. (0.5)

3. The secondary steam line break. (0.5)

4. A primary to secondary steam generator tube rupture. (0.5)

Ref. RGE-27, page 3.

Answer 2.10 (2.0)

1. A signal indicating that the boric acid storage tanks levels have decreased to 10%. (0.5)

2. If either valves MOV 826 A and B or valves MOV 826 C and D have not started to open five seconds after the SI actuation signal, a signal will be sent to open MOV 825 A & B. (0.5)

Ref. RGE-26, page 13.

Ginna Category 2 answers continued on next page.

Ginna Category 2 answers continued.

Answer 2.11 (2.5)

a. steam flow venturis (0.5)

b. 1. overpressure protection of the S/G.
2. plant cooldown without the condensor steam dumps. (0.5 each)

c. 1. instrument air pressure
2. spring pressure (0.5 each)

REFERENCE
RGE-40 pp. 5-7

Answer 2.12 (1.5)

The valve should remain open. (0.5) The nitrogen backup system will automatically cut in when the instrument air pressure drops below the nitrogen pressure regulator setpoint and hold the valve open. (1.0)

Ref. RGE-45, page 4.

Answer 2.13 (2.0)

a. service water ~~(0.4)~~ (0.33)
auxiliary condensate storage tank ~~(0.4)~~ (0.33)
spoolpiece to firemain ~~(0.4)~~ (0.34)

b. 1. normal auxiliary feed water pump breaker closed ~~(0.54)~~ (0.33)

2. Associated standby pump suction valve closed ~~(0.53)~~ (0.33)

3. Associated normal auxiliary feed pump breaker racked out ~~(0.53)~~ (0.34)

Ref. RGE-42, pages 7 and 8

Answer 2.14 (0.5)

Low vacuum trip.

Ref. RGE-49, pages 10 & 20 and logic diagram sheet number 3.

End of Ginna Category 2 answers.

3. Instruments and Controls (25.0)

ANSWER 3.01 (2.00)

a. By using steam pressure as a steam flow signal 'conditioner'

b. lower and stable (0.5)
As actual steam flow begins to increase, the steam/feed mismatch signal remains zero. The actual and indicated water level start to drop until the actual/program level mismatch signal opens the FWRV. Conditions stabilize when the resulting feed flow/steam flow error is offset by the actual/program level error. (1.0)

REFERENCE RGE-44 pg. 5

Answer 3.02 (3.0)

a. He should set the steam dump mode selector switch (SDMSS) to the MANUAL position and controller HC484 to AUTO and set to control the pressure at 1005 psig. (1.0)

b. 1. With the SDMSS in MANUAL, place HC484 in AUTO and lower the pressure set point. (1.0)

   2. With the SDMSS in MANUAL,place HC484 in MANUAL and adjust the balance knob to get the desired cooldown rate. (1.0)

Ref. RGE-45, page 10.

Answer 3.03 (2.5)

1. Reactor trip (from trip breakers). (0.5)
2. Manual pushbutton on the operator's console. (0.5)
3. Trip of all main feedwater pumps. (0.5)
4. Generator trip. (0.5)
5. Trip of all circulating water pumps. (0.5)

Ref. RGE-49, pages 9 and 10.

Ginna Category 3 answers continued on next page.

Answer 3.04 (3.0)

a. OPEN (0.5)

b. CLOSE (0.5)

c. CLOSE (0.5)

d. CLOSE (0.5)

e. CLOSE (0.5)

f. OPEN (0.5)

Ref. RGE-44, Pages 5, 9, and 10 and drawing RGE-CD-7.

Answer 3.05 (2.5)

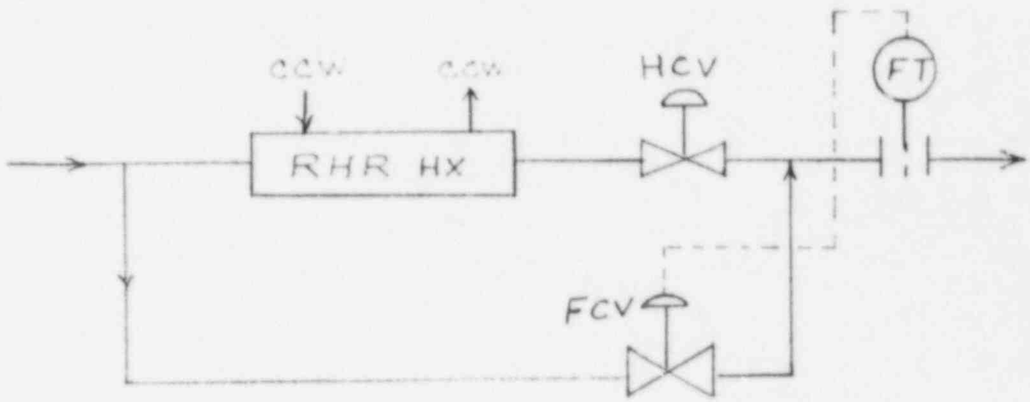
(Any 5 at 0.5 points each)

1. Motor driven AFW pumps.
2. Charging pumps.
3. Boric acid transfer pumps.
4. Service water pumps.
5. Containment air recirculation fans.
6. Pressurizer backup heaters.
7. Emergency Diesel Generator
8. Letdown Orifice Isolation valves

Ref. RGE-54, page 4.
RGE-8 pg 16

Ginna Category 3 answers continued on next page.

Answer 3.06 (3.0)



The following credit will be allotted to the sketch.

1. A control valve (HCV) appears in the discharge line from the RHR Hx. (0.5)

2. A control valve (FCV) appears in a bypass line around the RHR Hx and the valve mentioned in (1) above. (0.5)

3. A flow transmitter (FT) is located downstream of both of the above valves and its signal must connect to the bypass FCV. (0.5)

The RCS cooldown rate is controlled by a valve downstream of the RHR Hx which adjusts the flow rate through the Hx. The total flow rate is maintained constant by adjusting the bypass flow rate around the Hx by adjusting the position of the flow control valve in that line. This valve position is controlled by a signal from a flow transmitter downstream which measures total flow rate. (1.5)

Ref. RGE-25, page 12 and drawing RGE-RHR-3.

Ginna Category 3 answers continued on next page.

Ginna Category 3 answers continued.

Answer 3.07 (2.5)

(Any 5 of the following for 0.5 points each)

1. 1/2 IR > 20% power.

2. 1/4 PR > 103% power.

3. 1/4 OPΔT 1.71% < trip point.

4. 1/4 OTΔT 1.71% < trip point.

5. 1/1 Impulse pressure < 12.8% power.

6. 1/4 PR decrease ≥ 5% power in 5 sec.

7. Any rod ≤ 20 steps with remainder of ~~rods~~ BANK ≥ 35 steps.

8. Tavg - $\overline{\text{Tavg}}$ deviation of ± 4°F.

Ref. RGE-30, pages 17 and 18.

Answer 3.08 (1.0)

Deleted

~~a. Higher than. (0.5)~~
~~b. The same as. (0.5)~~

~~Ref. RGE-32, page 5.~~

Answer 3.09 (1.0)

An interlock from a pressure transmitter from another channel closes the PORV when actual pressure drops below 2335 psig.

Ref. RGE-19, page 10.

Answer 3.10 (2.0)

a. the condensate bypass valve will open (if in auto) (0.5)

b. 1. low lube oil pressure (0.25)
   2. overcurrent (0.25)
   3. undervoltage (0.25)
   4. 15 psid seal water to suction pressure (0.25)

c. 1. Discharge isolation valve closes (0.25)
   2. Recirc line control valve opens(on low suction flow)(0.25)

REFERENCE RGE-43 pg. 11,13,14

Ginna Category 3 answers continued on next page.

Answer 3.11 (2.5)

(Any five of the following at 0.5 points each.)

1. Suction valve open.

2. Suction pressure greater than 185 psig.

3. Discharge valve closed.

4. Recirculation valve open.

5. Lubrication system operating with oil pressure above a preset value.

6. Seal water booster pumps operating with seal water pressure 15 psig greater than feedpump suction pressure.

7. Blowdown selector switch in normal.

Ref. RGE-43, pages 12 and 13.

End of Ginna Category 3 answers.

4. Procedures, normal, abnormal, emergency, and Radiological Control (25.0)

Answer 4.01 (2.0)

Trip the reactor (0.5) by one of the following methods:

1. From the control board before leaving, if possible. (0.5)

2. Opening breakers at the reactor trip switch gear. (0.5)

3. Actuating the manual turbine trip at the turbine. (0.5)

Ref. Procedure E-5.

Answer 4.02 (2.0)

a. 1. Turbine runback if turbine in auto ~~(0.5)~~
   2. Turbine load limit runback if > 80% power ~~(0.5)~~ (2 reqd, 0.5 pts. each)
   3. Block of automatic rod withdrawal.

b. To get the power and load matched at a reduced power level (about a 20% load and power reduction). (1.0)
OR to limit flux peaking and hot channel concerns.

Ref. Procedure E-7.
FSAR 7.7.1.2.10

Answer 4.03 (5.0)

a. (5 at 0.5 points each)

1. Control bank at or approaching the low insertion limit.

2. Control bank at low low insertion limit.

3. An uncontrolled cooldown of the reactor coolant system following a reactor trip. (Borate using MOV-350).

4. An unexplained or uncontrolled reactivity increase. (Borate using MOV-350).

5. One or more control rods not known to be fully inserted following a reactor trip.

Ginna Category 4 answers continued on next page.

Answer 4.03 continued.

b. (5 at 0.5 points each)

1. Start either boric acid transfer pump.

2. If condition 3 or 4 above is occurring, open MOV-350. Record time opened and the flow rate on FI-113.

3. If any of the above symptoms or conditions except 3 and 4 are occurring, borate with the REACTOR MAKEUP CONTROL at 3 gpm via FCV-110B.

4. Determine the amount of boric acid desired to be added.

5. Stop boric acid flow and boric acid transfer pump when proper amount has been added or when control rods start to move out.

Ref. Procedure E-20.

Answer 4.04 (3.0)

(6 parts at 0.5 points each).

1. Verify all control rods are fully inserted. Refer to procedure E-20, IMMEDIATE BORATION, if all control rods are not known to be fully inserted.

2. If the plant is in a condition for which a reactor trip is warranted and an automatic reactor trip has not yet occurred, manually trip the reactor.

3. Verify that the turbine throttle, governor and intercept valves are closed.

4. Verify that the average coolant temperature is approaching the no load value of 547°F.

5. Verify that the main feedwater valves are closed if their controller is in AUTOMATIC and either Tavg is less than 554°F or S/G level is greater than 67%.

6. If the main feedwater valves are in MANUAL, exercise extreme caution with feedwater control so as not to reduce the coolant temperature below 547°F or increase the S/G level above 67%.

Ref. Procedure E26.2.

Ginna Category 4 answers continued on next page.

Answer 4.05 (3.0)

a. 1.25 Rem/Quarter (0.75

b. -3 Rem/Quarter is NOT exceeded. [0.75]
-Total accumulated dose does not exceed 5(N-18). [0.75]
-Accumulated exposure on record (NRC-4). [0.75] (2.25)

REFERENCE
10 CFR 20

ANSWER 4.06 (2.00)

a. Positive reactivity insertion due to boron removal (0.5)

b. large pressure transient could result when starting a RCP due to large temp difference between the RCS and S/G. (0.5)

c. ~~60~~ 70 GPM (0.5)
prevents channeling of demineralizer resin (0.5)

REFERENCE
a. O-1.1 step 5.7.1
b. step 5.9
c. ~~RGE-16 pg. 9~~ P-3 Step 2, 2, 3

Answer 4.07 (1.0)

5 cps.

Ref. Procedure O-1.2, page 6.

Answer 4.08 (1.0)

A low steamline SI would occur at a steam pressure less than 514°F if the RCS pressure was greater than 2000 psig (SI auto unblock setpoint).

Ref. Procedure O-1.1, page 22, and RGE-35, page 24.

Answer 4.09 (2.0)

1. Tank has been isolated and sampled. (0.5)
2. Waste release form. (0.5)
3. Circulating water pumps operating. (0.5)
4. The liquid release monitor is operable. (0.5)

Ref. S-3.4K pg. 1, T/S 3.5.4.1, 3.9.1.1a, 4.12.1.1a

Ginna Category 4 answers continued on next page.

Ginna Category 4 answers continued.

Answer 4.10 (3.0)

a. (any one for 1.0 point credit.)

1. High leak-off flow rate from the no. 1 seal.

2. Low delta P alarm for the no. 1 seal.

3. Low labyrinth seal delta P.

b. (any one for 1.0 point credit)

1. High standpipe level.

2. Low no. 1 seal leakoff flow.

c. Low standpipe level. (1.0)

Ref. Procedure E-23.

Answer 4.11 (1.0)

2, 1, 3.

Ref. Procedure E-1.4, pages 4 & 5.

End of Ginna Category 4 answers.

Attachment 2

MASTER

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

Facility: GINNA
Reactor Type: PWR-WEC2
Date Administered: 11/11/85
Examiner: O.W. Burke
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
25.0	25.0	______	______	5. Theory of Nuclear Power Plant Operation, Fluids, and Thermodynamics
25.0	25.0	______	______	6. Plant Systems Design, Control, and Instrumentation
25.0	25.0	______	______	7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
25.0	25.0	______	______	8. Administrative Procedures, Conditions, and Limitations
100.0		______ Final Grade		Totals

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

______
Candidate's Signature

5. Theory of Nuclear Power Plant Operation, Fluids, and Thermodynamics (25.00)

Question 5.01 (5.0)

A reactor whose reactivity information is given in figures 5.1 through 5.4 has been operating at 100% power for four weeks when a reactor trip occurs. Assume that the reactor is near BOL, and that the boron concentration is 900 ppm. Just prior to the trip all rods are all the way out except for bank D which is 165 steps withdrawn. Assume that boron worth is 10.0 pcm/ppm, Beff = 0.007, and λ =0.08.

a. What will Keff be immediately after the reactor trip (assume Tave is at T no load)? State all assumptions, show sources of numbers and show all calculations. (2.0)

b. On a restart four days after the trip you wish to go critical at 100 steps on bank D. What is the required boron concentration? State all assumptions and sources of numbers and show all calculations. (2.0)

c. If the reactor is just critical at 10^{-8} amps on the IR range with bank D at 100 steps, what new bank D position would be required to obtain a stable startup rate of 1 DPM? Show all work. (1.00)

Question 5.02 (2.0)

Explain why a dropped rod, when operating at power, could be worth approximately 200 pcm and the same rod stuck, on a reactor trip, could be worth 1000 pcm.

QUESTION ~~5.01~~ 5.03 (3.50)

Indicate the direction and reason for change in the following parameters during a plant load increase. Assume control rods are in manual. Also indicate why reactor power stabilizes after the load increase stops.

- Main steam flow
- Main steam pressure
- Main steam temperature (Tstm)
- Delta T (Tave - Tstm)
- Tave
- Reactor power

QUESTION ~~5.02~~ 5.04 (1.00)

A reactor operator adds 0.0001 delta k/k to a critical reactor at BOL and then adds the same amount of reactivity to the same critical reactor at EOL. How will the SUR at EOL compare with the SUR at BOL (greater than, same as, less than). Briefly explain the physical reason for your answer. No calculations are necessary.

Category 5 questions continued on next page

QUESTION ~~5.03~~ 5.05 (1.50)

Each of the following accidents occur at 50% power and EOL. Would the severity of each accident (length of time spent at high power) be MORE SEVERE, LESS SEVERE, or NO CHANGE compared to the identical accident at BOL conditions. Consider only the effect of MTC, consider each accident separately, and make no allowance for automatic protective action.

a. Main steam line break. (0.5)
b. Total loss of coolant flow. (0.5)
c. Rod withdrawal accident (starting from the intermediate range) (0.5)

QUESTION ~~5.04~~ 5.06 (3.00)

A reactor can be considered as having an upper region (region A) which is rodded and a lower region (region B) which is unrodded. If such a reactor is allowed to achieve Xenon equilibrium, then rods are completely withdrawn while maintaining constant power and temperature, explain the sequence by which a Xenon oscillation may be started. Your description need only include up to where the flux changes direction for the first time.

Question 5.07 (2.0)

In order to prevent overheating the fuel, the reactor is operated such that the point of DNB is not reached (DNBR > 1.3). Since the DNBR is not directly measured, what four primary system parameters do you, as the operator, monitor to assure that DNBR is greater than 1.3.

Question 5.08 (2.0)

a. Find the enthalpy change in an isentropic expansion of steam through a turbine into a condenser (Note: Entering steam is 100% quality at 825 psia, condenser pressure equals 2 psia). Explain how you arrived at your solution or show your work. (1.5)

b. How would the change in enthalpy in part (a) be affected by a less than ideal turbine (i.e., some degree of inefficiency)? Select one of the following answers. (0.5)

1. increase
2. remain the same
3. decrease

QUESTION ~~5.05~~ 5.09 (2.00)

How would the following occurances most likely affect established natural circulation flow (help, hinder, no noticeable effect). Briefly explain why.

a. S/G levels fall to low in the narrow range. (0.5)
b. S/G levels are rapidly increased from below the narrow range level indication into the normal operating band. (0.5)
c. Just prior to initiating RHR cooling, a S/G atmospheric relief fails open. (0.5)
d. Pressurizer pressure increases from saturation for Thot to 100 psia greater than saturation. (0.5)

Category five questions continued on next page

Question 5.10 (3.0)

Refer to figure 5.5.

a. Determine the pump head and the system flow rate with one pump operating and with all valves fully open. You may mark on figure 5.5 if you desire. Show all work. (2.0)

b. What will the pump head be with both pumps operating, with valve number 4 open and valves 1, 2, and 3 closed? (1.0)

End of Ginna Category 5 questions.

U.S. NUCLEAR REGULATORY COMMISSION

INTEGRAL CONTROL BANK WORTH VERSUS STEPS WITHDRAWN WITHOUT OVERLAP (BOL AND HZP)

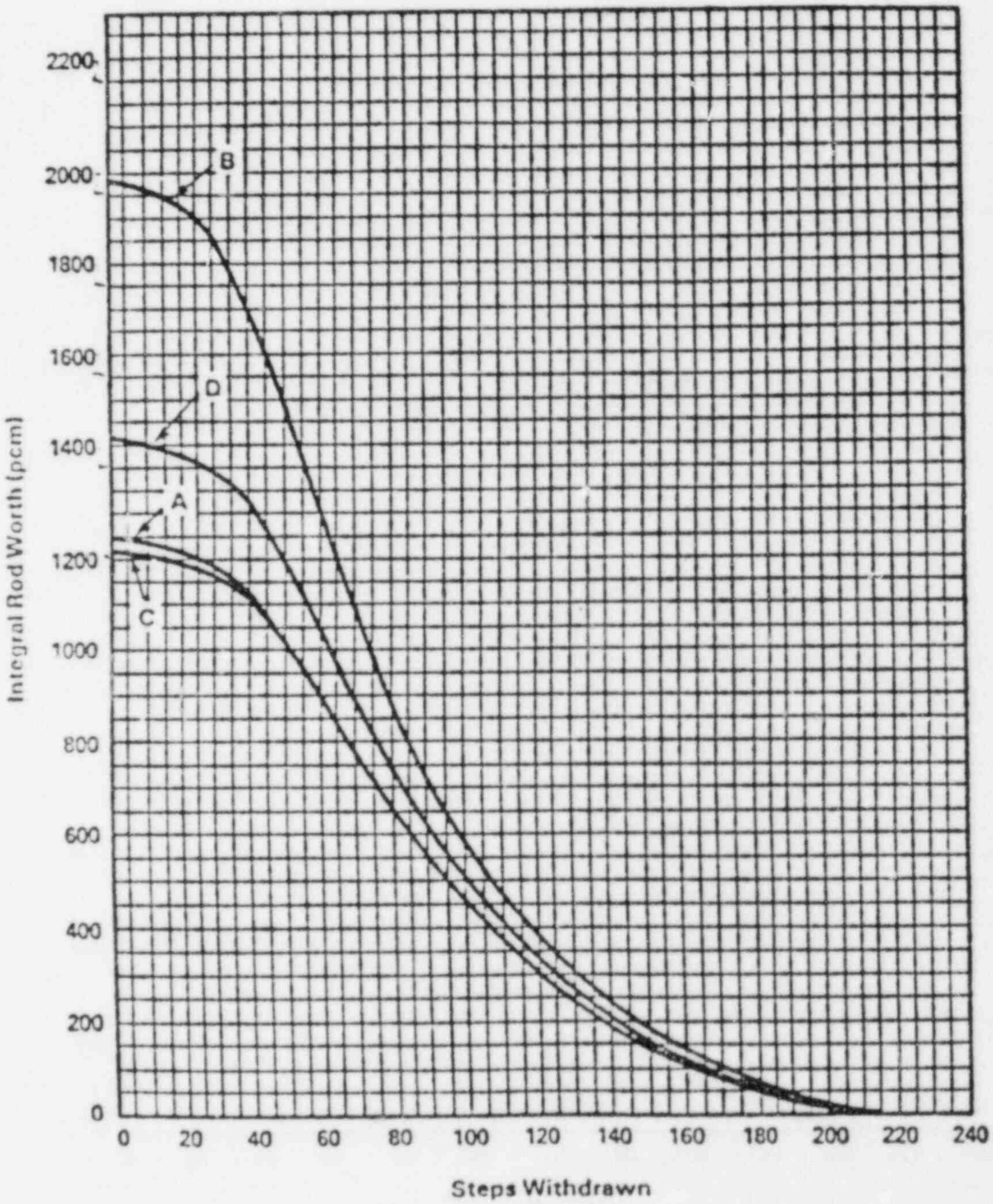


FIGURE 5.1

U.S. NUCLEAR REGULATORY COMMISSION

INTEGRAL SHUTDOWN BANK WORTH VERSUS STEPS WITHDRAWN (BOL AND HZP)

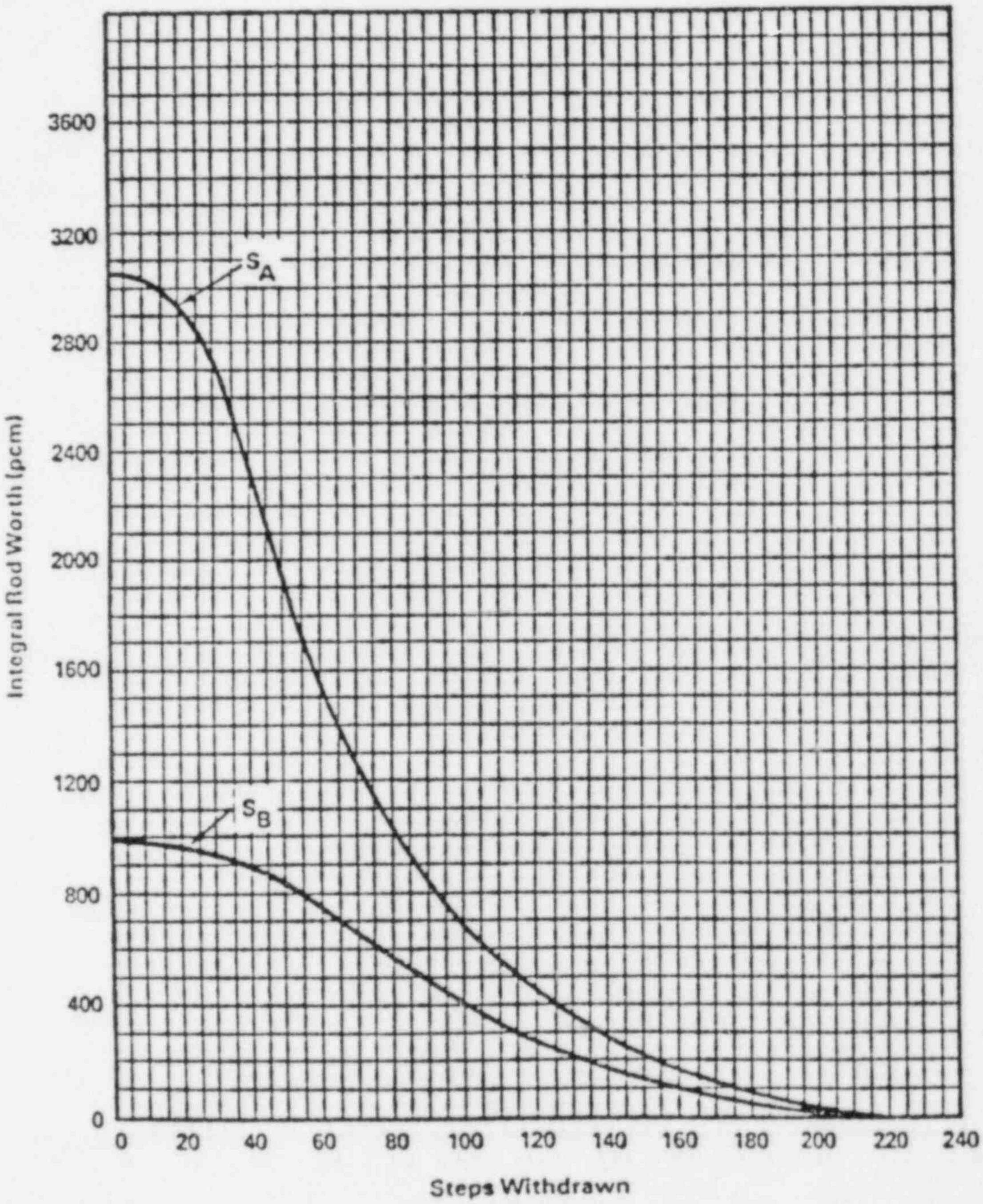


FIGURE 5.2

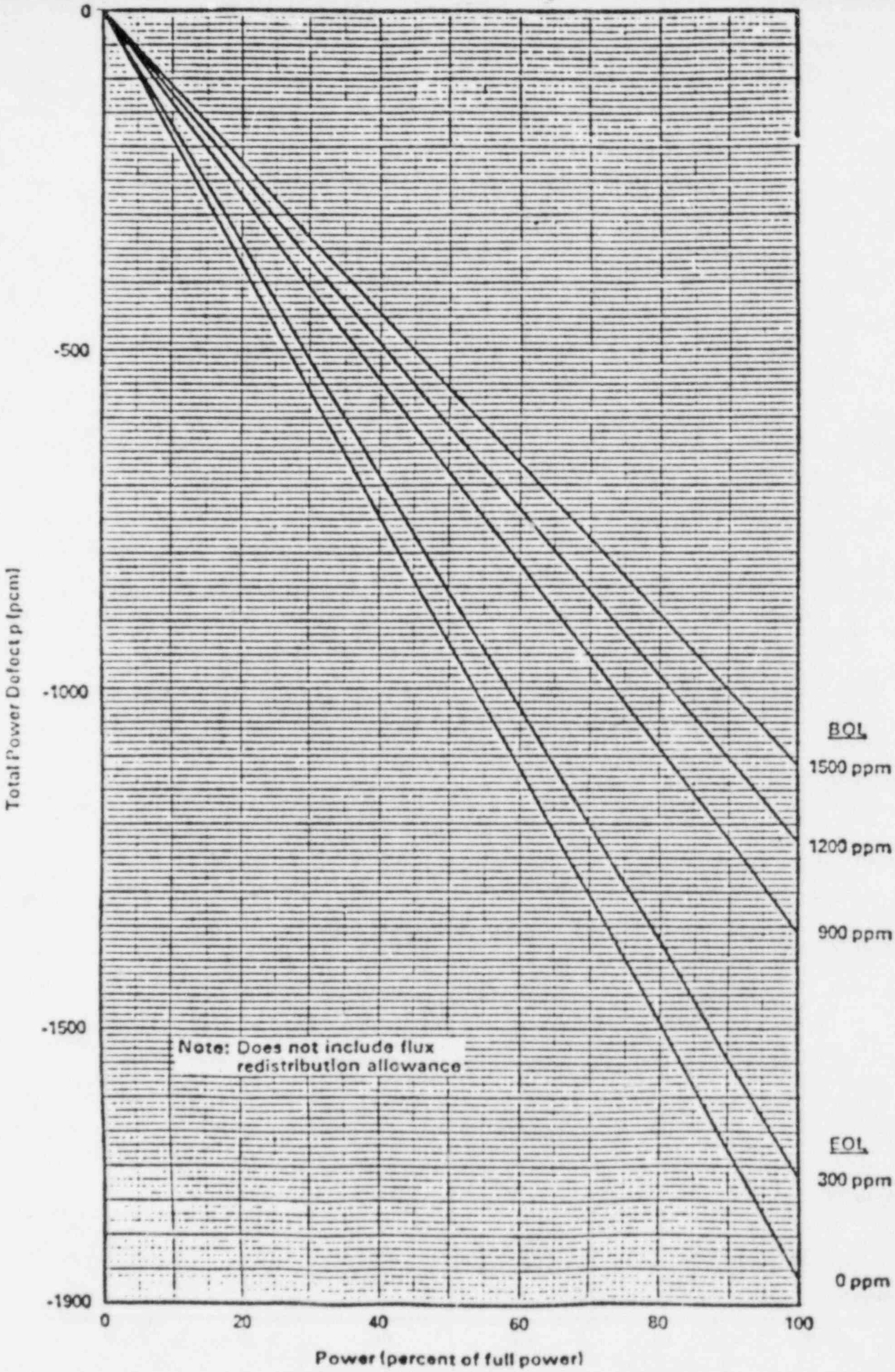

0
-500
-1000
-1500
-1900
Total Power Defect p (pcm)
BOL
1500 ppm
1200 ppm
900 ppm
EOL
300 ppm
0 ppm
Note: Does not include flux redistribution allowance
0
20
40
60
80
100
Power (percent of full power)

FIGURE 5.3

U.S. NUCLEAR REGULATORY COMMISSION

XENON REACTIVITY FOLLOWING A PLA[illegible]T [illegible]RIP FROM 25%, 50%, 75%, AND 100% POWER [illegible]

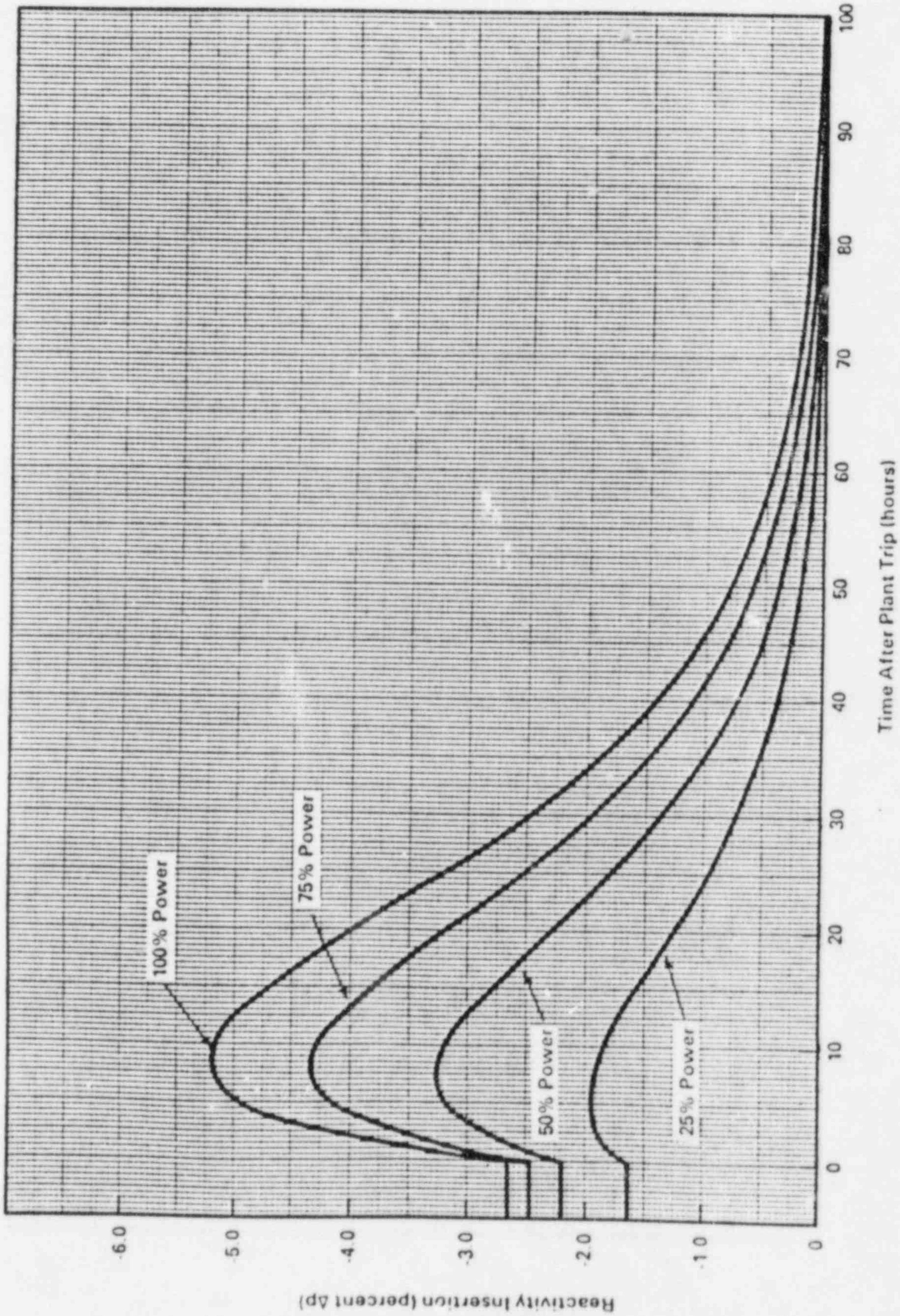
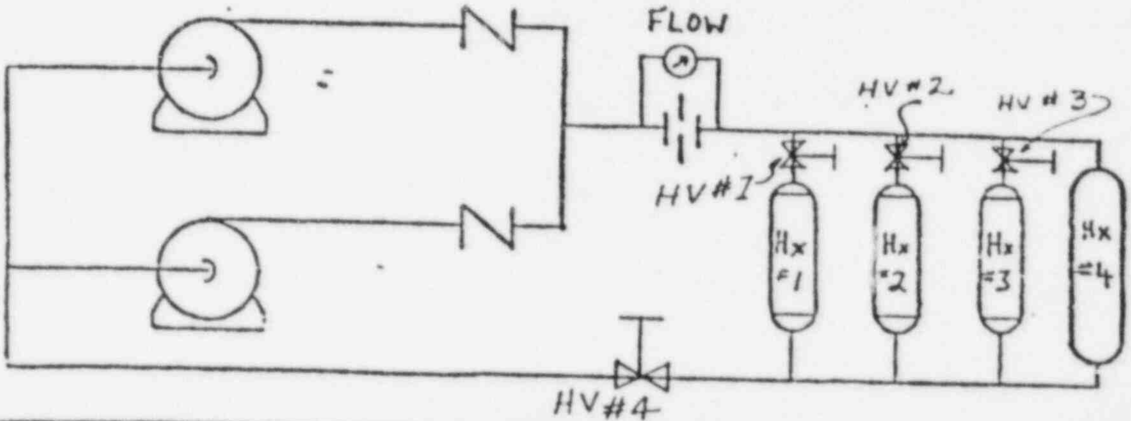


FIGURE 5.4

ASSUMPTIONS:

1. The two pumps are identical, centrifugal, constant speed pumps.
2. The friction pressure losses through the lines, open valves, check valves, and flow meter are negligible.
3. Heat exchangers numbers 1, 2, and 3 are identical.



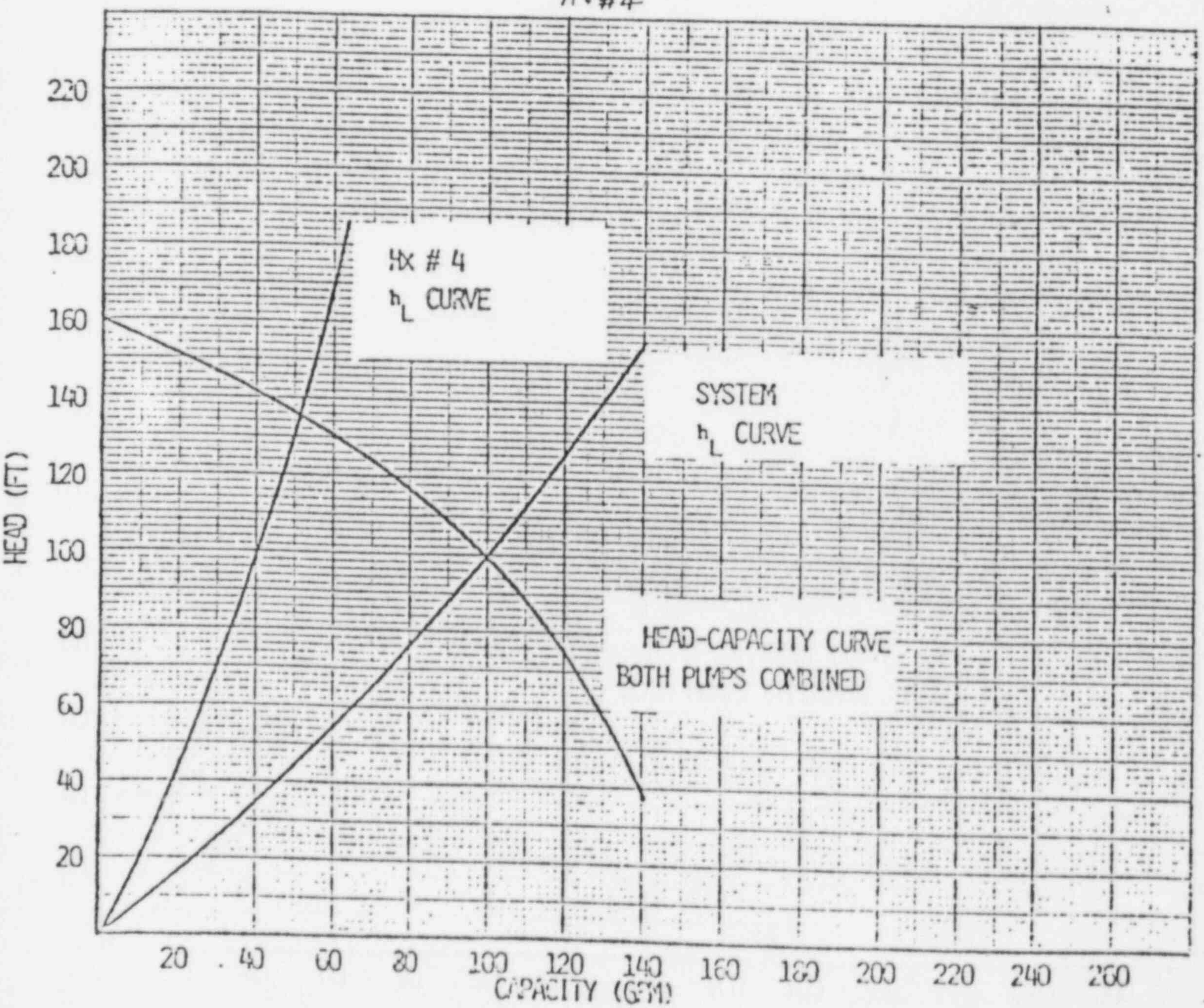


FIGURE 5.5

6. Plant Systems Design, Control, and Instrumentation (25.00)

Question 6.01 (2.0)

List four interlocks or conditions which must be met to allow the operator to open the letdown isolation valve (AOV-427) from the MCB?

Question 6.02 (1.0)

What is the maximum allowable letdown flow rate and what is the reason for this limit?

Question 6.03 (4.0)

Refer to figure 6.1

a. Indicate the valve positions [open, closed, or modulated (partially open)] of valves FCV-110A, FCV-110B, FCV-110C, and FCV-111 for the following positions of the makeup system mode selector switch:

1. BORATE (1.0)
2. DILUTE (1.0)
3. AUTO (1.0)

b. If the normal immediate or emergency boration path is not available, what alternate path would you use? (1.0)

Question 6.04 (2.5)

List the emergency diesel trips that will protect the diesel engine when there is no SI signal. Identify which of these will trip the engine with an SI signal present.

Question 6.05 (2.0)

Describe the breaker and relay actions that take place when the main generator trips.

Question 6.06 (3.0)

On figure 6.2, circle the valves that immediately receive an automatic signal to operate when a Safety Injection Actuation occurs. Also place an "O" or a "C" adjacent to the circles to indicate whether the automatic signal is an "open" or "close" signal. Assume that the plant was initially at the normal full power condition.

Ginna Category 6 questions continued on next page.

Ginna Category 6 questions continued.

Question 6.07 (1.5)

What control actions automatically occur as a result of a containment spray initiation signal (P signal)?

QUESTION ~~6.07~~ 6.08 (2.50)

List two safety related reasons for delaying the main generator trip for approximately 60 seconds following most turbine trips.

Question 6.09 (3.0)

Relay 20 can be called the condenser steam dump arming relay. Two permissives and an arming signal are required to energize relay 20.

a. List the two (2) permissives (include setpoints and coincidences where applicable). (1.0)

b. List the three (3) arming signals, any of which will, in conjunction with the two above permissives, energize relay 20. Include setpoints and coincidences where applicable. (1.5)

c. What operator action should be taken after the condenser steam dump valves close following an automatic dumping action (Relay 20 has been energized)? (0.5)

Question 6.10 (1.5)

Following a reactor trip, the recorder trace of one of the intermediate range detectors levels out at 10^{-9} amps:

a. Is the detector likely to be overcompensated or undercompensated? (0.5)

b. What is the compensating voltage used for? (0.5)

c. What additional operator action will be required in the above case to complete the shutdown? (0.5)

Ginna Category 6 questions continued on next page.

Ginna Category 6 questions continued.

QUESTION ~~6.02~~ 6.11 (2.00)

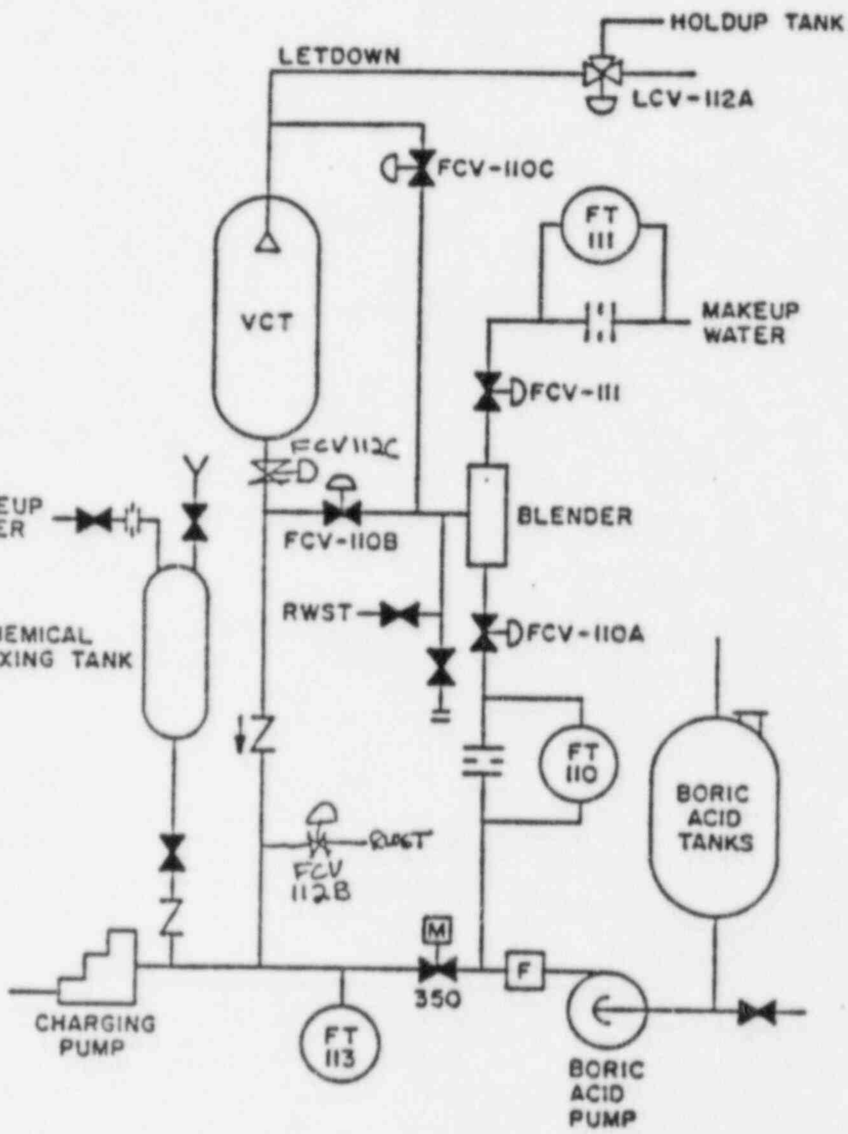
Answer the following questions regarding the OT Delta T trip:

a. Indicate whether the OT Delta T setpoint will increase, decrease, or not change if the following changes occur. Consider each change independently. Briefly justify each answer.

1. The pressurizer spray valve fails open. (0.5)
2. An overdilution of the RCS occurs with rods in manual. (0.5)
3. An overdilution of the RCS occurs with rods in auto. (0.5)

b. Briefly describe "lead-lag compensation" and list which OT Delta T ~~setpoint(s)~~ input parameters is/are affected by it. (0.5)

End of Ginna Category 6 questions.



MAKEUP CONTROL SYSTEM

FIGURE 6.1

RGE-VC-6
REV-2

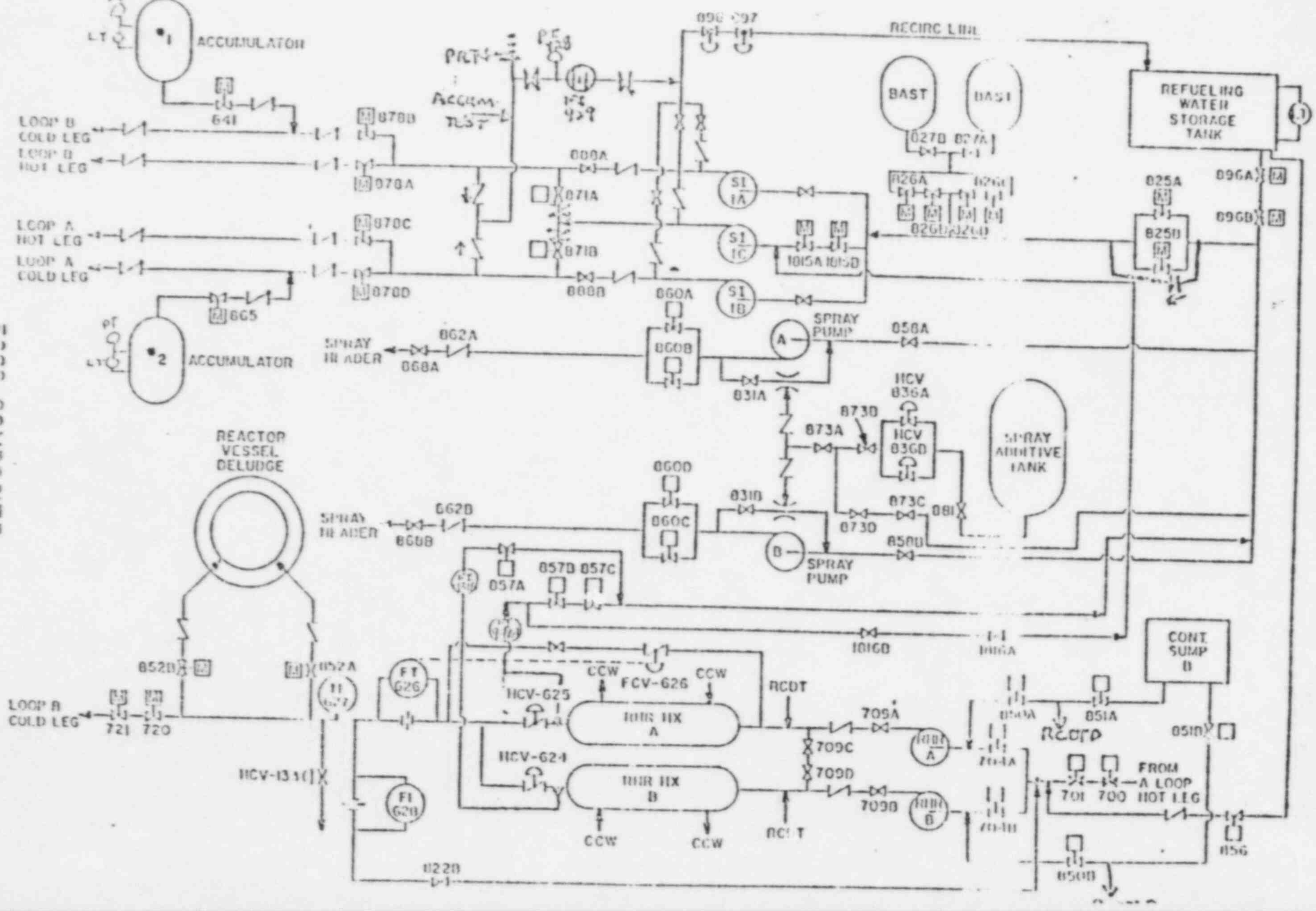


FIGURE - 6.2

ECCS COMPOSITE

7. Procedures - Normal, Abnormal, Emergency, and Radiological Control (25.0)

Question 7.01 (3.0)

According to procedure E-5, Control Room Inaccessibility, what are the emergency stations and primary responsibilities of the following personnel:

a. Shift supervisor
b. Head control operator
c. Control operator
d. Primary side auxiliary operator.

Question 7.02 (3.0)

In accordance with procedure E-1.5, VOID FORMATION IN THE RCS, there are six symptoms that indicate a potential approach to inadequate core cooling. List these six symptoms.

Question 7.03 (3.0)

a. In accordance with procedure E-20, IMMEDIATE BORATION, list the two symptoms or conditions that require immediate boration by opening MOV-350. (1.0)

b. What four immediate operator actions are required in response to the above symptoms or conditions? (2.0)

Question 7.04 (3.5)

What are the required immediate operator actions in procedure E-26.1, REACTOR TRIP-TURBINE NOT LATCHED?

Question 7.05 (3.0)

What is the intent of or what is to be accomplished by the implementation of the immediate operator actions of E-37.3, SPENT FUEL ASSEMBLY OR ROD CONTROL CLUSTER DROPPING OR COLLISION WITH ANOTHER OBJECT?

QUESTION ~~7.01~~ 7.06 (3.00)

Answer the following questions regarding RCP operation:

a. Why should the RCP #1 seal bypass valve never be opened during a loss of seal injection casualty while operating at power. ~~(1.0)~~ (1.2)

b. Under what general plant condition and for what purpose is the RCP #1 seal bypass valve used? ~~(1.0)~~ (1.2)

c. Why is continued RCP operation without seal injection flow undesireable? ~~(0.5)~~ (0.6)

~~d. How would you expect the following indications to change (increase, decrease, no change) following a loss of seal injection flow?~~
~~1. #1 seal leakoff temperature (0.25)~~
~~2. #1 seal leakoff flow (0.25)~~

deleted

QUESTION ~~7.08~~ 7.07 (3.00)

Answer the following questions regarding a LOCAL RADIATION EMERGENCY.

a. Under what conditions may a radiological incident be classified a LOCAL RADIATION EMERGENCY? (1.0)

b. Where should personnel in the affected area go after being monitored for contamination? (0.5)

c. What are the responsibilities of the on-duty Shift Supervisor after returning to the control room and evaluating plant conditions? List three out of a possible four. (1.5)

Question 7.08 (3.0)

In some situations, during a radiological emergency, certain individuals are allowed to receive doses greater than the normal exposure limits. For personnel participating in the following situations, what is their maximum allowed dose and who authorizes their participation?

a. Members of survey teams and those assisting in personnel decontamination. (1.0)

b. Life saving actions such as the removal of an injured person and providing first aid, ambulance service, or medical treatment. (1.0)

c. Performing assessment actions or undertaking corrective actions to prevent substantial loss of property. (1.0)

Question 7.09 (0.5)

Under your emergency plan, who may relieve the Shift Supervisor as Emergency Coordinator?

End of Ginna Category 7 questions.

8. Administrative Procedures, Conditions, and Limitations (25.00)

Question 8.01 (2.5)

By definition, containment integrity exists when five conditions are met. What are they?

Question 8.02 (2.5)

What are the following reactor trips specifically designed to protect against?

a. Power range high flux-high level trip. (0.5)

b. Low pressurizer pressure. (0.5)

c. Low RCS flow rate. (0.5)

d. High pressurizer level. (0.5)

e. Low-low S/G water level. (0.5)

Question 8.03 (2.0)

Ginna Technical Specifications limit the allowable RCS leakage rates. In the specific case of RCS leakage into containment, list four methods that could be used in detecting the leakage:

Question 8.04 (3.0)

In order to meet the Tech. Specs. pertaining to the capability of supplying boric acid to the RCS, three flow paths are required. Describe these three flow paths and their sources of boric acid.

Question 8.05 (2.0)

In the basis for power distribution limits (T.S. 3.10.2) the following statement is made: "For normal operation, it is not necessary to measure the hot channel factors. Instead it has been determined that, provided certain conditions are observed, the hot channel factor limits will be met." What are these 4 conditions?

Ginna Category 8 questions continued on next page.

Ginna Category 8 questions continued.

Question 8.06 (1.0)

Ginna T.S.3.7, AUXILIARY ELECTRICAL SYSTEMS, requires that 10,000 gallons of Diesel fuel is available. What is the basis for this requirement?

Question 8.07 (3.0)

What are the three provisions under which temporary changes to written procedures can be made according to Tech. Specs?

Question 8.08 (1.0)

What additional safeguard(s) are required by Tech. Specs. to prevent unauthorized entry into a HIGH RADIATION AREA with a radiation intensity of 12 ~~m~~ rem/hr. as compared to one with 900 m rem/hr?

delete ↑

QUESTION ~~8.01~~ 8.09 (3.00)

Answer the following questions regarding the release of radioactive effluents.

a. What three Tech Spec conditions must normally be met prior to or during a batch radioactive waste release? (1.8)

b. What two Tech Spec conditions must be met during a gaseous waste release to the plant vent? (1.2)

QUESTION ~~8.02~~ 8.10 (3.00)

Answer the following questions regarding refueling operations:

a. What is the Tech Spec limit on shutdown margin for being in the refueling mode and what is it's basis? (1.0)

b. What are the requirements for source range NI's during refueling when core geometry is being changed? (1.0)

~~c. What is the objective of the Tech Spec requirements during handling of irradiated fuel assemblies in the operating floor area of the of the auxillary building? (1.0)~~

delete ↑

Question 8.11 (2.0)

Administratively the sequence of steps in procedures may be changed if any one of two criteria are met without resorting to a procedural change (as per Tech Specs). What are the two criteria?

End of Ginna Category 8 questions

$1Ci = 3.7 \times 10^{10} d/s$

$\alpha_D = -1 \times 10^{-5} \frac{\Delta K}{K} / °F$

$\alpha_V = -1 \times 10^{-3} \frac{\Delta K}{K} / \%$ voids

$\alpha_M = -1.0 \times 10^{-4} \frac{\Delta K}{K} / \% °F$

$\alpha_P = -4.5 \times 10^{-4} \frac{\Delta K}{K} / \%$ power

$I(t) = Io\ e^{-\lambda t}$

$T1/2 = \ln(2)/\lambda$

$Cp = (CP_{base})\ (Ks)\ (K_A)$

$$\frac{\rho_1}{\gamma} + Z1 + \frac{V_1^2}{2g} + ha - hr - h_L = \frac{P^2}{\delta} + Z_2 + \frac{V_2^2}{2g}$$

$$\frac{V_2}{V^1} = \frac{(\Delta P_2)^{1/2}}{(\Delta p_1)}$$

$\dot{Q} = MCp\ \Delta t$

$\Delta\rho = f \frac{L}{D} \frac{\rho V^2}{2g_c}$

$f = 64/Re$

$\rho = \frac{k(eff) - 1}{K(eff)}$

$$\frac{1}{M} = \frac{CR1}{CR2} = \frac{1 - K(eff)2}{1 - K(eff)1}$$

$\dot{Q} = M\Delta h$

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

$\lambda = 0.1$

$h_L = km\dot{V}^2$

$P = P_o\ 10^{SUR(t)}$

$SUR = \frac{26.06}{\tau}$

$P = P_o\ e^{t}/\tau$

$A(x) = A_o e^{-\mu x}$

$M = 1/(1-k) = \frac{CR_1}{CR_0}$

$N(t) = No\ e^{-\lambda T}$

$\alpha_r \propto (L_f + L_s) \frac{(\phi rod)^2}{(\phi avg)}$

$n = \nu/(1 + d)$

$P = \Sigma\ \phi\ \nu/(3.7 \times 10^{10})$

$\tau = (\beta - \rho)/\lambda\rho$

$\tau = \bar{\ell}/\rho + (\beta - \rho)/\lambda\rho$

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

$v = v_f + xv_{fg}$

$H = xh_g + (1-x)\ h_f$

$S = xS_g + (1-x)\ S_f$

1 in = 2.54 cm

1 gal. = 3.785 liters

1 kg = 2.205 lb

$N = \rho A_0/A$

17.58 watts = 1 BTU/min
1psi = 6.895 Pa
1psi = 2.036 " H_g (@ 0C)
1psi = 27.68 " H^2O (@ 4C)

$\bar{\beta} = .0071$

$\bar{\ell} = 2 \times 10^{-5}$ sec

$\ell d = 12.5$

$RR = \Sigma_f \phi_{th}$

$SCR = \frac{S}{1 - Keff}$

$\rho = \frac{\beta}{\lambda\tau + 1}$

Reactor thermal power = $(h_2 - h_1)$ x steam flow rate

$K = \frac{1}{1 - \rho}$

5. Theory of Nuclear Power Plant Operation, Fluids and Thermodynamics (25.00)

Answer 5.01 (5.0)

a. The things affecting reactivity immediately after the trip will be rod position changes and the power defect. All rods except D bank go from all out to bottomed positions and bank D goes from 165 steps to bottomed. The rod worths are as follows, from figures 5.1 and 5.2.

rod bank	worth (pcm)	
SA	-3050	(0.1)
SB	-1000	(0.1)
A	-1250	(0.1)
B	-2030	(0.1)
C	-1220	(0.1)
D (-1465 + 100) (165 steps wdn.)	-1365	(0.2)
TOTAL ROD WORTH INSERTED	-9915	(0.3)

From figure 5.3 read the power defect as -1350 pcm at 100% power. This means that a + 1350 pcm change occurs after a trip. (0.4)

Total reactivity change = -9915 + 1350 = -8565 pcm (0.2)

$$K_{eff} = \frac{1}{1 - \rho} = \frac{1}{1 - (-.08565)} = \frac{1}{1 + 0.0856} = \underline{0.9211} \quad (0.4)$$

b. RODS (from figure 5.1)

D bank position remaining worth before trip + 100 pcm.
D bank position remaining at ECP + 500 pcm.

500 - 100 = 400 pcm dilution required. (0.5)

Xenon reactivity (From figure 5.4)

equilibrium value at trip -2650 pcm
value 4 days after trip ~~- 900 pcm~~ 0 pcm

2650 - ~~900~~ 0 = ~~+1750~~ +2650 pcm added (must borate) (0.5)

Ginna Category 5 answers continued on next page.

Answer 5.01-b (continued)

Power Defect (from figure 5.3)

+1350 pcm added (must borate) (0.25)

1350 + ~~1750~~ 2650 - 400 = ~~2700~~ 3600 pcm reactivity reduction required. (0.25)

$\frac{2700 \text{ pcm}}{10.0 \text{ pcm/ppm}}$ = ~~270~~ 360 ppm boration required. (0.25)

New boron concentration = 900 + ~~270~~ 360 = ~~1170~~ 1260 ppm (0.25)

c. SUR = $26/\tau$

1.0 = $26/\tau$; τ = 26 sec. (0.25)

$$\rho = \frac{\beta}{\lambda\tau + 1}$$

$$\rho = \frac{.007}{(.08)(26)+1} = \frac{.007}{3.08} = .00227 \text{ or } \underline{227 \text{ pcm}} \quad (0.25)$$

From figure 5.1, find D bank position for a worth of (500 pcm - 227 pcm = 273 pcm
D bank position would be about 130 steps. (0.5)

Ref: Energy Training Corporation (ETC) manual on Reactor Theory - Chapter 4, page 29 - Chapter 5, page 61 - Chapter 6, page 12 - Chapter 7, pages 19 and 41.

Answer 5.02 (2.0)

When a rod is stuck out with all other rods inserted, that rod is exposed to a much higher flux than the flux in the rest of the core. Because rod worth is a function of the relative flux difference between that adjacent to the rod and the core average, the rod could be worth about 1000 pcm, which is much more than normal. (1.0)

If a rod is dropped, while the rest of the rods remain out, the opposite to the above happens. The flux is depressed adjacent to the dropped rod relative to the flux in the rest of the core and so the dropped rod could be worth about 200 pcm. (1.0)

Ref: ETC Reactor Theory Manual, Chapter 7, page 19.

Ginna Category 5 answers continued on next page.

Ginna Category 5 answers continued.

Answer 5.03 (3.5)

1. Turbine control valves open wider thus decreasing the resistance to steam flow which causes the mass flow rate of the secondary to increase and steam pressure to decrease. (0.5)

2. Since the S/G is at saturated conditions, a decrease in pressure will cause a decrease in temperature (Tstm). (0.5)

3. Lowering Tstm increases the delta T across the S/G U-tubes, thereby transferring more energy from the primary coolant. (0.5)

4. As more energy is removed from the primary, Tave decreases. (0.5)

5. As Tave decreases, positive reactivity is added to the core by MTC, and reactor power increases. (0.5)

6. The system will inherently reach a new steady state through the actions of the MTC and fuel temperature coefficient of reactivity. (0.5)

Ref. ETC Reactor Theory Manual, Chapter 5, page 11, page 19 and page 38; also manual on Thermodynamics, fluid flow, and heat transfer, Chapter 8, pages 17 and 28; also from the same manual, Chapter 9, pages 6 and 22.

ANSWER ~~5.02~~ 5.04 (1.00)

SUR at EOL will be greater than SUR at BOL (0.25) because beta-eff becomes less at EOL (0.25) due to the buildup of Pu-239 and Pu-241 (0.5).

Ref. ETC Reactor Theory Manual, Chapter 4, pages 12-18.

ANSWER ~~5.03~~ 5.05 (1.50)

a. more severe
b. less severe
c. less severe

Ref. ETC Reactor Theory Manual, Chapter 5, page 30.

Ginna Category 5 answers continued on next page.

ANSWER ~~5.04~~ 5.06 (3.00)

1. Flux increase in region A burns out Xe-135 faster than it is being produced by I-135. For constant reactor power, this causes a net shift in flux from region B into region A. (0.5)
2. The flux decrease in region B causes Xe-135 to increase which further decreases the flux in this region. (0.5)
3. The combined effect of 1. and 2. above is to cause a disproportionate shift in power (greater than equilibrium) into region A. (0.5)
4. In region A, Xe will eventually increase to be in equilibrium with the higher flux level, and in region B will decrease to be in equilibrium with the lower flux level. This lowers region A flux and raises region B flux and thereby starts the oscillation. (0.5)

REFERENCE
ETC Reactor Theory Manual Chapt. 6 pg. 16

Answer 5.07 (2.0)

System parameters

1.	Primary coolant temperatures.	(0.5)
2.	Primary system pressure.	(0.5)
3.	Primary coolant flow rate.	(0.5)
4.	Reactor power level.	(0.5)

Ref. ETC Manual on Thermodynamics, Heat Transfer and Fluid Flow, Chapter 9, page 32.

Answer 5.08 (2.0)

a. 1. Solution using the Mollier chart. At the intersection of the 825 psia pressure line and the saturated vapor line, read 1199 BTU/LBM enthalpy. From the above point, trace the constant entropy line vertically downward to its intersection with the 2 psia pressure line and read the enthalpy of 819 BTU/LBM. The change in enthalpy = 1199 - 819 = 380BTU/LBM

Ginna Category 5 answers continued on next page.

Answer 5.08 (continued)

a. 2. Solution using steam tables. Remember that the isentropic process is a constant entropy process. Find in the steam tables, 100% quality steam at 825 psia pressure, entropy = 1.4129 and enthalpy = 1198.7 BTU/LBM. From steam table, at 2 psia, entropy of saturated water is 0.1750 and SFG = 1.7450 while enthalpy of sat. liquid is 94.03 and hfg = 1022.1.

Find the steam quality, x, at 2 psia and entropy 1.4129.

$$x = \frac{1.4129 - 0.1750}{1.7450} \times 100 = 70.94\%$$

The enthalpy at 2 psia = 94.03 + (1022.1 x 0.7094) = 819 BTU/LBM.

The enthalpy change = 1198.7 - 819 = 379.7 BTU/LBM.

Either solution 1 or 2 is acceptable for 1.5 points.

b. 3. (decrease) (0.5)

Ref. Chapter 2, Thermo and Heat Transfer Text

ANSWER ~~5.08~~ 5.09 (2.00)

a. no noticeable effect - heat transfer area of S/G U-tubes is unaffected. (0.5)

b. hinder - rapid cooldown of reactor coolant in S/G U-tubes forming a cold water slug. (0.5)

c. help - greater boiling and heat removal in S/G. (0.5)

d. help - greater subcooling. (0.5)

→ hindered - due to sustained cold water slug.

→ helped - due to better coverage of S/G U-tubes.

Ref: Thermo text paragraph 9.6 pp. 42-45.

Ginna Category 5 answers continued on next page.

Answer 5.10 (2.0)

a. Since the pumps are identical, one pump will produce half the flow rate of two pumps operating at a given head. (0.5)

On figure 5.5, at various pump heads, select points at flows half of those on the head-capacity curve for two pumps combined and plot a new head capacity curve for one pump operation through these points. (0.5) (see figure 5.5)

The intersection of this new pump curve and the system head loss curve is the operating point for one pump operation . (0.5)

The system flow rate is approximately 65 gpm. (0.25)

and the pump head is approximately 60 feet. (0.25)

b. Since all the flow is through HX4, the system will be operating on the HX4 head loss curve. At the intersection of the 2 pump head-capacity curve and the HX4 head loss curve, read the pump head as <u>135</u> feet. (1.0)

Ref. Ginna Thermodynamics, Heat Transfer, and Fluid Flow Book, Section 6, page 35, and Section 7, page 5.

End of Ginna Category 5 answers.

ASSUMPTIONS: 1. The two pumps are identical, centrifugal, constant speed pumps.
2. The friction pressure losses through the lines, open valves, check valves, and flow meter are negligible.
3. Heat exchangers numbers 1, 2, and 3 are identical.

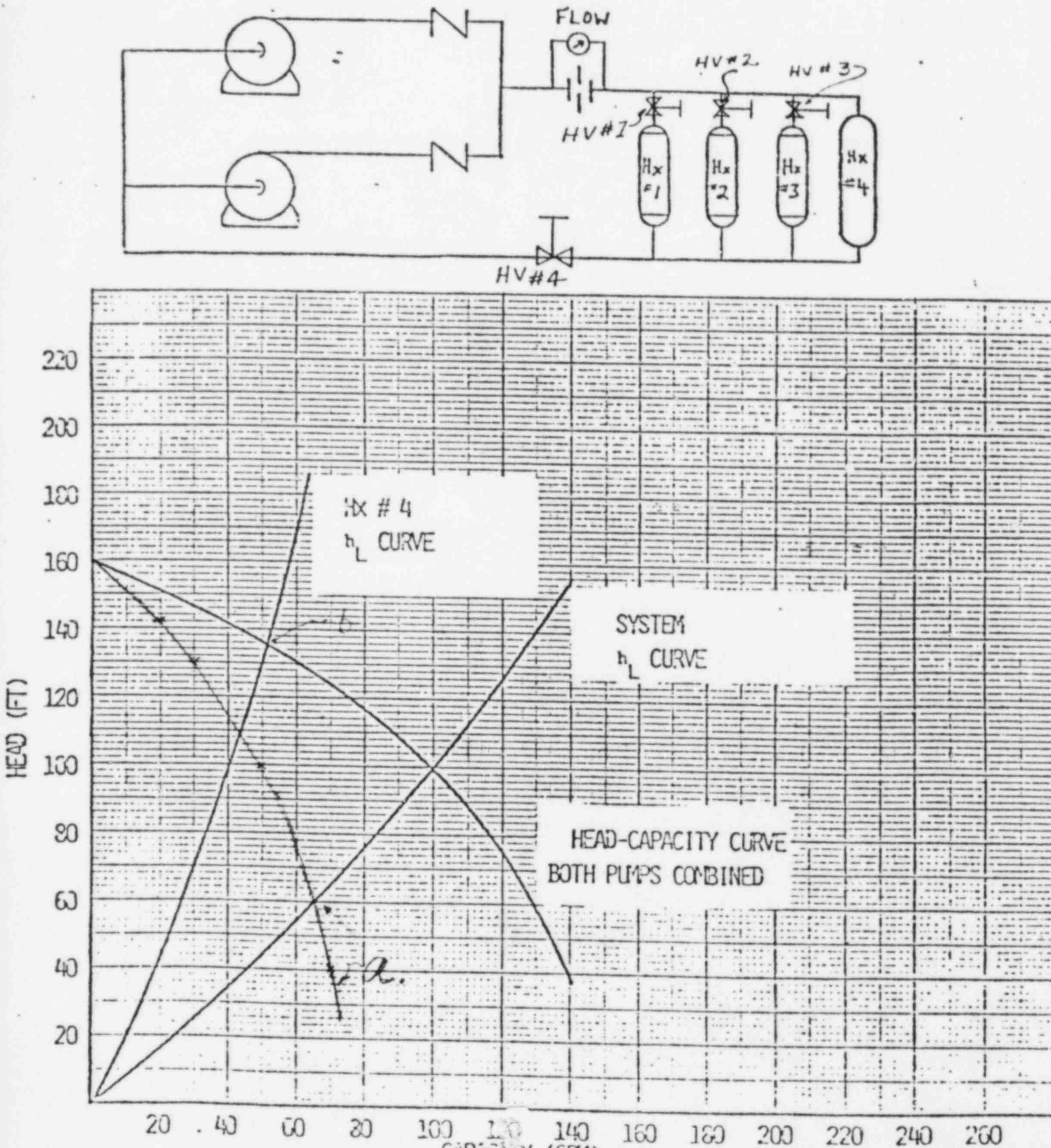


FIGURE 5.5

6. Plant Systems Design, Control, and Instrumentation (25.00)

Answer 6.01 (2.0)

~~1. All letdown orifice isolation valves (AOV-200A, B, and 202) are closed. (0.5)~~

~~2. The pressurizer level is greater than 10.6 percent. (0.5)~~

1. ~~3.~~ Proper control voltage is available to isolation valve AOV-427. ~~(0.5)~~ (0.66)

2. ~~4.~~ A containment isolation signal is not present. ~~(0.5)~~ (0.67)

3. ~~5.~~ Instrument air pressure is available. ~~(0.5)~~ (0.67) ~~(4 required)~~

Ref. RGE-16, Page 5.

Answer 6.02 (1.0)

The maximum allowable letdown flow rate is ~~60~~ 70 gpm. (0.5)

This limit is to prevent channeling of the resins in the demineralizers. (0.5)

Ref. RGE-16, page 9
P-3, Step 2.2.3

Answer 6.03 (4.0)

a.

	FCV-110A	FCV-110B	FCV-110C	FCV-111
1. BORATE	MODULATED	OPEN	CLOSED	CLOSED
2. DILUTE	CLOSED	CLOSED	OPEN	MODULATED
3. AUTO	MODULATED	OPEN	CLOSED	MODULATED

(Credit 1.0 point each for parts 1-3.)

b. An alternate emergency boration path is through an open FCV-110A and open manual valve ~~267~~ (356~~X~~) to the suction of the charging pumps. (1.0)

Ref. RGE-18, pages 2, 3 and 10; also schematics RGE-VC-6-1, -2, and -4
E-20 Step 3.1

Ginna Category 6 answers continued on next page.

OR thru V-110C to VCT to CCP
thru V-112B from RWST
thru V-358

Answer 6.04 (2.5)

1. Diesel engine overspeed. (0.3)

2. Low lube oil pressure. (0.3)

3. Reverse power relay. (0.3)

4. Overcurrent relay. (0.3)

5. Operator depresses local stop button. (0.3)

Items #1 and #2 will trip the engine with SI signal present. (1.0)

Ref. RGE-8, page 19.

Answer 6.05 (2.0)

When the main generator trips, the generator output breakers (1G1372 and 9X1372) are tripped open (0.5) and the exciter field breaker is tripped. (0.5) The unit auxiliary transformer 11 is de-energized and ~~an undervoltage relay on~~ buses 11A and 11B will instantaneously trip open the normal supply breakers (0.5) and close the bus tie breaker to buses 12A and 12B respectively (0.5) to keep buses 11A and 11B energized.

Ref. RGE-5, page 10.

Answer 6.06 (3.0)

See figure 6.2 The following valves receive signals and they are all "open" signals

826 A, B, C, & D
852 A & B
1815 A & B
878 B & D
841 & 865

Each of the above valves circled will be worth 0.2 points and each accompanying correct "O" or "C" will be worth 0.05 points. Any additional valves circles will detract from the score.

Ref. RGE-27, pages 14-17.

Ginna Category 6 answers continued on next page.

Answer 6.07 (1.5)

1. Both containment spray pumps start. (.5)

2. Motor operated spray ring header isolation valves (MOV860 A, B. C. & D) open. (0.5)

3. Air operated additive eductor suction valves (HCV836 A & B) to the NaOH tank open. (0.5)

Ref. RGE-24, page 12.

ANSWER ~~6.01~~ 6.08 (2.50)

a. An immediate turbine trip - generator trip coincident with a failure of auto bus transfer could result in a loss of forced reactor coolant flow which would be more severe than that reported in the the FSAR. If the 60 sec. time delay occurs, the loss of flow is not considered serious since the reactor will have been shut down for that time. (1.3)

b. On a major LOCA (double end shear of cold leg), the RCP's could overspeed and cause flywheel destruction and missile hazards inside containment. During the time delay, RCP's will be locked to 60 Hz grid frequency. (1.2)

REFERENCE
RGE-5 pp. 10 and 11

Answer 6.09 (3.0)

a. 1. Condenser vacuum must be at least 20 inches vacuum as sensed by 2/2 pressure switches in the condensers (CONDENSER AVAILABLE). (0.5)

2. At least one circulating water pump must be running (CIRCULATING WATER RUNNING), sensed by pump breaker contacts. (0.5)

b. 1. The steam dump mode selector switch is in MANUAL. (0.5)

2. The steam dump mode selector switch is in AUTO, and TURBINE TRIP exists as sensed by 2/3 auto stop oil pressure switches less than ~~[illegible]~~ psig or 2/2 turbine main stop valves shut. (0.5)

45psig ↑

3. The steam dump selector switch is in AUTO, and P-4 is energized (partial loss of turbine load greater than a 10% step decrease or greater than a 10% decrease in 2 minute) (0.5)

c. Reset or deenergize RELAY 20 using the steam dump RESET-AUTO-MANUAL switch on the MCB. (0.5)

Ref. RGE-45, pages 4 and 5.
ARP AR-D-24

Ginna Category 6 answers continued on next page.

Answer 6.10 (1.5)

a. Undercompensated. (0.5)

b. It counteracts the signal produced by the gamma radiation so that only the neutron level is indicated. (0.5)

c. The operator should manually reenergize the source range instruments. (0.5)

Ref. RGE-33, pages 16 and 17.

ANSWER ~~6.02~~ 6.11 (2.00)

a. 1. decreases - due to lowering pressure (0.5)
   2. decreases - due to rising average RCS temperature (0.5)
   3. no change - inward rod motion creates a more negative axial flux difference. A penalty is applied only for delta I greater than +21%. (0.5)

b. Lead-lag compensation is applied to the RCS temperature input to OT Delta T (0.25)
   This means the trip will occur sooner for a faster temperature rate of increase. (0.25)

REFERENCE
RGE-35 pg. 17
RGE-20 pg. 7
T/S pg. 2.3-2

7. Procedures, Normal, Abnormal, Emergency, and Radiological Control (25.0)

Answer 7.01 (3.0)

a. The SHIFT SUPERVISOR will supervise the immediate and subsequent actions of those individuals below him and provide other guidance or assistance as necessary. (0.75)

b. The HEAD CONTROL OPERATOR will report to the control station near the auxiliary feedwater pumps and begin directing the manual operations required for the hot shutdown, Xenon free condition. (0.75)

c. The CONTROL OPERATOR will report to the charging pump room, being knowledgeable of the fact that he is in a high radiation area, and manually handle the controls at this station as required by procedure. (0.75)

d. The PRIMARY SIDE AUXILIARY OPERATOR will report to the boric acid storage tank area for boric acid injection operations required for the Xenon free hot shutdown condition. (0.75)

Ref. Procedure E-5.

Answer 7.02 (3.0)

1. Core thermocouple temperatures reach or exceed saturation for existing RCS pressure (approximately 700°F). (0.5)

2. Low running current on running RCP's. (0.5)

3. Loss of, low, or erratic RCS flow with RCP running. (0.5)

4. Over temperature delta T set point decrease. (0.5)

5. Erratic or high pressurizer level following either a loss of coolant, a loss of coolant flow, a loss of heat sink, or rapid depressurization. (0.5)

6. Annunciator alarm AA-8, SUBCOOLING MARGIN. (0.5)

Ref. Procedure E-1.5.

Ginna Category 7 answers continued on next page.

Answer 7.03 (3.0)

a. 1. An uncontrolled cooldown of the reactor coolant system following a reactor trip. (0.5)
   2. An unexplained or uncontrolled reactivity increase. (0.5)

b. 1. Start either boric acid transfer pump. (0.5)

   2. Open MOV-350 and record the time opened and the flow rate on FI-113. (0.5)

   3. Determine the amount of boric acid desired to be added. (0.5)

   4. Stop the boric acid flow and the boric acid transfer pump when the proper amount has been added or when control rods start to move out. (0.5)

Ref. Procedure E-20.

Answer 7.04 (3.5)

(7 parts at 0.5 points each)

1. Verify all control rods are fully inserted. Refer to procedure E-20, IMMEDIATE BORATION, if all control rods are not known to be fully inserted.

2. If the plant is in a condition for which a reactor trip is warranted and an automatic reactor trip has not occurred, manually trip the reactor.

3. Verify that average coolant temperature is approaching the no load value of 547°F.

4. Verify that the main feedwater valves are closed if their controller is in AUTOMATIC and either Tavg. is less than or equal to 554°F or S/G level is greater than 67%.

5. If the main feedwater valves are in MANUAL, exercise extreme caution with feedwater control so as not to reduce the coolant temperature below 547°F or increase the S/G level above 67%.

6. If on manual steam dump, adjust the pressure setting of the controller to maintain the reactor coolant temperature slightly above 547°F.

7. Close air ejector and gland sealing steam valves to stop cooldown. If necessary, close MSIV's (Return switches to open).

Ref. Procedure E-26.1.

Ginna Category 7 answers continued on next page.

Ginna Category 7 answers continued.

Answer 7.05 (3.0)

Have personnel in the vicinity of the accident leave the area and gather in a group in the change area if the accident occurred in the reactor cavity or gather in a group at the East end of the auxiliary building if the accident occurred in the spent fuel pit or transfer canal. These groups should remain in the above locations until released by Health Physics. (1.0) Notify the control room and the control operator will notify Health Physics and evacuate the area. (1.0) Monitor the ventilation from the affected area using the applicable radiation monitors and evaluate the conditions for site contingency reporting per SC-100, GINNA STATION EVENT EVALUATION AND CLASSIFICATION. (1.0)

OR: Limit offsite release (1.0), limit personnel exposure (1.0), provide proper notification (1.0).

Ref. Procedure E-37.3
FSAR 15.7.3.3

ANSWER ~~7.01~~ 7.06 (3.00)

a. The TBHX has a limited capacity which could be exceeded by the sum of normal seal leakage plus bypass flow at high pressure (0.~~5~~ .6) and thermal shock the pump shaft, bearing, and seal components. (0.~~5~~ .6)
b. Reduced plant pressure (0.~~5~~ .6) for the purpose of providing sufficient cooling flow to the pump radial bearing (0.~~5~~ .6)
c. This could lead to seal deterioration as a result of unfiltered seal supply water. (0.~~5~~ .6)
~~d. 1. increase (0.25) 2. increase (0.25)~~

REFERENCE
O-2.5 pg. 4 and E-23.4 pg. 1
~~EAF part d.~~

ANSWER ~~7.02~~ 7.07 (3.00)

a. no offsite effect or potential for effect (0.5)
normally no notification or action required by offsite agencies (0.5)
b. Lunch room in the Service Bldg. (0.5)
c. 1. Dispatch survey teams as necessary (0.5)
2. Isolate affected area (0.5)
3. Determine cause and restore conditions to normal if possible (0.5)
4. Inform Plant Supt. and Duty Engineer (0.5)

(3 required, 0.5 each)

REFERENCE
Section 5.1 of Ginna E-Plan
SC-205

OR: 1. An unexplained area radiation monitor alarm
2. Report of unexpected increase in airborne activity in a work area.
3. Report of radioactive spill over several square feet.
4. High flux at shutdown
5. When deemed necessary

(0.2 pts. each)

Ginna Category 7 answers continued.

Answer 7.08 (3.0)

a. 1 REM. unless the Emergency Coordinator or Health Physicist gives special permission to receive a larger dose. (1.0)

b. 75 REM. whole body. (The individual must volunteer for the assignment and) it must be authorized by the Emergency Coordinator, (1.0) except that emergency action need not be delayed due to lack of approval.

not asked for in question

c. 25 REM. Authorization is required from the Emergency Coordinator. (1.0) except that emergency action need not be delayed due to lack of approval.

Ref. RG&E Nuclear Response Plan, page 49.

A-1 pp. 12-13

Answer 7.09 (0.5)

The shift supervisor may be relieved by the first qualified, trained person to arrive at the TSC. This person shall be the Emergency Coordinator until relieved by the Plant Superintendent.

(may give credit for names out of SC-600)

Ref. RG&E Nuclear Response Plan, Pages 8 & 10.

SC-600

End of Ginna Category 7 answers.

8. Administrative Procedures, Conditions, and Limitations (25.00)

.nswers - Ginna 11/11/85 O. W. Burke

Answer 8.01 (2.5)

1. All non-automatic containment isolation valves that are not required to be open during accident conditions are closed and blind flanges are installed where required. (0.5)

2. The equipment door is properly closed and sealed. (0.5)

3. At least one door in each personnel air lock is properly closed and sealed. (0.5)

4. All automatic containment isolation valves are operable, secured in the closed position or isolated by closed manual valves or flanges as permitted by Limiting Conditions for Operation. (0.5)

5. The containment leakage rate satisfies T.S.-4.4 requirements. (0.5)

Ref. Ginna T.S. definitions, page 1-4, also RGE-21, page 11.

Answer 8.02 (2.5)

a. Prevents core power from reaching a value at which fuel pellet centerline melting would occur. (0.25) It acts during power excursions that are too rapid to be protected by temperature and pressure protective circuitry. (0.25)

b. Loss of coolant accident, DNB and to limit OTΔT range. (0.5)

c. Cladding failure from high temperature due to DNB. (0.5)

d. RCS overpressure backup to code safety valves. (0.25) It also protects the safeties against water damage. (0.25)

e. Loss of heat sink during a loss of main feedwater accident due to auxiliary feedwater pump starting delays. (0.5)

Ref. Tech. Spec., pages 2.3-5 through 2.3-7.
RGE-35 attachment

Answer 8.03 (2.0)

1. Read the containment air particulate monitor. (0.5)

2. Pead the radiogas monitor. (0.5)

Ginna Category 8 answers continued on next page.

Answer 8.03 continued

3. Read the containment humidity detector. (0.5)

4. A leakage detection system in containment, collects and measures the moisture condensed from the containment atmosphere by cooling coils of the main recirculation units. , (0.5)

5. Sump pump actuation cycle. (0.5) (4 required)

Ref. Basis for leakage T.S., page 3.1-26,27

Answer 8.04 (3.0)

1. From the boric acid tanks (0.5) to the suction of the boric acid transfer pumps (0.25) to the suction of the charging pumps and then to the RCS. (0.25)

2. The charging pumps (0.5) take a suction on the refueling water storage tank (RWST) (0.5) and deliver it to the RCS.

3. The safety injection pumps (0.5) can take their suctions from either the boric acid tanks (0.25) or the RWST and deliver it to the RCS.

Ref. T.S. 3.2.2, page ^.2-3

Answer 8.05 (2.0)

1. Control rods in a single bank move together with no individual rod insertion differing by more than 15 inches from the bank demand position. (0.5)

2. Control rod banks are sequenced with a 100 (±5) step overlap between successive banks. (0.5)

3. The full length control bank insertion limits are not violated. (0.5)

4. Axial power distribution limits which are given in terms of flux difference limits and (control bank insertion limits are observed.) (0.5)

Ref. Basis for T.S. 3.10.2, Power Distribution Limits, pages 3.10-12 & 13.

Ginna Category 8 answers continued on next page.

Answer 8.06 (1.0)

It assures the operation of both diesels carrying design load of all the engineered safeguards equipment for at least 40 hours.

Ref. Ginna T.S. 3.7 bases, page 3.7-4.

Answer 8.07 (3.0)

1. The intent of the original procedure is not changed. (1.0)
2. The change is approved by two members of the plant management staff, at least one of whom is the Shift Foreman who holds a Senior Reactor Operator's license. (1.0)
3. The change is documented, reviewed by the PORC, and approved by the Station Superintendent within 10 days of implementation. (1.0)

Ref. Ginna T.S. section 6.8, PROCEDURES, page 6.8-1.

Answer 8.08 (1.0)

Locked doors shall be provided around the HIGH RADIATION AREA and the keys to the locks shall be maintained under the administrative control of the Shift Foreman on duty.

Ref. Ginna T.S. section 6.13.1b, HIGH RADIATION AREA, page 6.13-2.

Ginna Category 8 answers continued on next page.

Ginna Category 8 answers continued.

ANSWER ~~8.01~~ 8.09 (3.00)

a. circ pump running (0.6)
   gross activity monitor operable (0.6)
   Gross Activity within limits (0.6)

b. one main exhaust fan running (0.6)
   Pariculate, gaseous, and iodine monitors operable (0.6)

REFERENCE
~~a. T/S basis pg. 3.9-8~~
~~T/S 3.5.4.1 and Table 3.5-6~~
~~T/S 3.9.1.1a and Table 4.12-1 and T/S 4.12.1.1.a~~
~~b. T/S 3.9.2.3.b~~
~~T/S 3.5.4.1 and Table 3.5-6~~

a. S-4.1E, G, Y
b. S-4.2.5

ANSWER ~~8.02~~ 8.10 (3.00)

a. -5% delta k/k (0.5)
   to assure subcriticality even if all control rods are withdrawn (0.5)
b. 2 operable - visual in control room (0.5)
   1 audible in containment (0.5)
c. To limit doses in the event an irradiated fuel assembly is damaged significantly (1.0)

REFERENCE
a. T/S 1.2 and pg. 3.8-4
b. T/S 3.8.1.c
c. T/S 3.11

Answer 8.11 (2.0)

1. The procedure consist of valve line-ups or an inactivated system whereby the sequence of steps will not affect safe plant operation. (1.0)

2. The procedure is written in definitive sections whereby the change of sequence will not affect safe operation of the plant.

Ref. Ginna Administrative Procedure, A-503, PLANT PROCEDURE ADHERENCE REQUIREMENTS, page A503:2.

End of Ginna Category 8 Answers.

End of Ginna Examination.

ATTACHMENT 3

WRITTEN EXAMINATION COMMENTS AND RESOLUTIONS

RO Examination

Question

2.08d Comment: Service water cooling is not directly supplied to charging pumps but to the charging pump room fan coolers.

Resolution: Change answer to read "charging pump room fan cooler" per PID 33013-1250. Training material not sufficiently detailed.

3.05 Comment: The emergency diesel generator (EDG) and the letdown orifice isolation valves are also local stations for remote safe shutdown.

Resolution: EDG and letdown orifice isolations valves local control stations will also be accepted as correct answers per RGE-8 pg 16 and RGE-54 pg. 4.

3.08 Comment: The incore thermocouple system with reference junctions was replaced during the last refueling outage. Question is no longer valid.

Resolution: Questions must be deleted because licensee had not updated reference material prior to use by examiners.

4.02a Comment: Governor runback will not occur if turbine is in manual. Load limit runback to 80% will occur if turbine power is greater than 80%.

Resolution: Change answer to read:

1. Turbine runback if turbine is in auto
2. Turbine load limit runback from above 80% to 80%
3. Block of automatic rod withdrawal (2 required, 0.5 points each) as per procedure E-7, Step 2.4.

4.02b. Comment: Limiting local flux peaking near hot channels is a more basic purpose of these actions.

Resolution: Hot channel and flux peaking concerns will also be accepted as an answer, as per FSAR 7.7.1.2.10

4.06c Comment: Maximum limit is 70 gpm.

Resolution: Answer changed to 70 gpm as per procedure P-3v Step 2.2.3, CVCS System. Training material not updated.

SRO Examination

Question

5.10B Comment: Xe reactivity after 4 days = 0.

Resolution: Accepted. Final answer changed to 360 ppm location as per figure 5.4 of the exam.

5.09 Comment: Answer to part-b could be "helped due to better coverage of S/G A-tubes" and part-c could be "hindered due to sustained cold water slug" since neither question specified length of time or severity of the given condition.

Resolution: The above answers will be accepted as correct as per Thermo text Chapter 9, paragraph 9.6 pp. 42-45.

6.01 Comment: Answers #1 and #2 are incorrect due to incorrect training material (System Description).

Resolution: Deleted answers #1 and #2 because reference material provided to examiners was not accurate. New reference is updated RGE-16 pg. 5.

6.02 Comment: Same as RO question 4.06c

Resolution: Same as RO question 4.06c.

6.03b Comment: Other alternate paths could be:

1. thru V-110C to VCT to Changing pump
2. thru V-112B from RWST
3. thru V-358

Resolution: Above answers will be accepted in accordance with procedure E-20, Step 3.1.

6.04 Comment: The overcrank trip will trip the EDG with or without an SI condition and therefore should be an acceptable answer.

Resolution: Not accepted. Question asked for trips which would "protect the diesel engine" and the overcrank trip is only to conserve air.

6.05 Comment: Delete "an undervoltage relay" since there is no UV relay actually involved in the logic sequence.

Resolution: Comment accepted as per Westinghouse logic prints #3 and #4. Training material was not accurate.

6.09b.2 Comment: Turbine Trip setpoint is 45 psig.
Resolution: Change answer to 45 psig as per ARP AR-D-24.

7.05 Comment: The intent of the procedure is to:

1. Limit offsite release
2. Limit personnel exposure
3. Provide proper notification

Resolution: The above answer will be accepted as per FSAR 15.7.3.3.

7.06d Comment: Based on the information provided in the question, the answer is indeterminate.

Resolution: Part-d is deleted and its point value re-distributed within question 7.06.

7.07 Comment: Specific conditions which indicate a Local Radiation emergency are outlined in SC-205 and should also be acceptable answers.

Resolution: SC-205 conditions will be accepted. This reference was not provided to examiners prior to the exam.

7.08 Comment: This is not required SRO knowledge.

Resolution: Not accepted.

1. The Shift Supervisor (SS) could be the Emergency Coordinator (EC) when no off-shift assistance is available.

2. During the above situation, personnel decontamination may be required such that the 1.0 Rem dose may be exceeded by those assisting.

3. Implicit in taking over the role of EC is the assumption that the EC is aware of his/her limits of authority.

4. Section 5.4.4.1 of the Ginna Nuclear Response Plan clearly states the authority of the EC to grant permission to exceed specified exposure limits.

5. NUREG 1122 Generic Ability #36, Ability to take actions called for in the Facility Emergency Plan, including supporting or acting as the EC, is given a 4.7 out of 5.0 importance rating for SRO's.

7.08 b and c Comment: According to administrative procedure A-1 (Radiation Control Handbook) pp. 12-13, approval is not required for emergency exposure, only notification.

Resolution: Add "...except that emergency action need not be delayed due to lack of approval." to parts b and c as per the stated reference.

8.02b Comment: Add "DNB and limit on OT delta T range".

Resolution: Accepted based on RGE-35 attachment.

8.09 Comment: Tech Specs no longer addresses these conditions. New reference is S-4.1. E, G, Y for part a. and S-4.2.5 for part b.

Resolution: Answer remains the same, reference changed as above. Facility provided an out-of-date Tech Spec document to NRC examiners.