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

EXAMINATION REPORT NO. 84-11

FACILITY DOCKET NO. 50-244

FACILITY LICENSE NO. DPR-18

LICENSEE: Rochester Gas and Electric Co.
49 East Avenue
Rochester, New York 14649

FACILITY: R. E. Ginna

DATES: March 20, 1984 - March 21, 1984

CHIEF EXAMINER: L. Whitaker 5/14/84
Date

APPROVED BY: Chief, Project Section 1D 5/14/84
Date

SUMMARY: Two written examinations and two oral examinations were administered to candidates at the Ginna facility. These two candidates passed all portions of the examination.

REPORT DETAILS

TYPE OF EXAMS: Initial X Replacement ____ Requalification ____

EXAM RESULTS:

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

1. CHIEF EXAMINER AT SITE: L. D. Whitaker

2. OTHER EXAMINERS: R. K. Schreiber

3. PERSONS EXAMINED

RO	SRO
Sensenbach, B.	Neis, J.

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

   None

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

   None

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

   None

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

   None

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

   None

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

   None

7. Personnel Present at Exit Meeting:

NRC Personnel

L. Whitaker
W. Cook, RI, Ginna

NRC Contractor Personnel

R. Schreiber, PNL, Richland, WA

Facility Personnel

D. Morrell, Ginna Training Manager
B. Snow, Ginna Plant Superintendent
J. Wayland

8. Summary of NRC Comments made at exit interview:

--Appreciation of examiners was expressed for helpful and courteous control room personnel.

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

None

10. CHANGES MADE TO WRITTEN EXAM

Question No.	Change	Reason
1-11	Answer changed - TMI Accident Review indicated this increase will <u>not</u> happen until Bubble shifts	
3-6.b.4.	Answer key changed to ±5°F Tave deviation - system description is incorrect.	

Attachment:

Written Examination(s) and Answer Key(s) (SRO/RO)

U.S. NUCLEAR REGULATORY COMMISSION

SENIOR REACTOR OPERATOR LICENSE EXAMINATION

MASTER KEY

Facility: Ginna

Reactor Type: Westinghouse

Date Administered: March 20, 1984

Examiner: R. E. Schreiber

Candidate: ____________

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis 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 Cat. Value	Category
25	25.25			5. Theory of Nuclear Power Plant Operation, Fluids and Thermodynamics
25	25.25			6. Plant System Design, Control and Instrumentation
24	24.25			7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
25	25.25			8. Administrative Procedures, Conditions, and Limitations
99				TOTALS

Final Grade ________ %

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

____

Candidate's Signature

CATEGORY 5 - THEORY OF NUCLEAR POWER PLANT OPERATIONS, FLUIDS AND THERMODYNAMICS

5.1 a. What are the approximate values of the delayed fraction of neutrons, β, at beginning and end of core life? (0.5)

b. Why does this change occur? (1.0)

c. What is the effect (if any) on Rx operation? Explain. (0.5)

Answer(s)

a. BOL β = .007; current cycle .006.
EOL β = .0055; current cycle .005.

b. As Pu-239 builds in and U-235 decreases, the effect of Pu's smaller β is increasingly felt.

c. SUR is larger for a given ρ as β decreases, or,

$$SUR = \frac{26\lambda\rho}{\beta - \rho}, \lambda = 0.1 \text{ sec}^{-1} \text{ constant}$$

Reference(s)

Basic Rx theo.

-Category 5 Continued Next Page-

5.2 Explain briefly why a heat balance toward EOL might show a need to recalibrate the excore power range. NI's (1.0)

Answer(s)

As the core ages, flux redistributes radially and leakage flux increases.

Reference(s)

Basic Rx theo.

5.3 a. What are the sources and losses, in words or in equation form, for Xe and Sm during operation. (1.5)

Answer(s)

Xe sources: I decay and direct fission.
Xe losses: Xe decay and burnout.

Sm sources: Pm decay.
Sm losses: burnout.

Alternate:

$$\frac{dN_{xe}}{dt} = \lambda_I N_I + \Sigma_f \gamma_{xe}$$

$$- N_{xe} \sigma_{xe} \phi - \lambda_{xe} N_{xe}$$

$$\frac{dN_{sm}}{dt} = \lambda_{Pm} N_{Pm} - N_{sm} \sigma_{sm} \phi$$

(not need isotope numbers)

Reference(s)

Basic Rx theo.

5.3 b. How do Xe and Sm compare in their impact on short-term operation of the plant, such as daily load follow between 100% and 50% power? (1.0)

Answer(s)

b. Xe has a larger effect (more pcm change with large power swings). Xe also responds more rapidly, peaking in 10 hours or less. Sm changes are less and take days to reach a new equilibrium after a large change in power level.

Reference(s)

Basic Rx theo.

-Category 5 Continued Next Page-

5.4 <u>What</u> is the shutdown margin if $K_{eff} = 0.98$? (0.5)

Answer(s)

$$SDM = \frac{1-K_{eff}}{K_{eff}} \times 100$$

$$= \frac{1 - .98}{.98} \times 100$$

$$= 2.04\%$$

Reference(s)

Basic definition of SDM.

-Category 5 Continued Next Page-

5.5 How does a dropped rod affect quadrant power tilt and overall power in the following situations?

a. All rods at 220 steps, in manual control, at full power for many days prior to dropping rod J4 (C bank) (1.0)

b. Same situation as part a, but drop rod G-7 (C bank). (1.0)

c. Rods in auto, bank D at 200 steps, 80% power many days prior to dropping rod J4. (1.0)

Answer(s)

a. Tilt will be significant, overall power will decrease. MTC tends to bring it back if steam demand not decreased.

b. No tilt, overall power decrease.

c. Substantial tilt as rods back out to maintain overall power (rod stop prevents). Xe transient will make matters worse with time, unless action is taken. Tech. Spec. action statement is expected.

Reference(s)

Basic Rx theo.

-Category 5 Continued Next Page-

5.6 The figure shows typical control rod worth curves at EOL, HZP.

a. Explain why the differential rod worth varies so greatly with bank position. (1.0)

b. Explain why the integral rod worth curve is not only smooth but nearly a straight line. (1.0)

Answer(s)

a. Differential worth varies with flux squared, grid shielding, bank overlap. What is shown in the figure is the effect of withdrawing all 4 banks, sequentially, with 100 step overlap.

b. The differential curve represents the slope of the integral curve. The average slope is about 8 pcm/step ±4. Integration gives the smoothing, overlap gives the linearity.

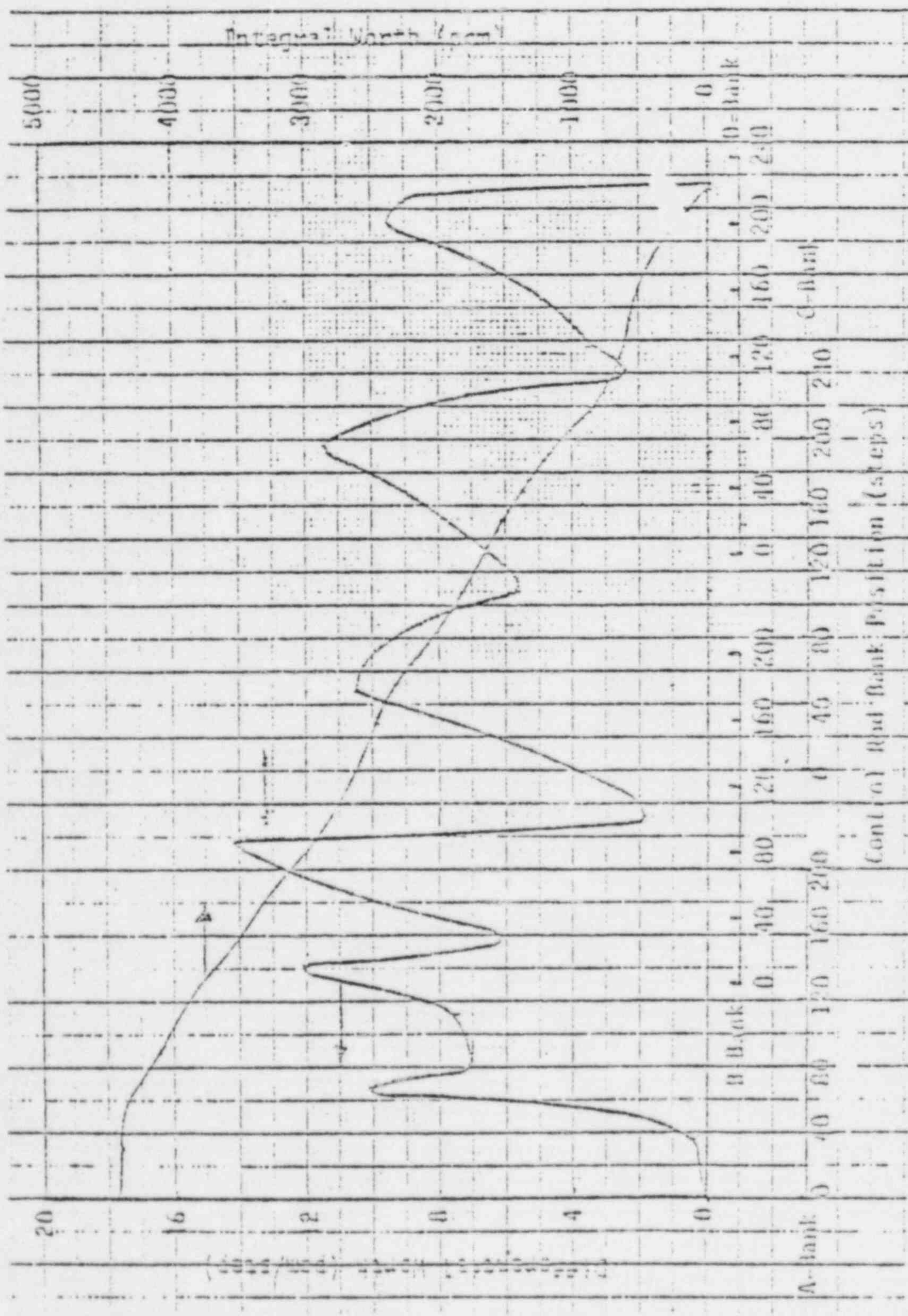
Reference(s)

Basic Rx Theo., page 90.

FIGURE Attached

-Category 5 Continued Next Page-

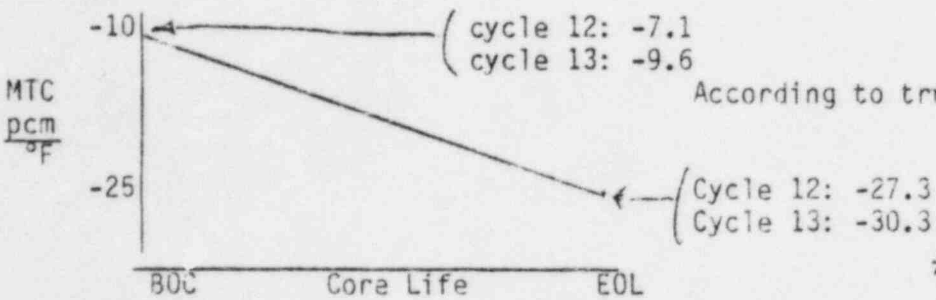
Figure , 5.6



R. E. Ginna Cycle 10 Differential and Integral Worth of D-C-B-A Banks at 9,300 MWD/MT - HZP, 100 Step Overlap

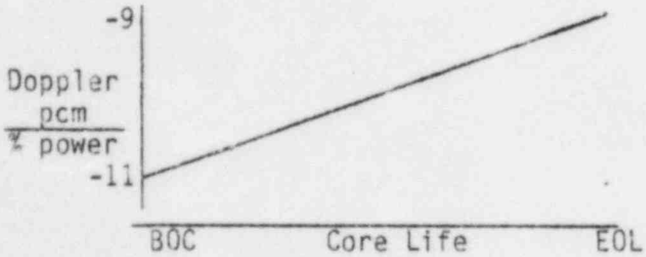
5.7 How do the moderate temperature coefficient and Doppler coefficient change over core life? Show a typical sketch for hot full power, all rods out, equilibrium Xe. (2.0)

Answer(s)

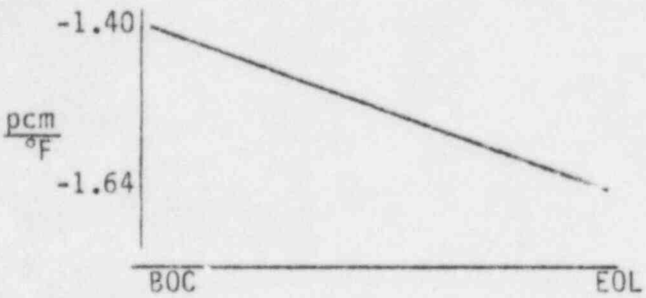


According to trng. matl. cy 1 or 10*

* Modified for EOL MTC value by exam given 4/82



According to trng. matl. (cy 1)



According to cycle 13 design report

If range of effective fuel temp. is a max of 900°F for HZP to HFP, the above become -12.0 pcm/% power @ BOL and -14.76 pcm/% power @ EOL. Values 50% or more above these values are probably total power coef., not just Doppler. Trng. matl. gives HFP total power coef. ranging from -12 pcm/% pm at BOC to -21 pcm/% power @ EOL.

Reference(s)

Basic Rx theo., page 22 and 31.

-Category 5 Continued Next Page-

5.8 a. When constructing a 1/M plot during an approach to criticality, why must you wait after each rod withdrawal step before recording the excore source range NI count rate? (1.0)

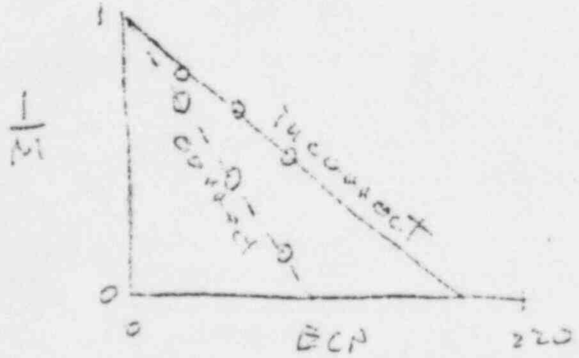
b. Suppose you do not wait before recording the count rate. Will your estimate of critical rod position, by extrapolation 1/M to zero, be too high (too many steps withdrawn) or too low? Use a sketch of 1/M versus rod position to support your answer. (1.0)

Answer(s)

a. 1/M = CRo/CR

Must wait to allow CR to rise to constant (equilibrium) value, otherwise 1/M too large.

b. Extrapolation of 1/M, if too large, to zero gives ECP too high.



Reference(s)

Basic Rx theo.

5.9 a. If Rx trip from full power followed in half an hour (nuclear power at 2%) by a trip of both RCPs, how long after pump trip will it take before steady, natural circulation is achieved? (1.0)

b. Sketch the response of core outlet temperature, TH, in the time between pump trip and the achievement of natural circulation. (1.0)

c. If the S/Gs are stagle at 1035 psig when RCP trip occurs, what is a reasonable value for TC? (1.0)

d. What limit is placed on ΔT (TH-TC) to assure adequate core cooling by natural circulation? (1.0)

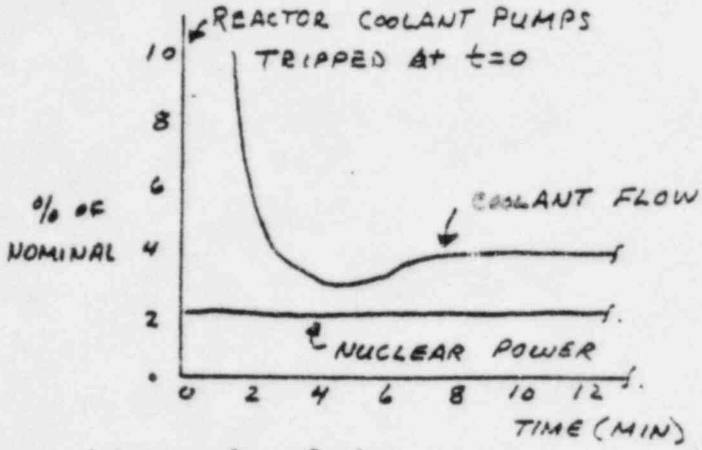
Answer(s)

Answers on attached sheet of figures.

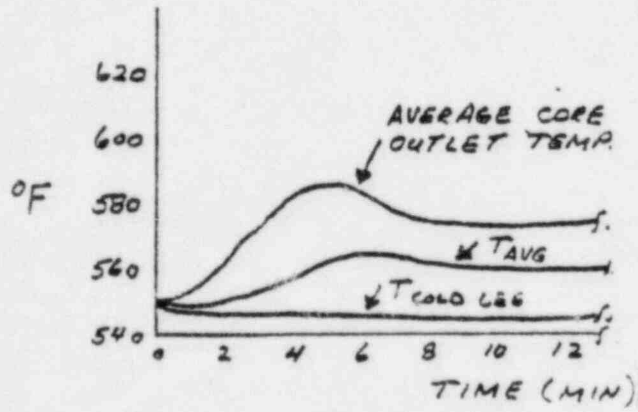
Reference(s)

Rx theo book says 2% nuclear power reached after 1/2 hr. Procedure 0-8.2 gives curves, attached, and ΔT limit.

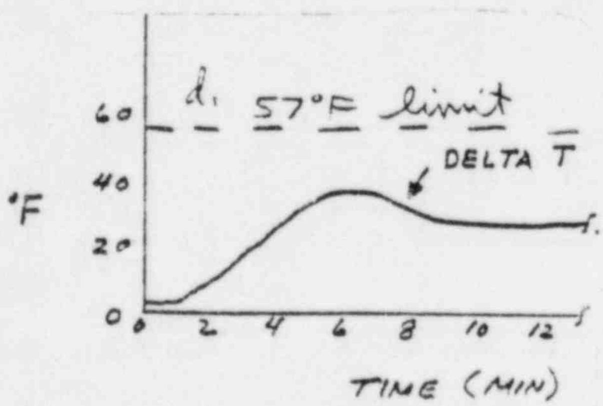
5.9 Expected Transient Response During Natural Circulation Test (1970)



a. Stable flow and temp. after 8 min.



b.



c. S/G press = 1035 + 15 = 1050 psia; Tsat = 550°F ≈Tc

-Category 5 Continued Next Page-

5.10 a.. What is the purpose of a thermal sleeve at the point where the surge line attaches to primary loop piping? (1.0)

b. Is reactor vessel stress greater during heatup or cooldown? (1.0)

c. How is thermal expansion of the whole RCS accommodated during heatup? (1.0)

Answer(s)

a. Reduce thermal stress fatique of the joint caused by outsurge of hotter water from the PZR (or cooler loop water into line).

b. Pressure stress is the same, tensile, during heatup or cooldown, but thermal stress changes from compression at the limiting point (vessel ID) during heatup, to tensile at cooldown, adding to the pressure stress.

c. Snubbers allow motion of whole system under slow thermal expansion, but restrain rapid motion.

Reference(s)

RGE-10 and PID No. 33013-424.

-Category 5 Continued Next Page-

5.11 Steam at 900 psia and 6.5% moisture content is leaking through a gasket to atmosphere.

a. What will the temperature of the leaking steam be? (0.5)

b. How much moisture will be present in the leaking steam? (0.5)

c. What was the temperature at 900 psia? (0.5)

Answer(s)

a. On Mollier chart, 900 psia and 6.5% moisture is at H = 1150 Btu/#. Crossing the diagram at constant H gives a point on the saturation line at atmospheric pressure, i.e., 212°F.

b. None, all vapor.

c. 532°F.

Reference(s)

Steam tables.

-Category 5 Continued Next Page-

5.12 If liquid flows into a tank through 3 pipes, each 1 inch diameter, and is heated by a steam coil in the tank such that its density decreases 10%, then flows out through a single 2 inch pipe, is it moving at a higher or lower velocity than when entering the tank?

Express the answer as a ration, V out/V in. Assume the tank is always full or does not change in weight with time.

Show work. (1.5)

Answer(s)

$$\underset{\text{in}}{\rho_1 V_1 A_1} = \underset{\text{out}}{\rho_2 V_2 A_2}$$ continuity equation (full tank, no weight change)

$$\frac{V_2}{V_1} = \left(\frac{\rho_1}{\rho_2}\right)\left(\frac{A_1}{A_2}\right)$$

$$= \left(\frac{1}{.9}\right)\left[\frac{3 \times \pi/4(1)^2}{\pi/4(2)^2}\right]$$

$$= 0.833$$

Reference(s)

Basic flow theo.

-End Section 5-

CATEGORY 6 - PLANT SYSTEMS: DESIGN, CONTROL, AND INSTRUMENTATION

6.1 Complete the sketch of the 3-element controller for S/G control. (3.0)

Answer(s)

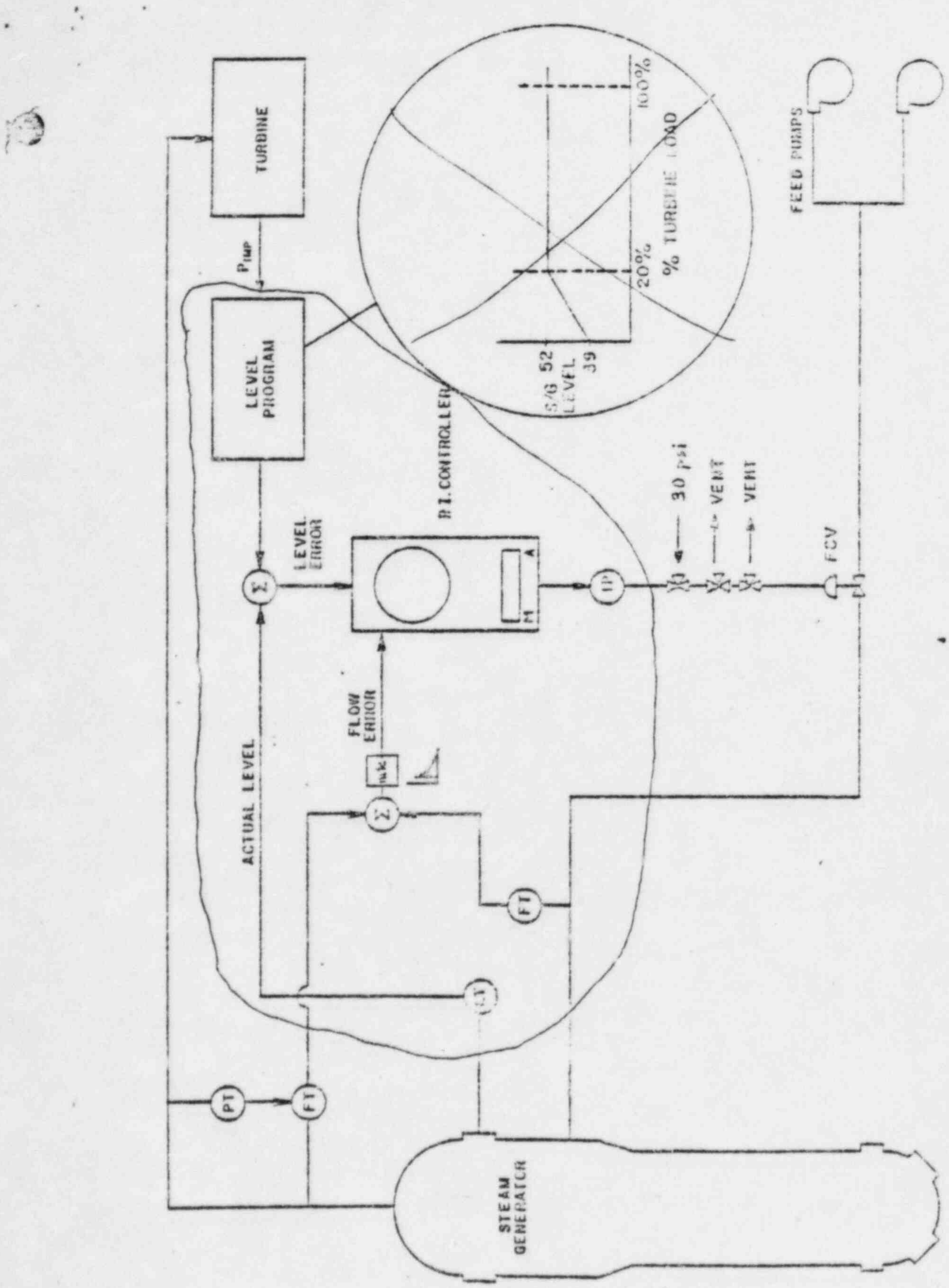
(label items in enclosed area)

figure attached

Reference(s)

RGE-44, fig CD-4

-Category 6 Continued Next Page-



MAIN FEED CONTROL

6.2 List 5 signals that will trip the turbine EHC system.
(Do not list "solenoid" of manual trips at the pedestal.) (2.5)

Answer(s)

- Overspeed
- Low bearing oil pressure
- Thrust bearing movement (due to wear)
- Low vacuum on condenser
- Rx trip
- Manual trip in control room
- Trip of all MFW pumps
- Generator trip
- Trip of all CW pumps

Reference(s)

RGE-49, pages 8-11

6.3 Fill in the labels for the PZR pressure settings. (3.0)

Answer(s)

figure attached

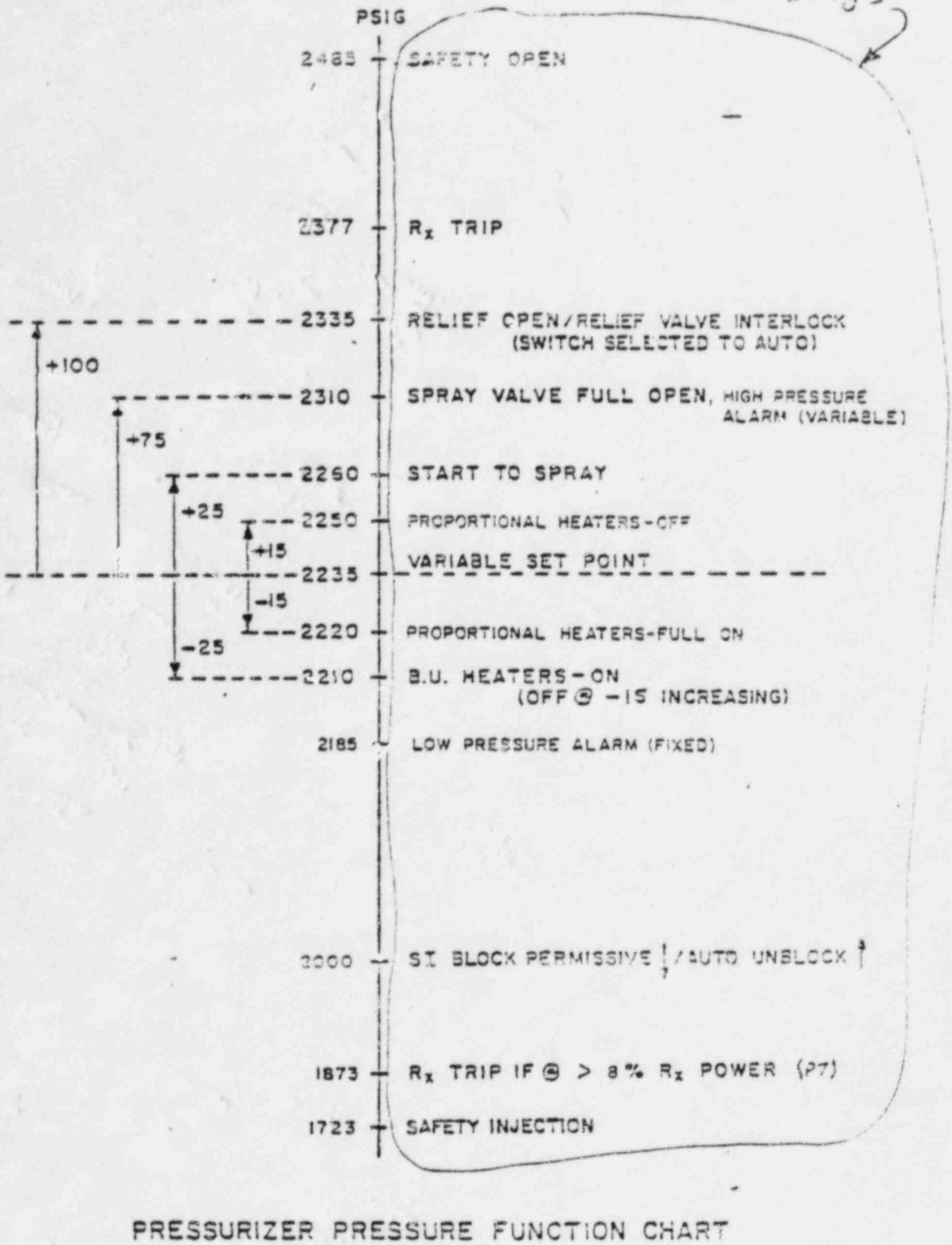
Reference(s)

RGE-19

-Category 6 Continued Next Page-

6.3 Answer

Q: Fill in the labels for the PZR pressure settings (3.0)



PRESSURIZER PRESSURE FUNCTION CHART

RGE-RC-6
REV-3

26 of 49

6.4 a. What is the purpose of the venturi in the steam pipe leaving the S/G? (1.0)

b. The S/G atmosphere steam dump valves are air operated. How do we dump steam from secondary if these AOVs lose air and fail closed? Assume MSIVs are tripped shut. (1.0)

Answer(s)

a. Limit steam flow and reduce RCS cooldown effect in event of steam break upstream of isolation valves, also measure steam flow. (half credit)

b.
- Nitrogen gas can be supplied as backup if air lost. (automatic)
- Handwheel at valves.
- Safeties (4) on each S/G.
- Turbine driven AFW pump.

Reference(s)

RGE-40, page 5-6.

-Category 6 Continued Next Page-

6.5 If neither the motor-driven nor the turbine-driven AFW pumps are available, what other 2 auxiliary feed water sources are available, and how would they be supplied (what pumps) to the S/Gs? (1.0)

Answer(s)

- A condensate supply tank of 10,000 gallons, or service water (primary source).
- Standby AFW pumps can deliver either source to the S/G's.

Reference(s)

RGE-42, fig AF-1

-Category 6 Continued Next Page-

6.6 What is the order of air flow in the Containment Recirculation System, accident mode, between the inlet louvers and the distribution header? (1.0)

Answer(s)

1. Cooling coils (E)
2. Moisture separators (D)
3. HEPA filters (B)
4. Fan and motor (F)
5. Charcoal filters (C)
6. Discharge ducting (A)

Reference(s)

RGE-22, page 6, and PID for HVAC No. 33013-533.

-Category 6 Continued Next Page-

6.7 What 3 signals or conditions automatically close the orifice isolation valves (AOV-200A, B, AND 202)? (1.5)

Answer(s)

- PZR level <10.6%
- Letdown isolation valve, AOV-427, receives closing signal (containment isolation)

(full credit)

- Loss of control air or voltage signal

Reference(s)

RGE-16, page 7

-Category 6 Continued Next Page-

6.8 What emergency (control room evacuation) controls and indicators are at or near the local operating station (hot shutdown panel) for the auxiliary feed pumps on the cold side, IB, basement? (2.0)

Answer(s)

- Ctmt. recirc. fans
- PZR backup heaters
- AFW pump controls
- SW pump control box
- Indicator @ AFW pump area
    - S/G pressure
    - S/G wide range level
    - PZR pressure
    - PZR level
    - AFW flow

Reference(s)

RGE-54, page 5, fig. OPS-10.

-Category 6 Continued Next Page-

6.9 Complete the sketch of the Reactor Makeup Control System. Show valves open, modulated, or closed for auto makeup. (3.0)

Answer(s)

figure attached

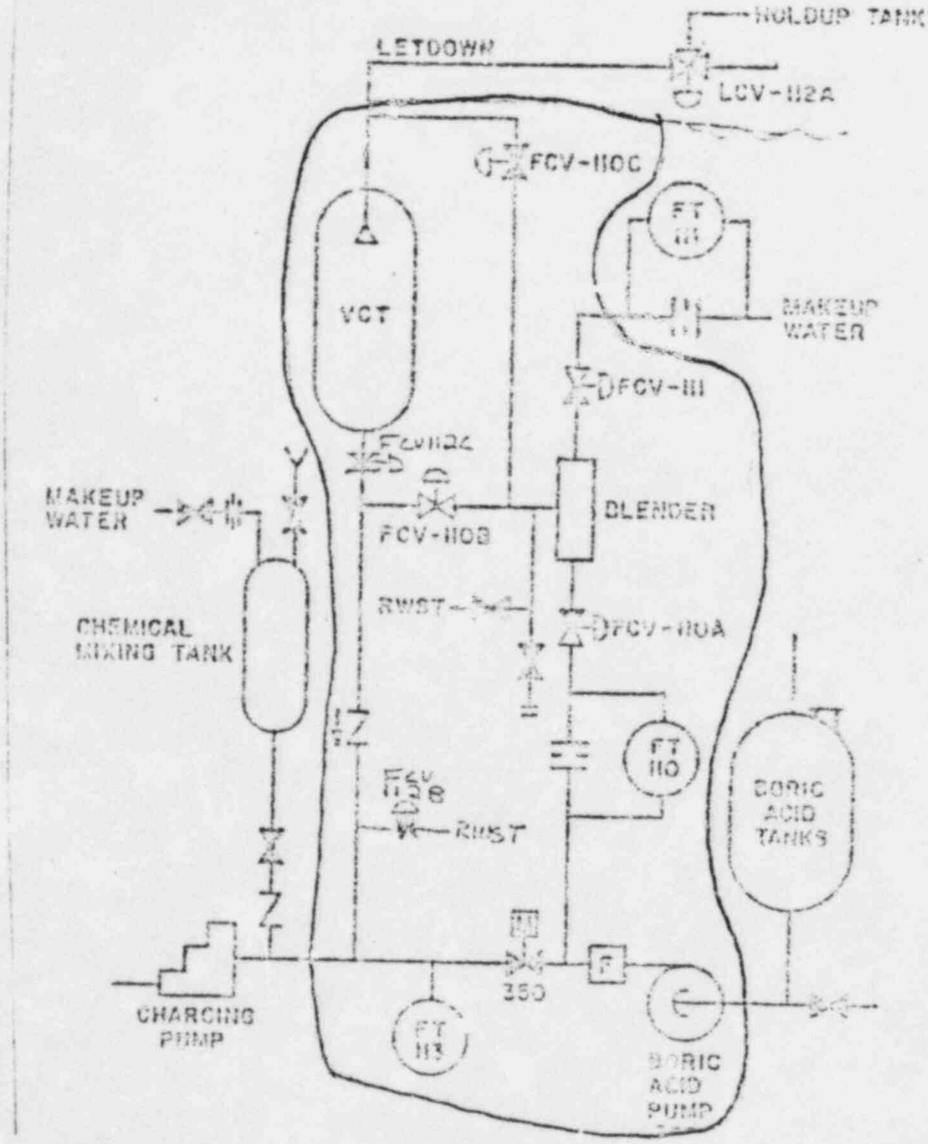
label items and show valve positions inside enclosed area

Reference(s)

RGE-18, fig. VC-6-1.

-Category 6 Continued Next Page-

6.9 Answer (3.0)



Ref: R6E-15, fig. VC-6-1

6.10 a. What is the rating of the EDG for continuous duty? (0.5)

b. What is the source of control power to the EDGs? (0.5)

c. If EDG output voltage drops below 480 (frequency constant), what controllable parameter is adjusted to raise the voltage? (0.5)

d. What are the three signals that will trip a running diesel in the presence of an SI signal? (0.6)

Answer(s)

a. 1950 KW

b. DC batteries

c. Field current in the exciter (voltage adjust knob)

d.
- Low oil pressure
- Engine overspeed

full credit

Reference(s)

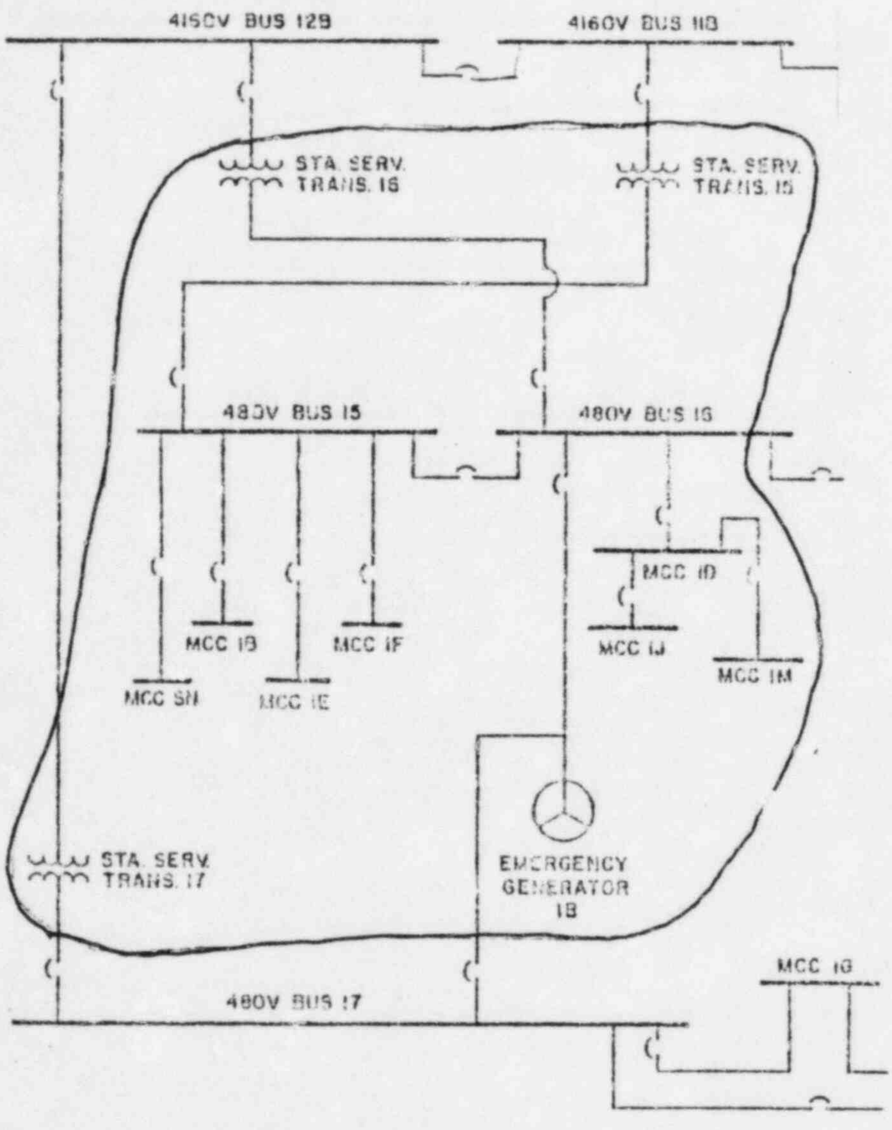
RGE-8, pages 2, 3, 7, 8, 19.

-Category 6 Continued Next Page-

6.11 Complete this portion of the 480 volts electrical distribution system. Show typical motor control centers and identify which go to 120 VAC and 125 VDC buses. Show all links or breakers, transformers, generators. Label all elements. (3.0)

Answer(s)

label items inside the enclosed area



MCC ID and 1B goes to 120 VAC and 125 VDC buses

Reference(s)

RGE-7, fig GT-4
RGE-9, fig GT-6

-Category 6 Continued Next Page-

6.12 a. Plant average Tavg ($\overline{Tavg}$), computed from the RCS TH and TC in each loop, is used as an input to 5 control circuits. List them. (0.5)

b. What 2 reactor protection trips use max Tavg, rather than $\overline{Tavg}$? (0.4)

Answer(s)

a.
- Steam dump
- PZR level
- Auto rod control
- FW full credit

full credit

- RIL computer (0 multiplier)

b.
- OPΔT
- OTΔT

Reference(s)

RGE-20, page 10, fig. RC-21.

-End Section 6-

CATEGORY 7 - PROCEDURES: NORMAL, ABNORMAL, EMERGENCY, AND RADIOLOGICAL CONTROL

7.1 What are the coolant temperatures and reactivity limits for the 4 reactor operating modes? (2.0)

Answer(s)

Mode	ΔK/K,%	Tave,°F
Refueling	≤ -10	≤ 140
Cold S/D	≤ -1	≤ 200
Hot S/D	≤ -1	≥ 540
Operating	≥ 0	~ 580

Reference(s)

TS definition 1.2

-Category 7 Continued Next Page-

7.2 a. What are 3 indications of a small S/G tube leak while plant is in Operating mode? (1.5)

Answer(s)

a.
- Alarm on R-15, air ejector
- Alarm on R-19, S/G blowdown
- HP (chemist) sampling of S/G

Reference(s)

O-6.10

part b. deleted

-Category 7 Continued Next Page-

7.3 a. Upon Rx trip, <u>what</u> should you immediately verify? (2.0)

b. To <u>what</u> procedures should you then turn? (0.5)

Answer(s)

a.
- Verify breakers open
- Verify rods on bottom
- Power decreasing
- Turbine has tripped

b. E-26 series

Reference(s)

Alarm response D-1.

-Category 7 Continued Next Page-

7.4 If No. 1 seal flow indicator on an RCP shows low leak-off flow, what two other indicators would you check for symptoms of pump seal malfunction? (1.0)

Answer(s)

- Seal leak off temp., TI-181 or 2, high
- Pump radial bearing water temp. Hi on TI-125 or TI-132
- Check standpipe level to be assured not #2 seal failure
- Low ΔP across #1 seal.

Reference(s)

E-23.1.

-Category 7 Continued Next Page-

7.5 Give <u>two accident situations</u> when it is necessary to stop the RCPs. (2.0)

Answer(s)

- If SI pump operation verified, and RCS pressure less than 165 psi above S/G pressure, then stop both RCP's. (Alternate pressure: 400 psi for adverse containment condition).
- LOCA
- Loss of CCW

Reference(s)

1. E-1.3 or 1.4, para. 3.2
2. RGE-21, page 12
3. RGE-13, page 13, 19, figure 6

-Category 7 Continued Next Page-

7.6 a. How is the accuracy of PZR and S/G level indications affected by LOCA? (1.0)

b. How do you compensate for this effect? (1.0)

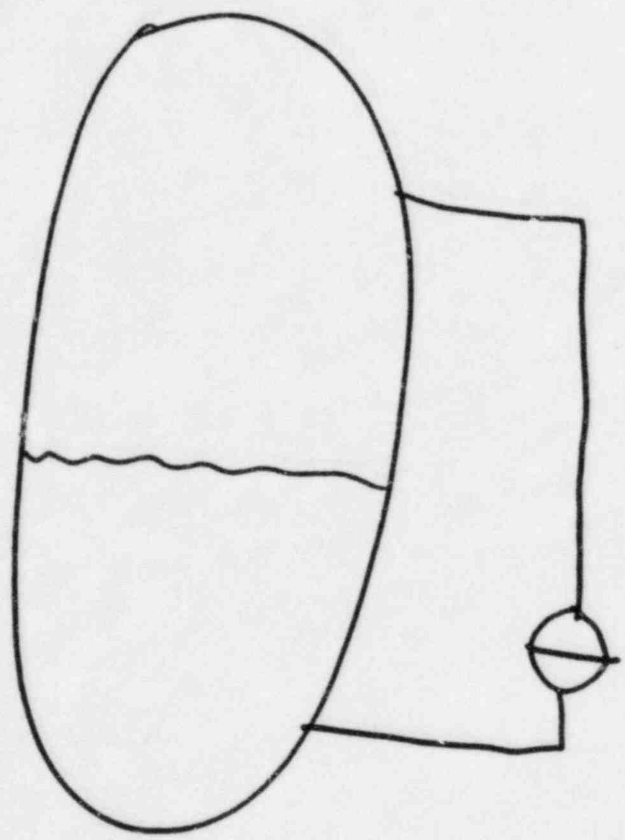
Answer(s)

a. Read lower than actual. Corrective increases as containment temp. goes up; it reaches 20% @ T = 400°F

b. Control to min levels indicated in E-1.2, Sec. 3.

Reference(s)

E-12, Sec. 3, tables 1-4, figures 1-4.



7.7 Suppose the plant is in Hot Shutdown Mode when PZR pressure and level suddenly drop. Pressure then holds at a lower value and level returns, climbing steadily to fill the PZR while pressure remains steady.

a. What abnormal or emergency event would you suspect has happened? Why? (1.0)

b. What other indications would be important in confirming your diagnosis of the accident? (1.5)

Answer(s)

a. Small break LOCA. Bubble develops in head. [Steam space break in PZR will not produce a rapid drop in level.]

b. Check incore temp. and compare to T_{sat} @ given pressure. Subcooling meter should confirm. If containment vessel temp or pressure increase, or S/G level or pressure increase, these confirm accident (could be tube rupture which is a special case of small break LOCA).

Reference(s)

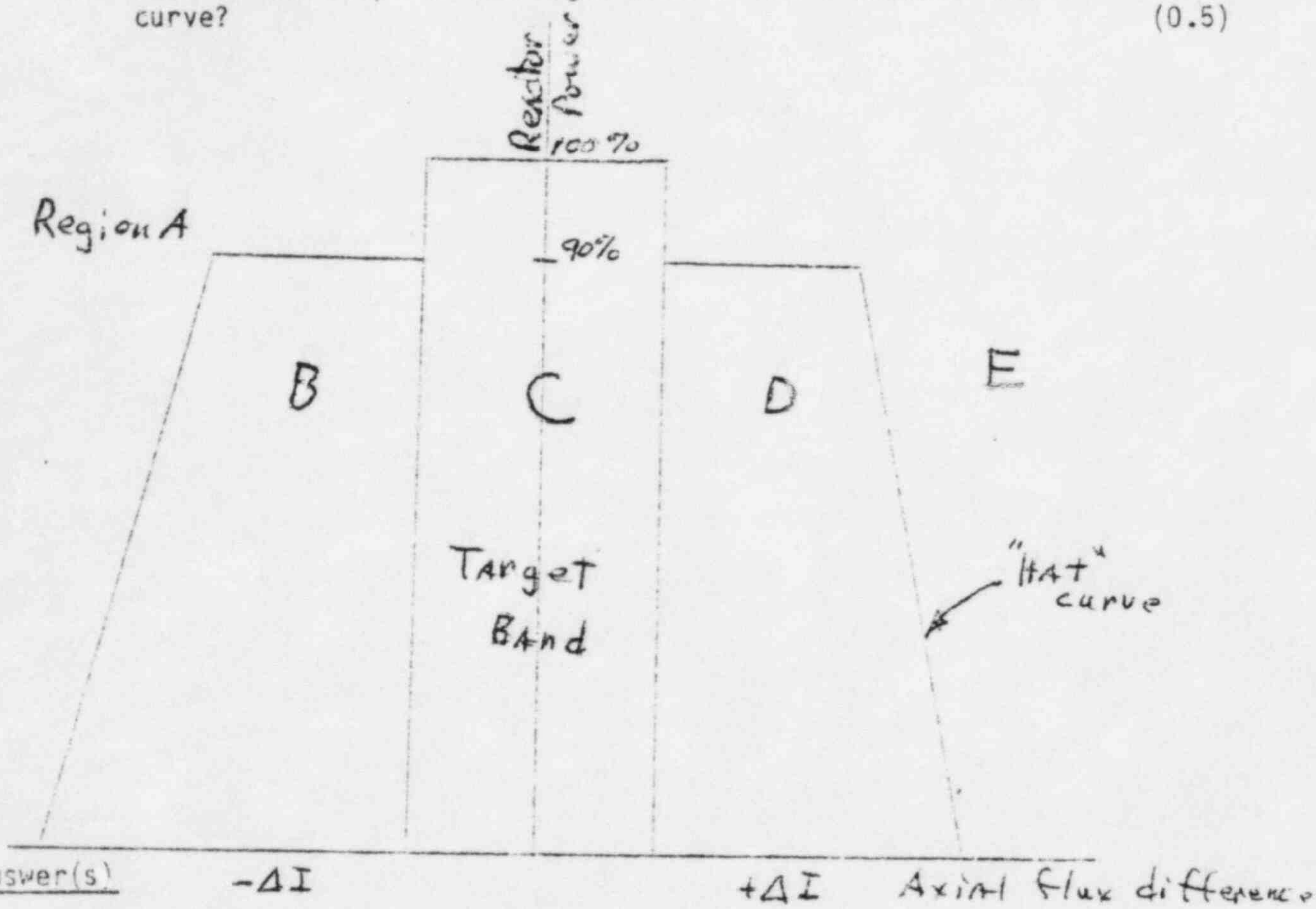
E-1.1, Sec. 1

-Category 7 Continued Next Page-

7.8 a. In the sketch of the axial flux target band, below, <u>show</u>, the region(s) in which operation is allowed for a maximum of 1 hr in 24. (0.5)

b. In which region(s) is operation not allowed? (0.5)

c. What is the slope of the right side of the indicated "hat" curve? (0.5)



Answer(s)

a. B, D
b. A E
c. +[illegible] ΔI for each 2% below 90% power

Reference(s)

TS-3.10.2.10

-Category 7 Continued Next Page-

7.9 a. Why is the charging pump control switch in pull-stop during cooldown? (1.0)

b. How often do you check? (0.5)

Answer(s)

a. Prevent overpressurization of RHR system. This assumes over pressure protection system not operable and temp. >200°F.

b. Check every 12 hours (or, listed in TS).

Reference(s)

TS-3.2.4, page 3.2-3.

-Category 7 Continued Next Page-

7.10 What actions are required if there is an alarm indicating rod stop during withdrawal because of an urgent failure of the rod control system? (1.5)

Answer(s)

- Stop reactivity changes
- Check RCS temp, maintain temp as needed with boron addition or dilution, or turbine load adjustment
- Notify I&C after checking which cabinet has urgent failure.

Reference(s)

C-30 alarm response

-Category 7 Continued Next Page-

7.11 If the VCT high-temperature alarm indicates the temperature has drifted above 145°F, what four actions would you consider to bring the temperature down? (2.0)

Answer(s)

- Insure TCV-145 is diverting to VCT, rather than sending water to the demins.
- Check letdown and charging flow in regen Hx.
- Increase CCW to non-regen Hx.
- Increase CCW to seal water Hx.

Reference(s)

A-18 alarm response

-Category 7 Continued Next Page-

7.12 a. RCS Leakage specifications limits (TS 3.1.5) are: (1.0)

__________gpm from pressure boundary, known to be through pipe, vessel, a valve body

__________gpm from known leakage source, other than above

__________gpm total unidentified leakage

__________gpm in any one S/G, average over 24 hours.

b. Give 4 ways RCS leakage is detected. (2.0)

Answer(s)

a. none
10
1
0.1

b.
- Inventory balance (Rx makeup >0.25 gpm over normal)
- Radioactivity monitors (20% over normal)
- Containment humidity
- Containment cooling coil collection
- Containment temp
- Containment liquid accumulation in sump (time between pump actuations decreases 10%)
- Boric acid crystal deposits
- Sonic transducer in tailpipe of safeties
- Physical inspection (steam, puddles)

Reference(s)

TS-3.1.5, basis, page 3.1-26

-Category 7 Continued Next Page-

7.13 a. If, during an RX trip, not all rods drop fully into the core, by how much must you borate to compensate? (0.5)

b. How many gallons of 12% boric acid from the BAST would be required? (0.5)

Answer(s)

a. 100 ppm/rod

b. 175 gal/rod

Reference(s)

E-20

-End of Section 7-

CATEGORY 8 - ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS

8.1 Who approves an RWP? (1.0)

Answer(s)

- Station Superintendent or assistant
- HP
- Job supervisor of the group involved

Reference(s)

A-1, page 26

-Category 8 Continued Next Page-

8.2 True/False: The Head Control Operator or the Control Operator is responsible for issuing keys for locked valves or breakers and keeping the operations log on these keys? (0.5)

Answer(s)

False. The SS issues the keys, but operator keeps logs.

Reference(s)

A-52.2

-Category 8 Continued Next Page-

8.3 a. Give 4 examples of unusual conditions that must be reported by an individual to his supervisor and to the SS. (1.6)

b. True or false. The individual noting the unusual conditions need not interrupt his tasks but may file his report at the end of his normal shift. (0.4)

Answer(s) a and b

All Personnel

Any individual, who observes or is aware of an unusual condition or potential tech. spec. violation shall immediately report the condition and circumstances to his supervisor and the shift supervisor. The following are examples of reportable events:

- reactor trip
- forced power reduction or outage
- radiation exposure
- unplanned radioactive material release
- equipment malfunction or system degradation
- reactor coolant leakage
- reactivity anomaly or violating a limiting condition for operation.

Refer to tech. spec. Section 6.67 and 0-9.3 for more detailed definitions and to 0-9.3 for one hour reporting requirements.

Reference(s)

A-25, paragraph 3.1.1.

-Category 8 Continued Next Page-

8.4 According to Operations Standing Order D-80-1, how many copies of the station security plan is the SS allowed to make for use of CR staff? (0.5)

Answer(s)

None

Reference(s)

OSO D-80-1

-Category 8 Continued Next Page-

8.5 Briefly define the following areas, or give an example, and state the allowed radiation levels in each.

a. Locked high radiation area (0.5)

b. Restricted area (0.5)

c. Radiation area (0.5)

d. Contaminated Area (0.5)

Answer(s)

a. Locked High Radiation Area. An area in which the intensity of radiation is greater than 1000 mrem/hr and whose key is maintained under the Shift Supervisor's control.

b. Restricted Area. All areas within the Station fence. Normal access is through the main gate. All parts of the restricted area which are not designated as controlled areas should not normally exceed 1.2 mrem/hr of whole body exposure or 250 dpm/100 cm^2 (beta-gamma) of smearable surface contamination in order to achieve ALARA exposure.

c. Radiation Area. Any area in which there exists radiation at such levels that the whole body dose exceeds 1.2 mrem/hr.

d. Contaminated Area. An area in which smearable surface contamination is greater than 10,000 dpm/100 cm^2 of beta or gamma.

Will allow numerical values within ±15% of values given above.

Reference(s)

A-1

-Category 8 Continued Next Page-

8.6 During refueling at least (how many?) source range monitors will be in service, all with visual indication in control room and (how many?) with audible indication in containment and CR. When is fuel being moved. (1.0)

Answer(s)

2

1

Reference(s)

TS-3.8.1.c.

-Category 8 Continued Next Page-

8.7 What 3 measures must be taken immediately if the set point drifts high on a radioactive effluent monitor? (1.5)

Answer(s)

- Correct setpoint without declaring the channel inoperable.
- Suspend release of effluents monitored by that channel.
- Declare the channel inoperable.

Reference(s)

TS-3.5.4.2, page 3.5-2a (amend. 57)

-Category 8 Continued Next Page-

8.8 a. The I-131, equivalent, RCS limit is 12 uCi/gm above 80% power, but can be a higher value at lower power. Explain. (1.0)

b. A temperature limit of 500°F is placed on the RCS if coolant activities exceed TS levels. What is the basis for the 500°F limit? (1.0)

Answer(s)

a. Above 80% power (and above 500°F) the accident analysis for S/G TR and blackout allows release of coolant activity beyond the plant boundaries via the secondary safeties. Below 80% power, the amount of coolant calculated to reach the plant boundary is less.

b. At 500°F, the saturation pressure on the S/G is 681 psia, below the safety relief setting.

Reference(s)

TS-3.1.4, basis, page 3.1-23

-Category 8 Continued Next Page-

8.9 Why is there a requirement (TS 3.1.3.1) that the reactor not be allowed to go critical below 500°F? (1.0)

Answer(s)

MTC most positive cold, BOL.

Reference(s)

TS-3.1.3.1, basis, page 3.1-18.

-Category 8 Continued Next Page-

8.10 a. What conditions may cause the CR to be inaccessible? (1.0)

b. What are the 3 ways to trip the Reactor if it is necessary to evacuate the control room? (1.5)

Answer(s)

a. Fire, smoke, fumes, such as chlorine, intrusion.

b.
- Reactor trip in control room.
- Reactor trip breakers @ switch gear panel.
- Turbine trip on end of turbine.
- Trip MG sets @ supply breakers, buses 13 and 15.

Reference(s)

E-5

8.11 a. Under what conditions is Containment Integrity required? (1.0)

b. Give 4 situations that represent loss of containment integrity. (2.0)

Answer(s)

a. Containment integrity is required whenever the Reactor is not in the Cold Shutdown condition, or whenever the reactor head is removed and the RCS boron concentration is less than 2,000 ppmB, when making positive changes in reactivity by rods or boron dil. when boron <2000 ppm.

b. The following are indications of Loss of Containment Integrity:

- Any non-automatic containment isolation valve which is not required to be open during accident conditions is open or blind flanges required for containment integrity are not in place.
- The equipment hatch is not properly closed or sealed.
- Both doors in either personnel airlocks are not properly closed and sealed.
- Any automatic containment isolation valve is inoperable, not secured in the closed position or isolated by manual valves or flanges as permitted by tech. specs. Examples of failures are:
  - Automatic valve indicator does not indicate valve fully closed.
  - Automatic valve indicating light indicates valve not fully closed.
  - Purge supply or exhaust valve malfunctioning.
  - The containment leakage fails to satisfy tech. specs. 4.4.
  - Abnormally high nitrogen use from electrical penetrations pressure manifolds. Cont. isolation valve (tech. specs. Table 3.6.1) inoperable or exceeds allowable leakage.

Reference(s)

E-25

-Category 8 Continued Next Page-

8.12 List 6 items that the off-going SS will review at shift turnover? (3.0)

Answer(s)

5.2 The offgoing Control Room Operators and Shift Supervisor (SS) will review the 0-6.13 Daily Surveillance Log.

5.3 The offgoing Shift Supervisor shall review the following matters (NA if no entry applicable) with the offgoing Control Room Operators and then the oncoming Shift Supervisor. The oncoming SS review with the oncoming Control Room Operators.

5.3.1 Jumper wires installed (see log).

5.3.2 Trouble reports submitted.

5.3.3 Equipment and systems Out of Service (OOS).

5.3.3.1 Hold Book.

5.3.3.2 Review of reports for A-52.4, Control of Limiting Conditions for Operating Equipment.

5.3.3 . Review of reports for A-52.5, Control of Limiting Conditions for System Specifications.

5.3.4 Operational activities which have occurred on the previous shift.

5.3.5 Continuing procedures, i.e., waste evaporator operation, plant cooldown, etc.

5.3.6 Scheduled operational activities.

5.3.7 Unusual conditions.

5.3.7.1 Review of A-25.1 Ginna Station Event reports.

5.3.7.2 Review of temporary changes in procedures.

Reference(s)

0-9

-Category 8 Continued Next Page-

8.13 What are your quarterly exposure limits, according to 10 CFR 20? (2.0)

Answer(s)

Whole body = 1 1/4 rem
Extremities = 18 3/4 rem
Skin = 7 1/2 rem

- 3 rem whole body is allowed if 5(N-18) rule is met and NRC form 4 is provided.
- Other special rules apply to women. If a woman, she must give the sense of these rules. Also, acceptable to list his/her personal limits because of accumulated dose and availability of dose record (NRC-4).

Reference(s)

10 CRF 20

-Category 8 Continued Next Page-

8.14 a. In addition to the Health Physics Manager, <u>what two</u> other people must approve temporary changes in HP procedures? (2.0)

b. <u>Who</u> may make the temporary PCN. "For One-Time Use Only?" (1.0)

<u>Answer(s)</u>

a. • SS

• Duty Engineer, <u>or</u> Operations Mgr., <u>or</u> Plant Supt., <u>or</u> Asst. Plant Supt.

b. Any of those giving approval.

<u>Reference(s)</u>

A-601

-End of Section 8-

U.S. NUCLEAR REGULATORY COMMISSION

REACTOR OPERATOR LICENSE EXAMINATION

MASTER KEY

Facility: Ginna

Reactor Type: Westinghouse

Date Administered: March 20, 1984

Examiner: R. E. Schreiber

Candidate: ______________

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis 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 Cat. Value	Category
		N/A		1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow.
		N/A		2. Plant Design Including Safety and Emergency Systems
		N/A		3. Instruments and Controls
25.5				4. Procedures: Normal, Abnormal, Emergency, and Radiological Control
				TOTALS

Final Grade ______ %

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

____

Candidate's Signature

CATEGORY 4 - PROCEDURES: NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL

4.1 Who approves a Radiation Work Permit (1.5)

Answer(s)

- Station superintendent or his assistant.
- HP.
- Job supervisor of the group involved.

Reference(s)

A-1, page 26.

-Category 4 Continued Next Page-

4.2 Upon reactor trip, <u>what</u> auto actions should you immediately verify? (1.0)

Answer(s)

- Breakers open.
- Rods on bottom.
- Reactor power decreasing.
- Turbine has tripped.
- $T_{avg.} \rightarrow 547°F$.

Reference(s)

Alarm response D-1 and E-26.

-Category 4 Continued Next Page-

4.3 a. Give 4 examples of unusual conditions that must be reported to the shift supervisor. (1.0)

b. True or false. You may wait until your shift ends to make your report of unusual conditions. (0.5)

Answer(s)

a.
- Rx trip.
- Forced power outage or reduction.
- Radiation exposure.
- Unplanned release of radioactivity.
- Equipment malfunction or system degradation.
- RCS leak.
- Reactivity anomaly.
- Violation of LCO.

b. False. Immediately.

Reference(s)

Procedure A-25, paragraph 3.1.1.

-Category 4 Continued Next Page-

4.4 If N . 1 seal flow indicator on an RCP shows low leak-off flow, what 2 other indications would you check for symptoms of pump seal malfunction? (1.0)

Answer(s)

- Seal leakoff temperature, high.
- Pump radial bearing water temperature, high.
- Check standpipe.

Reference(s)

E-23.1.

-Category 4 Continued Next Page-

4.5 Briefly define, or give an example, of each of the following areas:

a. Locked High Radiation Area (0.5)

b. Restricted Area (0.5)

c. Radiation Area (0.5)

d. Contaminated Area (0.5)

Answer(s)

a. An area whose intensity of radiation is so high that the key is maintained under SS control.

b. All areas within the fence. Normal access through main gate.

c. Any area where radiation level exceeds 1.2 mrem/hr whole body dose rate (±15% of dose rate acceptable).

d. Area where surface contamination is greater than 10^4 dpm/100 cm^2, $\beta\gamma$ (±15% of count rate acceptable).

Reference(s)

Procedure A-1.

-Category 4 Continued Next Page-

4.6 Give 2 accident situations where it is necessary to stop the RCPs. (2.0)

Answer(s)

1. During SI, if RCS pressure drops below 400 psig.

2. If CCW flow is cut off to the oil heat exchanger on the RCP, stop RCP's in 2 minutes.

3. LOCA.

Reference(s)

1. E-1.3, paragraph 3.2.
2. RGE-13, page 19.

-Category 4 Continued Next Page-

4.7 Suppose the plant is in Hot Shutdown when PZR pressure and level suddenly drop. Pressure then holds at a lower value and level returns, climbing steadily to fill the PZR while pressure remains low, but steady.

After you have confirmed the reactor and turbine tripped, what are you generally trying to accomplish by your immediate actions? (4.0)

Answer(s)

Acceptable answer is the general sense of Section 2 of E-1.1, omitting those parts that are covered by question 4.2.

E-1.1, Section 2.0

2.0 IMMEDIATE OPERATOR ACTIONS

2.1 Conditions requiring reactor trip or safety injection may be characterized by a number of unusual situations and instrument indications.

2.1.1 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.

2.1.2 If the Plant is in a condition for which safety injection is warranted and an automatic safety injection has not yet occurred, manually initiate safety injection.

2.2 Verify the following actions and system status. If any of the following automatic actions have not occurred and are required, they should be manually initiated.

2.2.1 Reactor trip (all rods on bottom) and turbine stop valves closed.

2.2.2 Busses 14, 16, 17, 18 are energized and at approximately 480 volts.

2.2.3 Main Feedwater Isolation has occurred.

2.2.4 Containment Isolation has occurred (Alarm--A26), and all X & Y relay green lights are off on C.I. panel.

2.2.5 Auxiliary Feedwater Pumps have started and the Auxiliary Feedwater System valves are in their proper Emergency Alignment, that is, the discharge MOV's are fully open and after pump start, throttle back to deliver approximately 230 GPM.

2.2.6 SI & RHR Pumps have started and the monitor lights indicate that the Safety Injection System valves are in the proper safeguards position.

-Category 4 Continued Next Page-

2.2.7 Service water pumps have started and indicate sufficient service water pressure.

2.2.8 Containment Ventilation isolation has occurred (Alarm--A25).

2.2.9 Containment recirculation fans running and charcoal filters in service.

2.2.10 SI pump suction swap-over if $\leq$10% BAST level, 825 A and/or B Open.

2.3 Verify the following:

2.3.1 Safety Injection flow from at least one train is being delivered to the reactor coolant system when the Reactor Coolant System pressure is below the high head safety injection pump shutoff head. If not, attempt to operate equipment manually or locally.

2.3.2 Auxiliary Feedwater flow from at least one train is being delivered to the steam generators. If not, attempt to operate equipment manually or locally. If these attempts fail, start standby Aux. FW pumps per E-29.3.

NOTE: Only after steam generator water level is >25% in the narrow rangé should the Auxiliary Feedwater System Flow be regulated to maintain required level.

2.3.3 Verify that heat is being removed from the reactor Plant via the steam generators by noting the following:

2.3.3.1 Automatic steam dump tot he condenser is occurring.

2.3.3.2 Reactor coolant average temperature is decreasing towards programmed no-load temperature.

NOTE: If condenser steam dump has been blocked due to a control malfunction or loss of the "Condenser Available" condition, decay heat removal will be effected by automatic actuation of the steam generator power-operated relief valves, or, if these prove ineffective, the steam generator code safety valves. In this event, steam pressure will be maintained at the set pressure of the controlling valve(s) and reactor coolant average temperature will stabilize at approximately the saturation temperature for the steam pressure being maintained.

2.4 Whenever the Containment 18 psig pressure setpoint is reached verify that the Main Steam Isolation Valves have closed. If not, manually close the main Steam Isolation Valves from the Control Board.

-Category 4 Continued Next Page-

2.5 Whenever the Containment 28 psig pressure setpoint is reached verify that containment spray is initiated. If not manually initiate containment spray.

2.6 Evaluate condition for Site Contingency Reporting per SC-100 Ginna Station Event Evaluation and Classification.

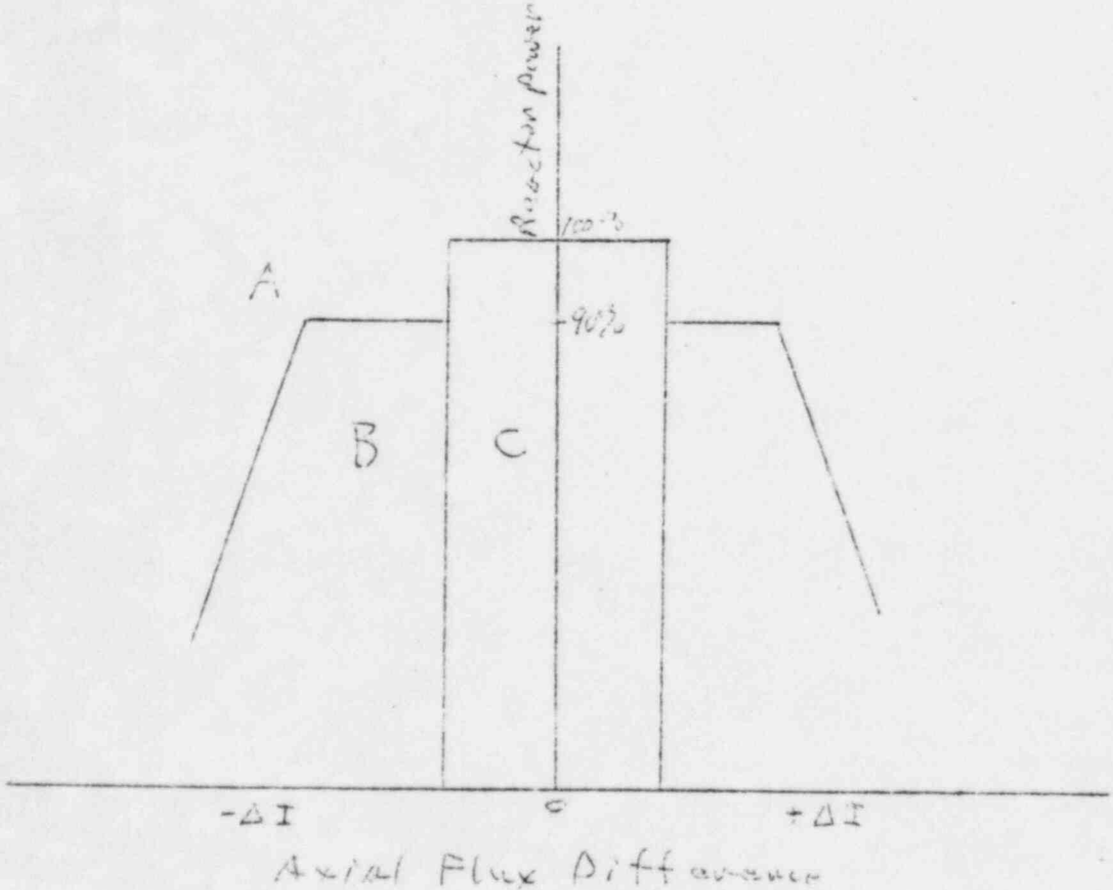
2.7 Notify appropriate Personnel of the nature of the emergency.

Reference(s)

E-1.1, Section 2.

-Category 4 Continued Next Page-

4.8 According to tech specs, what are the operating restrictions associated with Regions A, B, C in the figure below? (1.5)



Answer(s)

A. Not allowed (immediately go below 50%).
B. 1 hr/24
C. No restriction

Reference(s)

TS-3.10.2.10.

-Category 4 Continued Next Page-

4.9 Why is there a requirement that the reactor not be allowed to go critical below 500°F? (1.0)

Answer(s)

MTC most positive for cold, BOL conditions.

Reference(s)

TS-3.1.3.1, basis, page 3.1-18.

-Category 4 Continued Next Page-

4.10 a. What conditions may cause the control room to be inaccessible? (1.0)

b. What are the 3 ways to trip the reactor if it is necessary to evacuate the control room? (1.5)

Answer(s)

a. Fire, smoke, fumes such as chlorine, intrusion.

b.
- Reactor trip in CR
- Rx trip breakers at switch gear location.
- Turbine trip on end of turbine
- MG set supply breakers @ buses 13, 15.

Reference(s)

Procedure E-5.

-Category 4 Continued Next Page-

4.11 What immediate actions are required if there is an alarm indicating rod stop during withdrawal because of an urgent failure of the rod control system? (1.0)

Answer(s)

- Stop reactivity changes and maintain constant RCS temperature using boron addition and dilution.
- Turbine adjustments to control temperature.
- Notify SS.

Reference(s)

Alarm response C-30.

-Category 4 Continued Next Page-

4.12 If the VCT high-temperature alarm indicates the temperature has drifted above 145°F, what 4 actions would you take in dealing with this abnormal situation? (2.0)

Answer(s)

- Insure TCV-145 is diverting to VCT.
- Check charging and letdown flow in regen. Hx.
- Check before increasing CCW to non-regen. Hx.
- Check before increasing CCW to seal water Hx.

Reference(s)

Alarm response A-18.

-Category 4 Continued Next Page-

4.13 What are your quarterly exposure limits, according to 10 CFR 20? (2.0)

Answer(s)

- Whole body = 1 1/4 rem.
- Extremities = 18 3/4 rem.
- Skin = 7 1/2 rem.
- 3 rem whole body is allowed if 5(N-18) rule is met and NRC Form 4 is provided.
- Other special rules apply to women.
- Also, acceptable to list their personal limits because of accumulated dose and availability of dose record (NRC-4).

Reference(s)

10 CFR 20

-Category 4 Continued Next Page-

4.14 Match the following RCS leakage limits in column A with their definitions in column B. (2.0)

A		B
0	1.	Total unidentified leakage, gpm
0.1	2.	Total leakage through all S/Gs, gpm
1	3.	Leakage through any one S/G, averaged over 24 hours, gpm
10	4.	Pressure boundary leakage, known to be through piping, vessel, or valve body, gpm
	5.	Pressure boundary leakage, known, other than above, gpm

Answer(s)

1. 1
2. --
3. 0.1
4. 0
5. 10

Reference(s)

TS-3.1.5.

-Category 4 Continued Next Page-

4.15 After a reactor trip, how many ppm boron must be immediately added to the RCS for each stuck rod? (0.5)

Answer(s)

100 ppmB/rod
or, 175 gallons/rod.

Reference(s)

E-20.

-End Section 4-

TABLE ES-108-1

REACTOR/SENIOR REACTOR OPERATOR LICENSE EXAMINATION
GRADING QUALITY ASSURANCE CHECKOFF SHEET

ITEM	DESCRIPTION	REVIEWER'S INITIALS	DATE
1	Spot-check 50% of category totals and overall grade totals	RJG	3/27/84
2	Detailed review, 1 question per category, 50% of categories, 50% of applicants	RJG	3/27/84
3	Borderline cases reviewed (±2%)	RJG	3/27/84
4	High-failing/low-passing examination comparison	RJG (NA)	3/27/84
5	Spot-check other failures to justify decision for denial	RJG (NA)	3/27/84
6	Overall category or individual question performance	RJG	3/27/84
7	Detailed review, if necessary	RJG	3/27/84

Grading Examiner: R E Schreiber Date: 3/26/84

Reviewed: Robert [illegible] Date: 3/27/84

Approved: R E [illegible] Date: 3/28/84

Facility: Ginna Exam Date: 3/20/84

Senior 1/4 Operator 1/4

TABLE ES-201-5

REACTOR/SENIOR REACTOR OPERATOR LICENSE EXAMINATION
ADMINISTRATION AND GRADING - DETAILED REVIEW GUIDE

Plant/Unit Ginna Examination Date 3/20/84

Examiners R E Schreiber Proctors G. Hurwitch

___Cold ✓ Hot ___Requalification ______

Item	Description	Check When Completed
1	Adequate spacing during examination	✓
2	100% proctoring	✓
3	Examination and answer key reviewed by	✓

Dick Morrill
Plant Reviewer

Item	Description	Check When Completed
4	Grading review completed (Tables ~~ES-201-7 and ES-201-8~~ attached)	✓

R E Schreiber 3/28/84
Chief Examiner's Signature Date

RO (circle) SO