TRAINING PROGRAM ADMINISTRATIVE FORM

1 3
2,2.A

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. 4 8	NAME	EMPLOYEE NO 4 8
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1.4	5	0.8	0.1.6	B.A.

TOTAL COURSE DURATION

HOURS
27 31

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.00 Rev 3

MODE PREFIX
32 34

35 COMMENT 59

SHIFT CYCLE 1 HALF 1

TOTAL EXAM POINTS 37 MIN POINTS TO PASS 25.9

EXAM SCORE ______ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

8001220789

INSTRUCTOR SIGNATURE DATE

SUPERVISOR OF TRAINING/TRAINING COORDINATOR DATE

Total Points 37.0

NAME:

SCORE:

UNIT II
CATEGORY IV CRO
CYCLE 1-1 EXAM

(1.0) 1. How can you verify that someone who is making an application to remove equipment from service is qualified to do so?

(1.0) 2. Is it permissible for a piece of equipment to be tagged out for a person by title, i.e., Shift Foreman or Mechanical Maintenance Foreman? Explain.

(1.0) 3. How do you know if a Radiation Work Permit is required for work under a new tagging application? When and how during the processing of that application do you confirm that the RWP has been issued?

(1.0) 4. If an application has been reported cleared for the day with tags to remain, who may have the tags removed? What are his required actions prior to requesting the tags be removed?

(1.0) 5. If station needs require the removal of active "uncleared" tags and the man who was given clearance for work is not on site, who is permitted to have the tags removed?

(1.0) 6. May a licensed CRO trip the unit without prior notification or approval of his Shift Supervisor or Shift Foreman? Explain.

(1.25) 7. a) Describe in sequence the steps to manually start and load one od the emergency diesel generators for a surveillance run.

(0.5) b) What is the surveillance procedure acceptance criteria?

(0.25) c) What is the maximum MVAR load at 3.0 MWe?

(3.0) 8. Draw a one line diagram of the vital 120 volt AC distribution system. List vital loads such as computer, RPS, ESAS, NNI's, etc.

(5.0) 9. Draw a one line diagram of the normal and E.S. distribution systems. Start at 230 KV lines and stop at 480 V MCC's. Include all ties, and show normal lineup.

(0.5 ea) 10. Define the following:

a) Hot Shutdown
b) Hot Standby
c) Cold Shutdown
d) Refueling Shutdown
e) Quadrant Power Tilt
f) Power Imbalance
g) Shutdown Margin

(0.5) 11. A component is considered operable when it is capable of performing its intended function within a required range. When is it considered capable?

(2.0) 12. What conditions must be met to satisfy the requirements for containment integrity?

(0.5) 13. What is "Rated Power"?

14. What are the required manual actions for the following?

(2.0) a) Running Nuclear Services River Water Pump "A" Trip?

(2.0) b) Running Sec. Serv. River Water Pump "A" Trip?

(2.0) 15. List the components in order of flow through the pretreatment system.

(0.5) 16. Define Core Alteration and give one example other than movement of a fuel assembly.

(2.0) 17. What source of power will the vital bus STS normally select? When will it select the alternate source automatically? Include setpoints.

(2.0) 18. Describe the air system for starting the EDG's. Include all sources of air.

(2.0) 19. Describe the methods of controlling NDCT icing. Be Specific.

(1.0) 20. Describe the Amertap System ball flowpath.

(1.0) 21. Describe the CW flume level control system. Include control scheme, setpoints and makeup source.

UNIT II
CATEGORY IV CRO
CYCLE 1-1 EXAM
KEY

1. In front of the active tagout book is a list of personnel who are authorized to request equipment be removed from service.

2. No. All tagging requests must be made out to a specific individual

3. On the front of the request is a block which must be checked if a RWP is required. After the tags are hung if a RWP is required the CRO who is assigned to S&T will look in the active RWP book to see if a RWP is filled out. If one is required and not filled out, the man making the application will not be given clearance to go to work until the RWP is completed.

4. Shift Foreman. The Shift Foreman must go out and make an inspection of the equipment he wants to remove the tags from. If he determines that it would be safe for the tags to be removed he makes the request to have the tags removed.

5. Unit Superintendent.

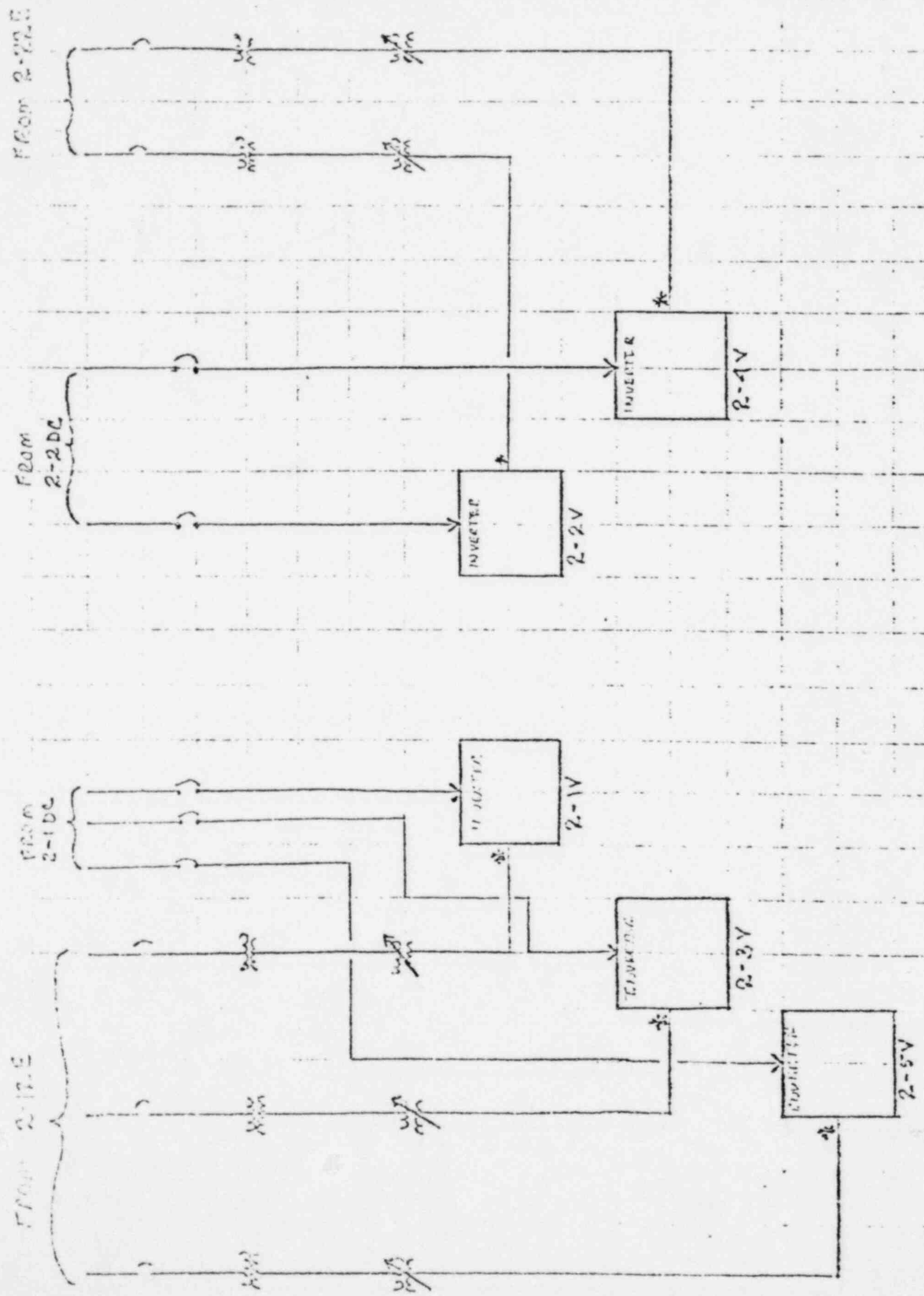
6. Yes. If the CRO determines that damage to equipment may occur or cause injury to personnel he may trip the Unit without prior approval from the SS or SF.

7A. a) Have AO make general inspection to ensure diesel is ready to run.
b) Insure NRWS in operation.
c) Get clearance from dispatcher to run and load diesel.
d) Select maintenance exercise.
e) Select parallel.
f) Select droop.
g) Run DC fuel oil pump to ensure lines are full.
h) Push engine start button. This starts prelube pump - after time delay diesel starts.
i) Insure engine starts and comes up to speed - yellow and green lights on.
j) Turn sync. scope on.
k) Match incoming and running voltage.
l) Adjust engine speed so as to get sync scope rotating slowly in the fast direction.
m) At ≈ 3-5 of 12 go to close on breaker. When sync check relay is satisfied, the breaker will close. Immediately go to raise to pick up load. ≈ 300 to 1000 kw. Turn sync scope off.
n) Select MVAR position and adjust voltage so as to get 500 to 1000 MVAR out.
o) Slowly increase load to 3 MW.

B. Diesel starts and comes up to speed in ≈ 10 sec.
Diesel carries load of 3 MW for one hour.
Diesel is lined up to supply emergency power.
Diesel fuel oil pumps start and pump oil.
Daytank contains minimum of 500 gal. fuel oil.
Diesel fuel oil storage tank contains minimum of 19,000 gal.

C. By limits and precautions max MVAR's is 2.5 MVARs.
By graph in procedure 2.25 MVARs for .8 PF.

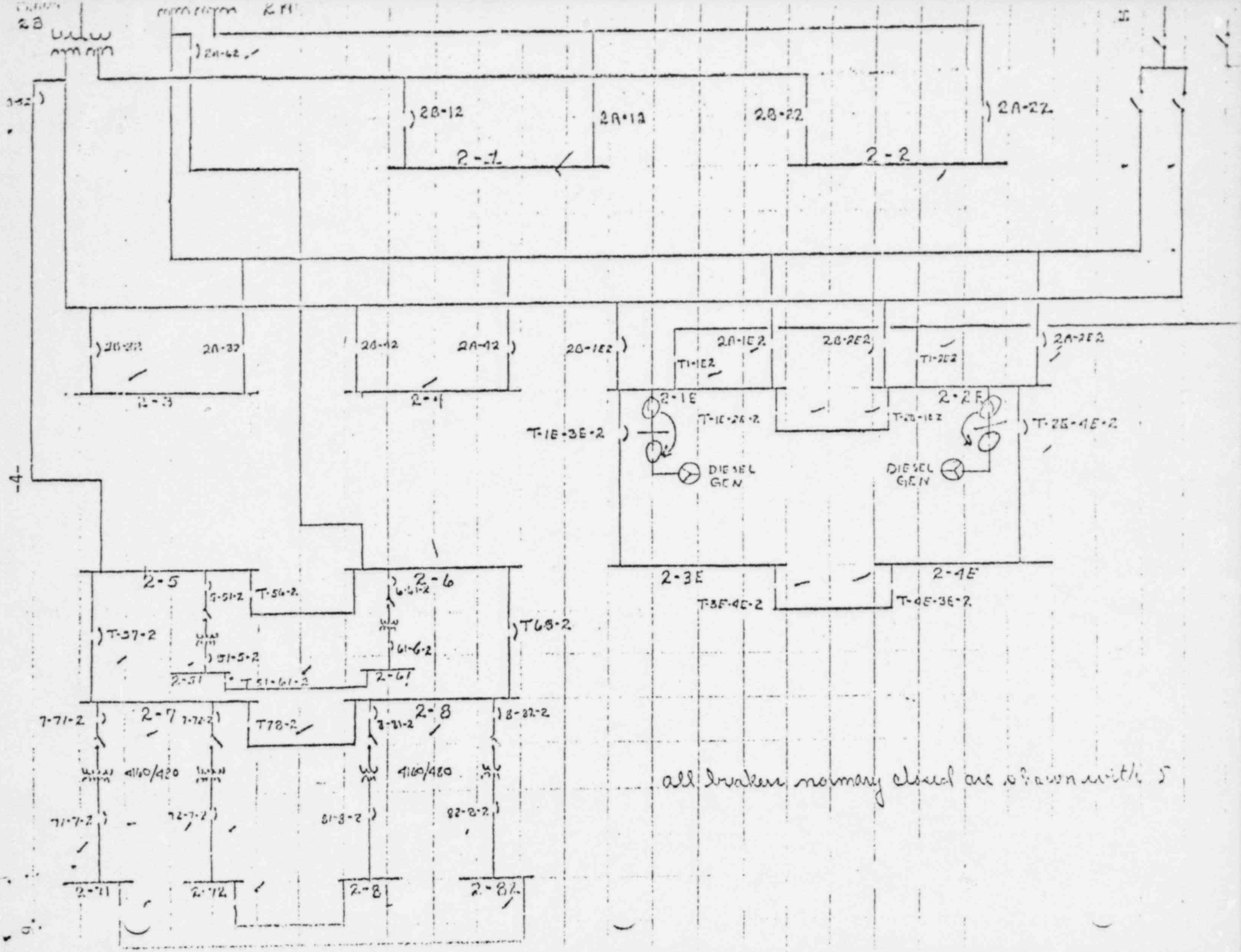
8.



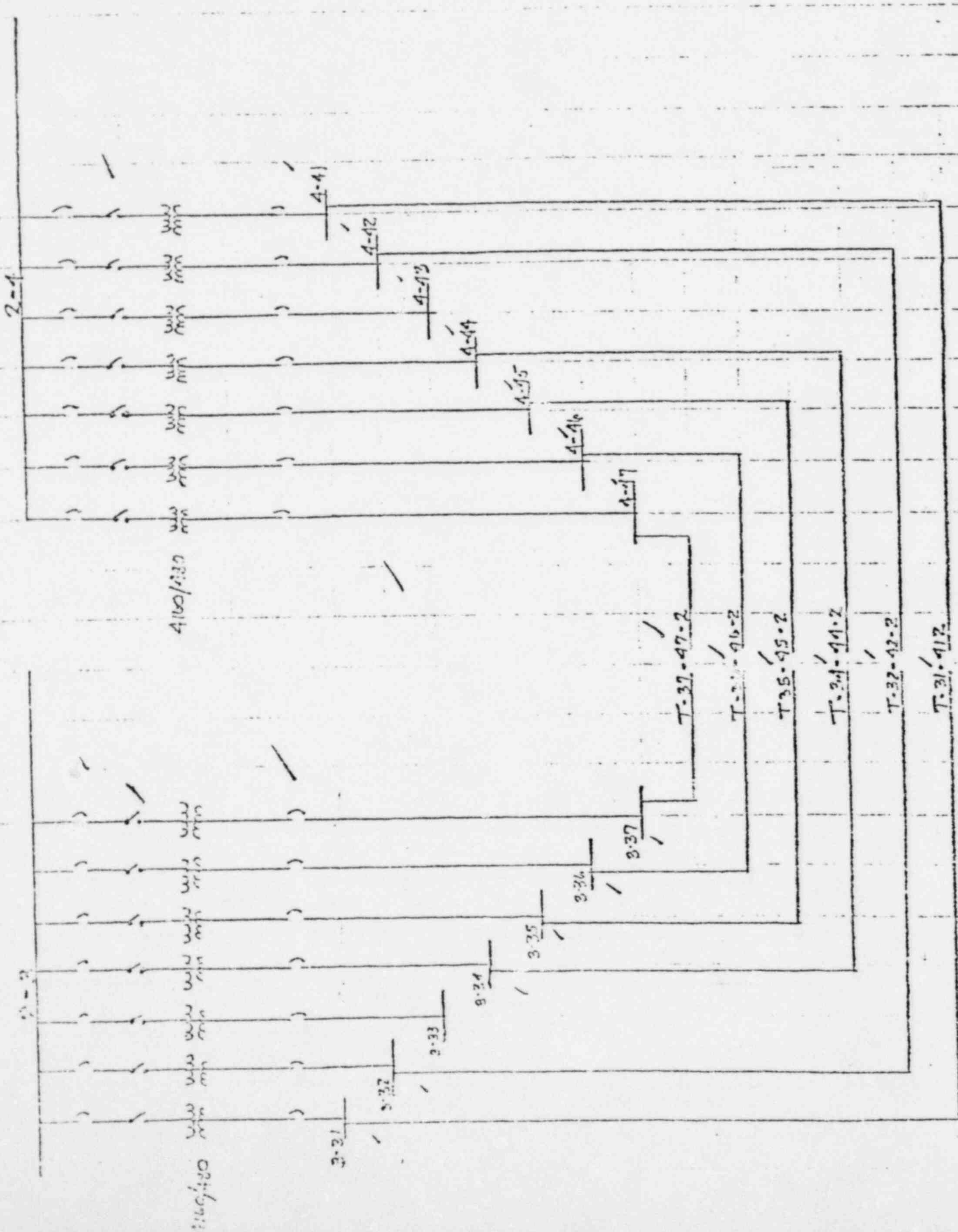
* alternate power supply

8. (continued)

2.1V - 2.4V	2.5V
RC Pump Monitors	Computer
CR Ind. Lights	CR Ind. Lights
Page - N & E	Turb. Overspeed
ESAS	
RPS	
N.I.	
Fire Protection	
ICS Power	
Ground Detectors	
FW Pump Turb. Speed Ind.	


2B
2A-62
2B-12
2A-12
2B-22
2A-22
2-1
2-2
2B-32
2A-32
2-3
2B-42
2A-42
2-4
2B-1E2
2A-1E2
2B-2E2
2A-2E2
T1-1E2
T1-2E2
2-1E
2-2E
T-1E-2E-2
T-2E-1E2
T-1E-3E-2
T-2E-4E-2
DIESEL GEN
DIESEL GEN
2-3E
2-4E
T-3E-4E-2
T-4E-3E-2
2-5
2-6
5-51-2
T-56-2
6-61-2
T-37-2
T68-2
51-5-2
61-6-2
2-51
2-61
T 51-61-2
2-7
2-8
7-71-2
7-72-2
T78-2
8-81-2
8-82-2
4160/480
4160/480
71-7-2
72-7-2
81-8-2
82-8-2
2-71
2-72
2-81
2-82
all breakers normally closed are drawn with S

-4-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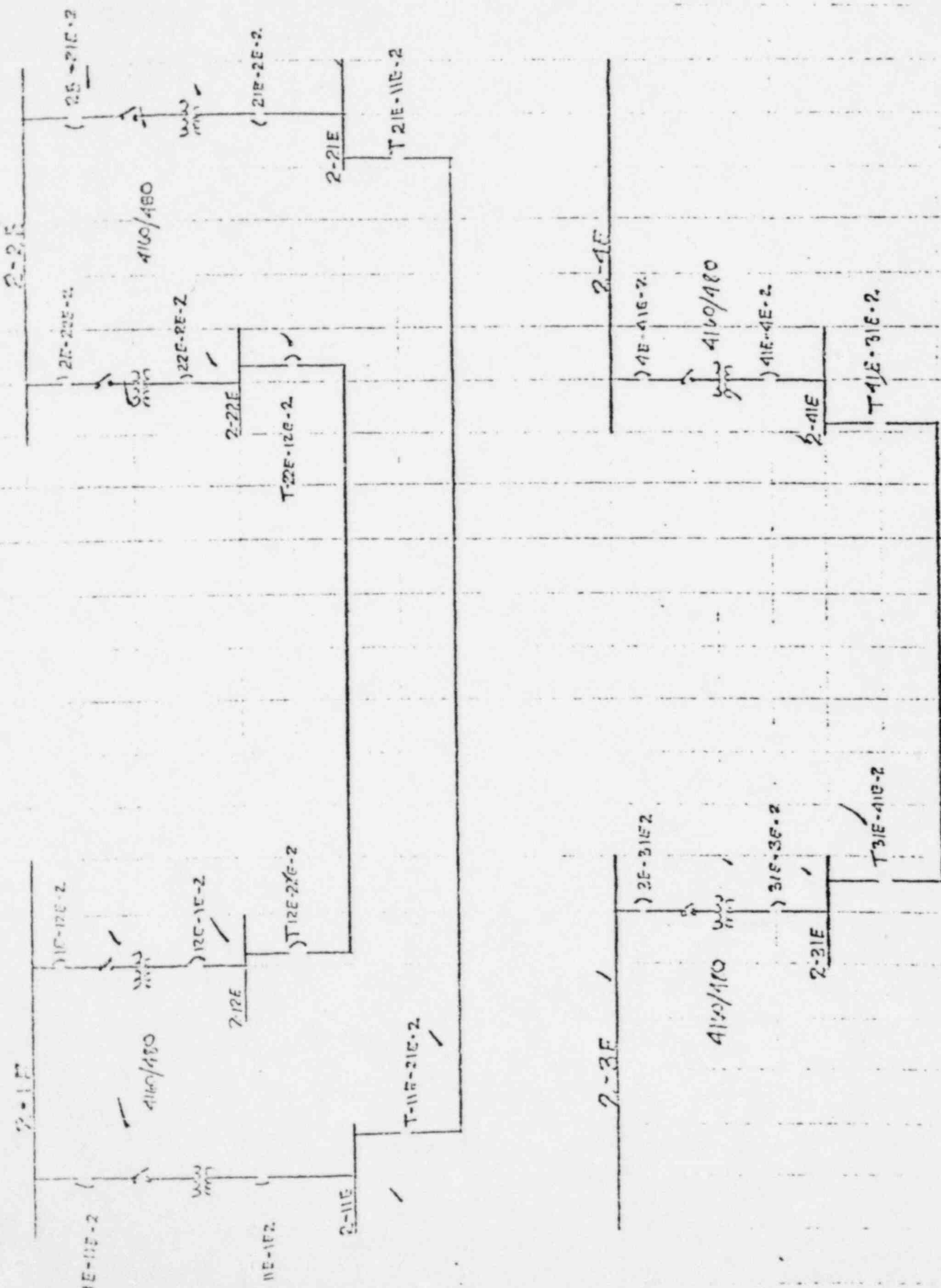
4-44
4-45
4-46
4-47
3-31
3-32
3-33
3-34
3-35
3-36
3-37

9. (continued)



2-2E
4160/480
2-21E
2-22E
2-4E
4160/480
2-41E
2-1E
4160/480
2-12E
2-11E
2-3E
2-31E

10. a) Hot shutdown Keff $<.99$ % Pwr. 0 Temp. $> 200^{o}F$. $< 280^{o}F$

	Keff	% Pwr.	Temp.	
a) Hot shutdown	$<.99$	0	$> 200^{o}F$.	$< 280^{o}F$
b) Hot standby	$<.99$	0	$\geq 280^{o}F$	o
c) Cold Shutdown	$<.99$	0	$\leq 200^{o}F$	o
d) Refueling shutdown	$<.95$	0	$\leq 140^{o}F$	o

f) Quadrant Power Tilt = $\left(\frac{\text{Power in any quandrant}}{\text{Avg Power to all Quadrants}} - 1\right) \times 100$ expressed in %

g) Power Imbalance = Power in top half of core (-) minus power in bottom half of core

h) SDM = That amount of reactivity by which the Rx is or would be subcritical assuming the following:

1. No change in APSR rod position.
2. All control rods fully inserted in the core with exception of most reactive rod which is assumed to be fully withdrawn (stuck out).

11. When by testing it does what is was supposed to do. This also includes the instrumentation, cooling water, lube oil, or anything else which would be necessary to aid in the performance of the intended function.

12. a) All penetrations which are to be closed during accident conditions are:

1. Are in their closed positions.
2. Are either blocked off by manual valves, flanges, ore deactivated automatic devices.

b) Equipment hatches or doors are in place.
c) Personnel & emergency hatches functioned as per Tech. Specs.
d) EBS system operational as per Tech. Specs.
e) All equipment meets its leakage specs as per Tech. Specs.

13. Rated Power = the total heat transferred from the core to the RCS (2772 MW).

14. a) NSRW pump trip - when a pump trips the pump selected for backup should start. If this pump does not start, attempt to start pump in other loop. All components which were being cooled from the operating loop must be now switched over to the other loop (i.e.) NS coders, IC coolers. Attempt to restore tripped pump to operation.

b) SSRW pump trip - standby pump should start. If it doesn't start attempt to start manually. If pump will not start, throttle lock on SR-V74 to maintain discharge pressure. If de-icing screenhouse, shift supply from NSRW. If you need the cooling pretreatment can possibly shutdown.

15. a) Inlet flow control valve.
b) Chemicals are added prior to water entering flocculator.
c) Anthracite filters.
d) Clearwell

16. Core alteration is the movement of any component within the reactor pressure vessel head removed and fuel in the vessel. Lifting of the upper plenum assembly.

17. The vital bus static transfer switch normally selects the inverter output. It will shift to the alternate supply when the voltage drops to a sustained 97% or instantaneous 50%. This is a normal seeking bus transfer. If voltage is restored in the 2-10 sec the static transfer switch will switch back to its normal supply.

18. The starting air system consists of 2 compressors and 2 air receivers for each diesel genrator. One compressor is motor driven. The other compressor can be either driven by a motor or a small diesel engine if AC power is lost. The air compressors keep the receivers pressurized between 225# and 250#. This is the only cross connected system associated with the diesel generators. Air from either pair of receiver tanks can be used to start either diesel. There are two air start solonide valves, an air start control valve, air start distributor, air start check valves and an air header.

When the start signal is received the air start solonide valves open. The air start linkage open the air start control valve and admits air into the header which goes to each cylinder. Air also passes into a pilot line which goes to the air start distributor. The valves in the air start distributor are arranged so they open in the proper firing order. When the air enters the distributor, it forces the valves down against the cam shaft so the valves open in the proper order and iar flow into the cylinder between the pistons and forces them apart. Forcing the pistons apart causes the crankshafts to rotate fast enough so as to start the engine.

19. Natural draft cooling tower de-icing can be accomplished in two ways. The inboard header flow control valves are throttled down so as to raise the water level in the outboard distributor basin. The level is raised as high as possible without causing tower to overflow. With most of the water in the outboard distribution basin the ice buildup on the louvres should be minimized. The cooling towers can also be de-iced in sections if necessary. This is accomplished by shutting off half of the flow to the towers so all flow goes to the other half. This type of operation is limited to 1 hour duration.

20. The amertap balls enter the circ water system at the condenser inlet. They are injected opposite normal flow so as to get better dispersion of the balls. The balls flow through the tubes and core out into four sets of screens. When the balls are collected in the upper screen they come out through the reinjection pump and are reinjected upstream of the lower screens. This provides a common place for ball collection. The balls come out of the lower screens through the recirc pump, the ball collector basket and back to the condenser inlet where the cycle starts over again.

21. The circ water flume is controlled by a level switch located in the circ water house. Normal makeup comes from the secondary river water return header. When the level switch senses a low level SR-V21 closes to shutoff SR return to mechanical draft coolign tower and opens SR-V17 to the circ water flume. When level returns to normal SR-V17 closes and SR-V21 opens to return flow again to the mechanical draft cooling tower. The flume lo lo level alarm is at elev. 290'. As of this time the instrument people do not have the numbers at which SR-V17 opens and closes. The cooling tower level alarms are 300' 3" hi alarm, 299' 3" low alarm.

TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2, 2, A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1 4	5	9 8	0 1 6	B B

TOTAL COURSE DURATION

HOURS
27 31

4. LECTURE HOURS ________ OTHER HOURS ________ EXPLAIN ________

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.00
Rev 3

MODE PREFIX 32 34

35 COMMENT 59

SHIFT CYCLE 1 HALF 2

TOTAL EXAM POINTS 31 MIN POINTS TO PASS 21.7

EXAM SCORE ________ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ________ DATE ________

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ________ DATE ________

Total Points 31.0

NAME:____________________
SCORE:____________

UNIT II
CATEGORY IV CRO
CYCLE 1-2 EXAM

(2.0) 1. List your immediate action on loss of feed to both steam generators. (Automatic and Manual actions required).

(1.0) 2. Explain how to establish feed to a steam generator that has boiled dry. Include maximum reactor power.

(1.0) 3. a) With power > 10% FP, what is the maximum operating range level of an OTSG? Why?

(1.0) b) What is the normal (minimum) low level of an OTSG? Why?

(1.5) 4. a) What is the purpose of the minimum level for the condensate storage tanks, with the reactor in operation?

b) What is the minimum in feet and in gallons?

(2.0) 5. Explain the operation of the FWP turbine control valves and the sources of steam through them.

(1.0) 6. When you are ready to admit steam, in what order do the stop and control valves open?

(1.5) 7. While increasing turbine speed, at what speeds would you expect the worst conditions to be shown on the Main Turbine Vibration Recorder?

(0.5) 8. How fast may the turbine be loaded up to 40% load?

(2.0) 9. List the conditions which will automatically trip the main turbine. Include respective setpoints.

(0.5) 10. a) How may main steam safety valves must be operable to have the plant at 100% FP?

(1.0) b) What must be done if the number from part "a" is not met?

(1.0) 11. What is the maximum flow and ΔP on a deep bed demineralizer in service? Why?

(3.0) 12. Draw a one line diagram of the Condensate-Feedwater-Main Steam Train showing major components and major valves. (Do not include instrumentation).

13. List the required manual actions for the following events:

(2.0) a) OTSG Tube Rupture

(2.0) b) Turbine Trip

(1.0) 14. Explain the condensate flow control scheme through the gland steam condenser.

(1.5) 15. What conditions will cause the Emergency Feedwater Pumps to "Auto" start?

(0.5) 16. a) How many lube oil pumps are provided for each FW-pump turbine?

(1.0) b) When is each used?

(1.5) c) Describe any differences in their discharge flowpaths.

(2.0) 17. List the sources of "air side" hydrogen seal oil and limitations imposed when each is used.

UNIT II
CATEGORY IV CRO
CYCLE 1-2
KEY

1. Automatic

   1. Rx trip on high pressure - turbine trips.
   2. Emergency feedwater pumps start and maintain 30" SU range.

   Manual

   1. Trip the Rx
   2. Verify turbine trip, stop valves close.
   3. Verify emergency feedwater pumps start.
   4. Verify EF-V 11A/B controlling level at 30". Feedwater flow to S/G must be limited to < 360 GPM (180,000 lb/hr).

2. When feeding a dry steam generator the emergency feedwater nozzles are used so as to prevent thermal shock to the tube sheet. The limit for feeding a dry S/G is ≈2 in/min.

   If able to restore feedwater flow prior to reaching 25" in S/G continue normal operation. If not able to restore feedwater flow prior to reaching 15" reduce power to ≈8% Rx power and use EF to raise level to 25".

3. a) Max operating level in OTSG is 82.5% an operating range indication to prevent excess carryover and be able to maintain steam quality .

   b) Normal minimum level in OTSG is 30" on startup range. This is to provide sufficient water inventory for plant cooldown.

4. a) Insures sufficient water inventory to be able to cooldown to 280°F following a loss of off-site power or loss of feedwater. Also to be able to maintain plant in hot standby for 13 hours while discharging steam to atmosphere during a loss of off-site power.

   b) 220,000 minimum volume by Tech. Specs. If this volume were divided into both tanks at 110,000 gal. each, this would correspond to a level of ≈13.2 feet.

5. The feed pump control valves consists of 4 low pressure poppets and one HP valve. When the feedwater pump is first started on aux. steam the low pressure poppets are open to admit steam. The poppets are arranged with different length stems to allow overlap. When the low pressure valves are full open the high pressure valve starts opening. As high pressure steam is admitted, the high pressure valve will open if necessary to maintain speed, or as secured. When sufficient extraction steam is available, the hgih pressure valve will close and the feedwater pump is again operating on low pressure steam. This transfer from high pressure to extraction steam is done automatically as the valves close to maintain speed. The HP valve will close first.

6. When the turbine is first started it is rolled with the governor full open and speed is controlled with the throttle valves. The throttle valves are used up to a point where all trips are tested and unit is again brought up to 1700 RPM. When unit is at 1700 RPM the transfer is made from the throttle valves to the governor valves. The turbine is then increased to sync speed with

the throttle valves wide open.

GV opening sequence is 2+3, then 1, then 4.

7. There are several critical speed numbers in the turbine procedure for the LP turbine. Throughout the turbine startup there are three different critical speeds of 970, 1650, and 1955. Until the turbine reaches 600 RMP you would not have any indication on the vibration recorder. When the turbine reaches 600 PPM the recorder switches from eccentricity to vibration.

8. a) Anticipated 1st stg. temp change.
   b) Initial 1st stage temp.
   c) Desired # of fatigue cycles (10,000)

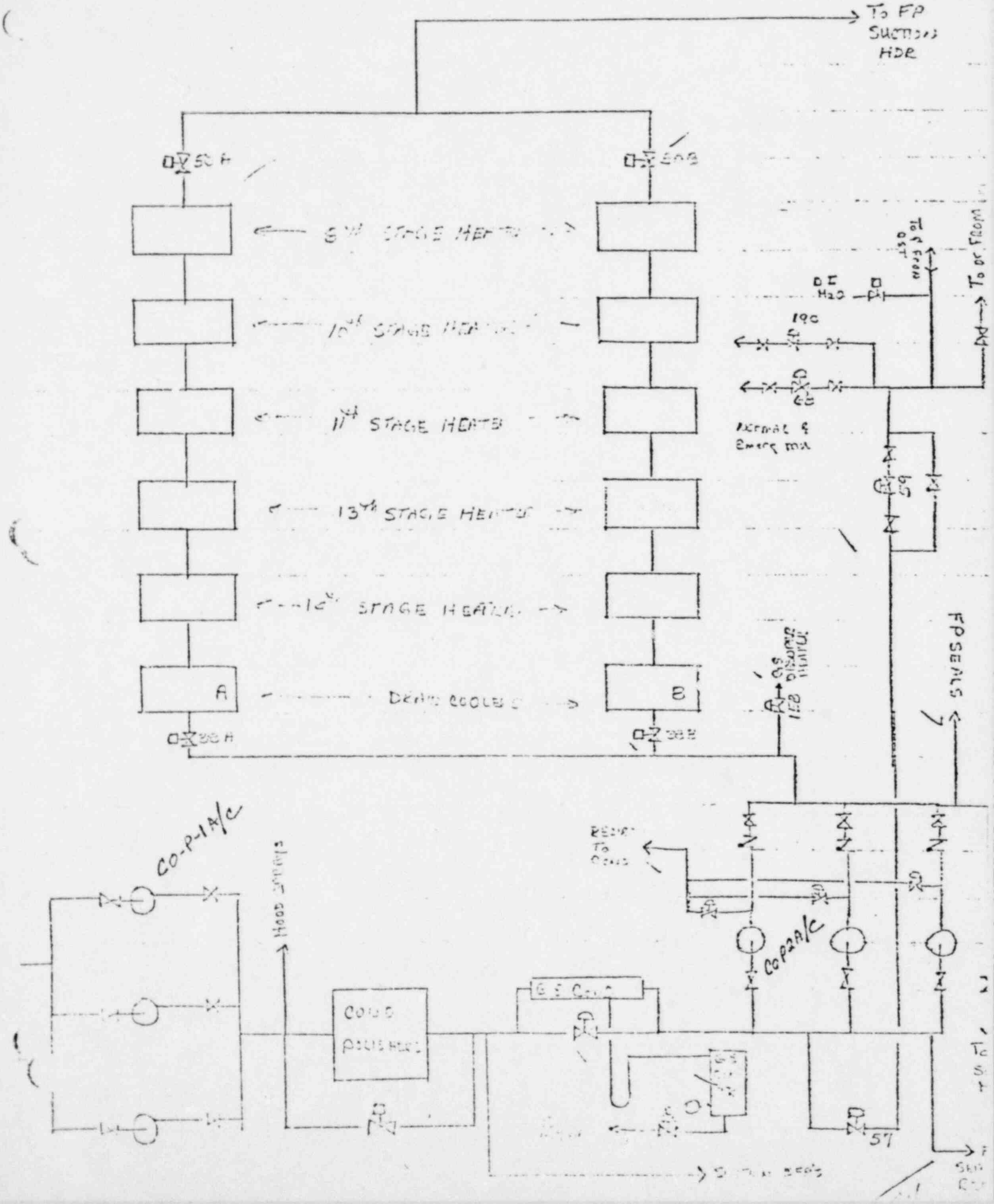
9. Rx Trip
   Loss of both FW Pumps
   Loss of SC Cooling pumps (3)
   Low vacuum (18-22")
   Overspeed (1998 RPM)
   Low Oil pressure (psig)
   Loss of EHC Power
   Thrust bearing failure (75# oil pressure)
   Loss of 2 of 3 speed inputs to ± EOSP
   Manual Trip

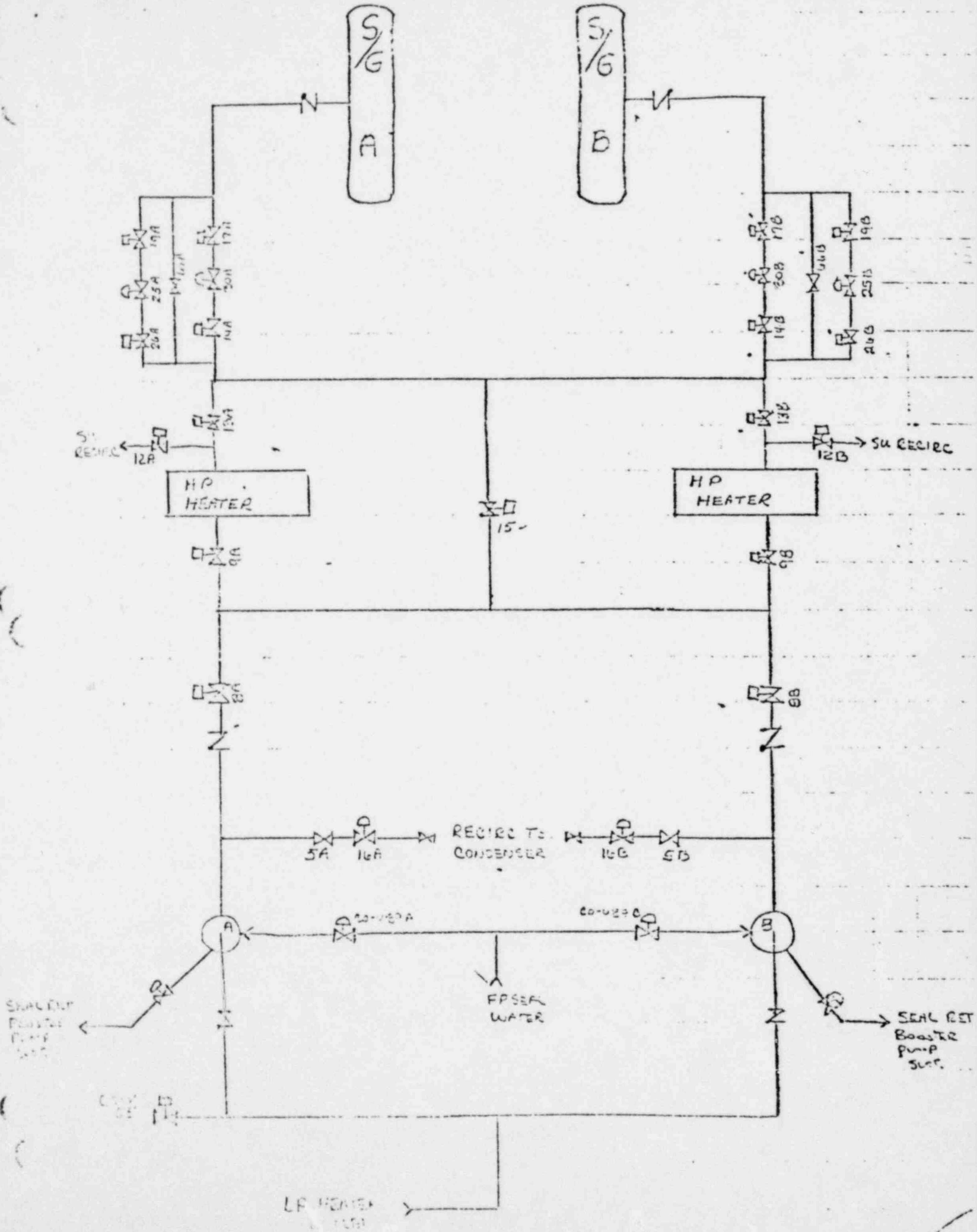
10. Per STS. Mode 1, 2, 3 all amin steam safety valves must be operable.

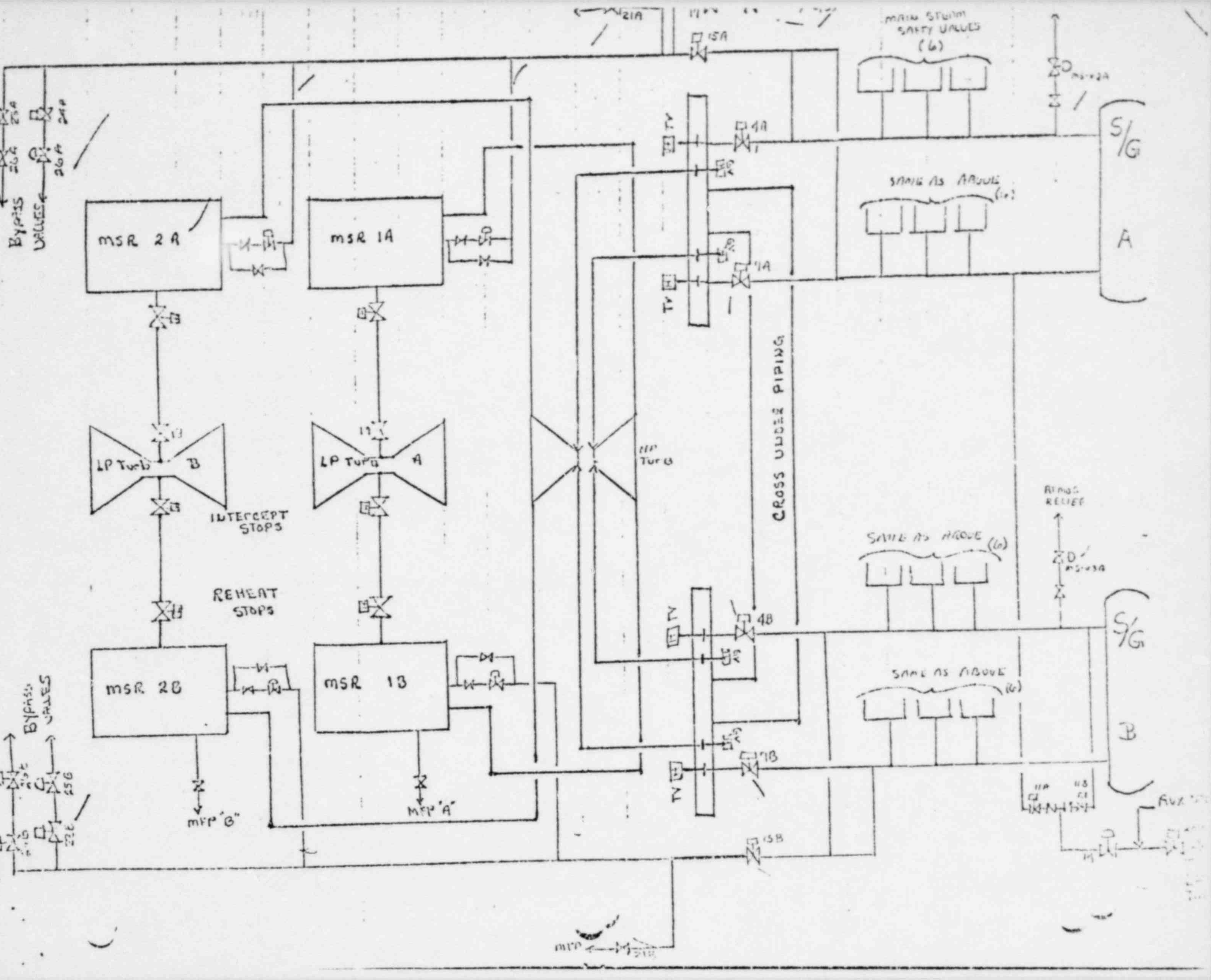
    If main steam safety valves are not operable the overpower trip setpoint must be reduced a given amount for each valve which is inoperable up to a max. of four / 5/6.

11. Max flow per vessel is 2500 GPM. There is a high system ΔP alarm of 45# and a high resin trap P alarm of 5#. The reason for the high ΔP on the resin trap is to insure that you don't break through the resin retaining screen.

12. See attached sheets.


To FP
SUCTION
HDR
50 A
50 B
STAGE HEATER
STAGE HEATER
11th STAGE HEATER
13th STAGE HEATER
STAGE HEATER
A
DRAIN COOLER
B
38 A
38 B
To or From
To or From
H2O
19C
Normal &
Emerg mu
59
FP SEALS
18B
CO-P-1A/C
COP2A/C
COND
POLISHERS
57


S/G A
S/G B
HP HEATER
HP HEATER
SU RECIRC
12A
13A
12B
13B
SU RECIRC
15
9A
9B
8A
8B
RECIRC TO CONDENSER
5A
16A
16B
5B
FP SEAL WATER
SEAL RET BOOSTER PUMP SUCT.


MAIN STEAM
SAFETY VALVES
(6)
S/G
A
SAME AS ABOVE (6)
S/G
B
SAME AS ABOVE (6)
SAME AS ABOVE (6)
ATMOS RELIEF
CROSS UNDER PIPING
HP TURB
4A
1A
4B
1B
15A
15B
21A
TV
MSR 2A
MSR 1A
MSR 2B
MSR 1B
LP TURB B
LP TURB A
INTERCEPT STOPS
REHEAT STOPS
BYPASS VALVES
BYPASS VALVES
MFP "B"
MFP "A"
MFP
AUX

13. a) <u>OTSG Tube Rupture</u>

Indications would be:

a) Initial loss of RC pressure then becoming stable after a short time.
b) Decreasing makeup tank level.
c) VA-R-748 alarm.
d) Activity in S/G by secondary sample

Manual Actions:

a) Verify MU-V17 maintaining pressurizer level.
b) Verify VA-R748 alarm
c) Have chemistry sample both S/G
d) If supplying steam to Unit I notify Unit I Control Room and shut steam valve A5-V23.
e) Attempt to determine which S/G has leak and isolate its atmospheric steam relief.
f) If makeup tank level decreasing rapidly ($>$ 10"/min) begin reducing load. Do shutdown as carefully as possible to avoid lifting main steam safety valves.

b) <u>Turbine Trip</u>

Manual Actions

a) Insure turbine is tripped and generator breakers are open.
b) Insure TV, GV and reheat stop valves are closed.
c) Verify extraction steam valves close and discharge valves open.
d) Verify starting of seal oil backup pump, turning gear oil pump and bearing oil lift pump or start.
e) Insure Rx to feedwater is running back to 15% power.
f) If Rx or feedwater is in hand, run back manually to 15% power.

14. Water flow through the gland steam condenser is controlled with CO-V26. This is actually a ΔP control valve set to maintain a 5# Δ P across the condenser to insure sufficient water flow through condenser at all times.

15. Feedwater pump auto start (Emergency)

1. Loss of both feedwater pumps
2. Loss of 4 RCPs.
3. Feedwater rupture detection system.

16. There are three oil pumps on the main feedwater pump.

a) 1) Main AC oil pump
2) Aux AC oil pump
3) DC emergency oil pump

b) Normal operation only main AC pump is used.
Aux. oil pump starts if control oil pressure drops to 70 psig or bearing oil pressure drops to 15 psig.
Emergency DC oil pump starts if bearing oil pre sure 10 psig.

c) Main & Aux. AC oil pump flow paths are indentical.
Emergency DC oil pump only supplies oil to bearings.

17. Normal supply = air side seal oil pump maintains air side seal oil 12 psi above gas pressure.

Backup Sources:

a) Main oil pump on turbine shaft - no limitations.
b) Seal oil backup on turbine oil reservoir - no limitations.
c) Air side seal oil backup pump - no limitations.
d) Turning gear oil pump: generator gas pressure must be reduced to 2 psig.

The main shaft oil pump and seal oil backup pump will provide seal oil when either the air side seal oil pump stops or seal oil pressure decreases to 8 psig above gas pressure.

The air side seal oil backup pump will provide seal oil when oil pressure at the seals decreases to 5 psig above gas pressure.

During operation 1, 2, & 3 above can maintain normal gas pressure in the generator.

TRAINING PROGRAM ADMINISTRATIVE FORM

1 3
2,2,A

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. 4–8	NAME	EMPLOYEE NO. 4–8
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1 4	5	0 8	0 1 6	C

TOTAL COURSE DURATIO

HOURS
27 31

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.00 Rev 3

MODE PREFIX 32 34

35 COMMENT 59

SHIFT CYCLE 1 HALF 2

TOTAL EXAM POINTS N/A MIN POINTS TO PASS N/A

EXAM SCORE N/A #1 ORAL RESULTS ______

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ______ DATE ______

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ______ DATE ______

CATEGORY IV CRO

1ST CYCLE ORAL

) 0 ONLY UNIT I CRO ANSWER
* ONLY UNIT II CRO ANSWER
UNMARKED BOTH UNIT I & II CRO ANSWER

NAME ______________________________

GRADE	AREA/COMMENTS
	1. DEFINE a. Hot Shutdown b. Cold Shutdown c. Tilt d. Imbalance 0 e. Redundancy * e. Shutdown Margin COMMENTS:
)	2. TAGGING a. Clearance b. Tags remain c. Testing d. Dispatcher e. Type of tags f. RWP COMMENTS:
)	3. ELECTRICAL a. Transfer feed to VB b. 4160 Auto Transfer c. Manual Tie Breakers d. Use of Disconnect Switches COMMENTS:

GRADE	AREA/COMMENTS
	4. TURBINES a. FWP Turbine Startup b. FWP Turbine Steam Supply c. EFWP Turbine Steam Supply d. EFWP Turbine Auto starts/controls (and motor) e. Main Turbine startup (simulate or use procedure) f. Manual action for Turbine Trip COMMENTS:
	5. CIRC. WATER a. Valve interlocks b. Pump stop 0 c. 7th switch * c. Makeup (effect MDCT ops) d. Chemical addition/conductivity control COMMENTS:
	6. LOG ENTRIES a. CRO b. Bypass and Jumper COMMENTS:

GRADE	AREA/COMMENTS
	7. DIESEL GENERATORS a. Auto starts b. Auto stops c. Starting Medium 1. Band 2. Min. Press to start D.G. COMMENTS:
	8. RIVER WATER a. Source Lube Oil b. Cross Connect 0 c. Failure Decay Heat River String * c. Failure Secondary Services River Water COMMENTS:
	9. FEEDWATER/CONDENSATE a. Pump Interlock Cond/Cond Booster/FW b. Condition COP1A/C/COP2A/C FW P1A/B running COP2B tagged out COP2C Trips which FW pump will trip? (Verify ?) c. Operation 1. FW Valves (Reg. Valves & Block Valves) 2. FWP Speed (Note: Has not been assigned ICS may not know this) d. OTSG level control startup 1. Prior to containment integrity 2. Just after containment integrity 3. @ 3% Full Power COMMENTS:

GRADE	AREA/COMMENTS
	10. MAIN STEAM a. Tap off 1. Safeties 2. Dumps 3. Bypass b. Isolation Valves c. Stop/Control Valve Sequence COMMENTS:

SUMMARY SHEET

1. ____________ 6. ____________

2. ____________ 7. ____________

3. ____________ 8. ____________

4. ____________ 9. ____________

5. ____________ 10. ____________

OVERALL ________

COMMENTS:

________________________________ DATE

________________________________ SIGNATURE OF TRAINING COORDINATOR

TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2, 2, A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.	CATG	TYPE	SUBJECT	LESSON ID
15			22	23 – 26
1 4	5	9 8	0 1 6	B D

TOTAL COURSE DURATION

HOURS
27 – 31

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.00 Rev 3

MODE PREFIX (32–34)

COMMENT (35–59)

SHIFT CYCLE 2 HALF 1

TOTAL EXAM POINTS 33.5 MIN POINTS TO PASS 23.45

EXAM SCORE ______ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ______ DATE ______

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ______ DATE ______

Total Points 33.5

NAME: ______________________
SCORE: __________

UNIT II
CATEGORY IV CRO
CYCLE 2-1 EXAM

(1.0) 1. It is desired to run MU-P-1C for 24 hours as the operating makeup pump.

a) Outline the steps necessary to shift from MU-P-1B to MY-P-1C. (Be specific).

(5.0) 2. Draw the makeup and purification system, include major equipment and remotely operated valves. (Label all valves and components DO NOT include instrumentation).

(2.0) 3. The boric acid mix tank pumps discharge can be directed to various systems.

a) List all possible end points where the discharge of the pumps may be directed.

4. Certain chemical(s) are added to the reactor building spray system during a LOCA condition.

(1.0) a) What are these chemical(s)?

(1.0) b) Why are they added?

(1.5) 5. Briefly explain how Emergency Boration is accomplished.

(0.5) 6. During normal power operation (100%), what is the position of DHV5A and DHV5B?

7. Briefly answer the following questions pertaining to the nuclear plant hydrogen system.

(0.5) a) Where is the hydrogen used (system)?

(0.5) b) When is the hydrogen used?

(0.5) c) What are the limits on hydrogen content?

(0.5) d) What are the consequences if the concentration is lower than the lowest limit?

8. The makeup and purification demineralizers (A & B) are different during operation.

(1.0) a) What is the difference?

(1.0) b) Why are they different?

(0.5) 9. a) What is the Tech. Spec. limits for dissolved Oxygen in the reactor coolant system?

(1.0) 9. b) What are the two (2) major sources of dissolved Oxygen in the Reactor Coolant System?

(1.5) 10. Briefly explain the actions which must be taken prior to opening an inspection hatch on the Isolated Phase Bus Duct Cooling System.

(3.0) 11. Make a simple sketch of the Decay Heat Removal System. (Include all major equipment and remotely operated valves, label the components and valves). (DO NOT INCLUDE INSTRUMENTATION).

(1.0) 12. There are certain chemicals added to the Condensate System.

a) List the chemicals added..

(2.0) b) Briefly explain why each of the chemical are added.

13. The Technical Specifications discuss the Safety Limits for the plant.

(1.5) a) What parameters are used to define the Safety Limits?

(2.5) b) Sketch the curves used to define these limits.

(1.5) 14. Briefly describe how testing of the auto-stop protective devices may be accomplished during normal operation without causing a turbine trip.

(3.0) 15. Explain the principle of operation of the Generator Core Monitor.

UNIT II
CATEGORY IV CRO
CYCLE 2-1 EXAM
KEY

1. Insure proper valve lineup. Suction and discharge cross connect valves, between MU-P 1B/C must be opened. Valves between MU-P 1A/B must be shut. Insure MU-P 1C ready to run, oil pressure, cooling water, etc. start MU-P 1C. When sure MU-P 1C operating properly strop MU-P 1B. If the B pump is to be selected as the backup pump - change pump selector switch to the B/C position. Do not change the position of this switch with the B MUP operating as this will cause the pump to trip.

2. See attached sheet.

3. a) Upstream of batch controller.
   b) Upstream of makeup filters.
   c) Spent fuel pump suction header.
   d) Borated water storage tank.
   e) Core flood makeup tank.

4. a) Borated water from BWST - Sodium hydroxide,
   b) Borated water is added to insure Rx remains shutdown during LOCA sodium hydroxide is added to maintain the proper PH of the coolant so as to aid in the absorption of I by spray water and maintain the absorved I is solution.

5. Emergency boration can be accomplished by two different flowpaths. Either upstream of batch controller or downstream of MU-V8. If using the batch controller the amount desired must be set in the counter, MU-V10 open, and pumps started. When counter counts down to zero the pumps will auto stop if in auto. If using flowpath downstream of MU-V8 the amount desired is again set in counter, MU-V127 in makeup alley must be opened and pumps started. When desired amount of boric acid is added or counter reaches 0, stop pumps. Verify SDM - if necessary add more boric acid.

6. During normal power operation DH-V 5A/B are closed. New change just installed on loss of voltage to ES bus 2-1E 2-2E DH-V 5A/B will open from respective bus.

7. a) Makeup system
   b) $> 400^oF$
   c) 15-40 CC/L d) 15 cc/L is minimum for scavenging free oxygen, 40 is max. so as not to exceed 100 CC/L total gas concentration

8. "A" Demin has HoH resin - B demin has LoH resin

   The resin bed with LoH resin is normally used. Li is used to control RCS PH. During normal everyday operation Li is generated in the RCS. When the Li content becomes too high, the non lithiated bed is placed in service to lower primary system Ph.

9. a) 1 ppm max.
   b) Makeup water
      Water disassociation

10. Generator breakers must be opened, gen field breaker must be opened. Fans must be off - all three components should be red tag to insure personnel safety.

11. See attached sheet.

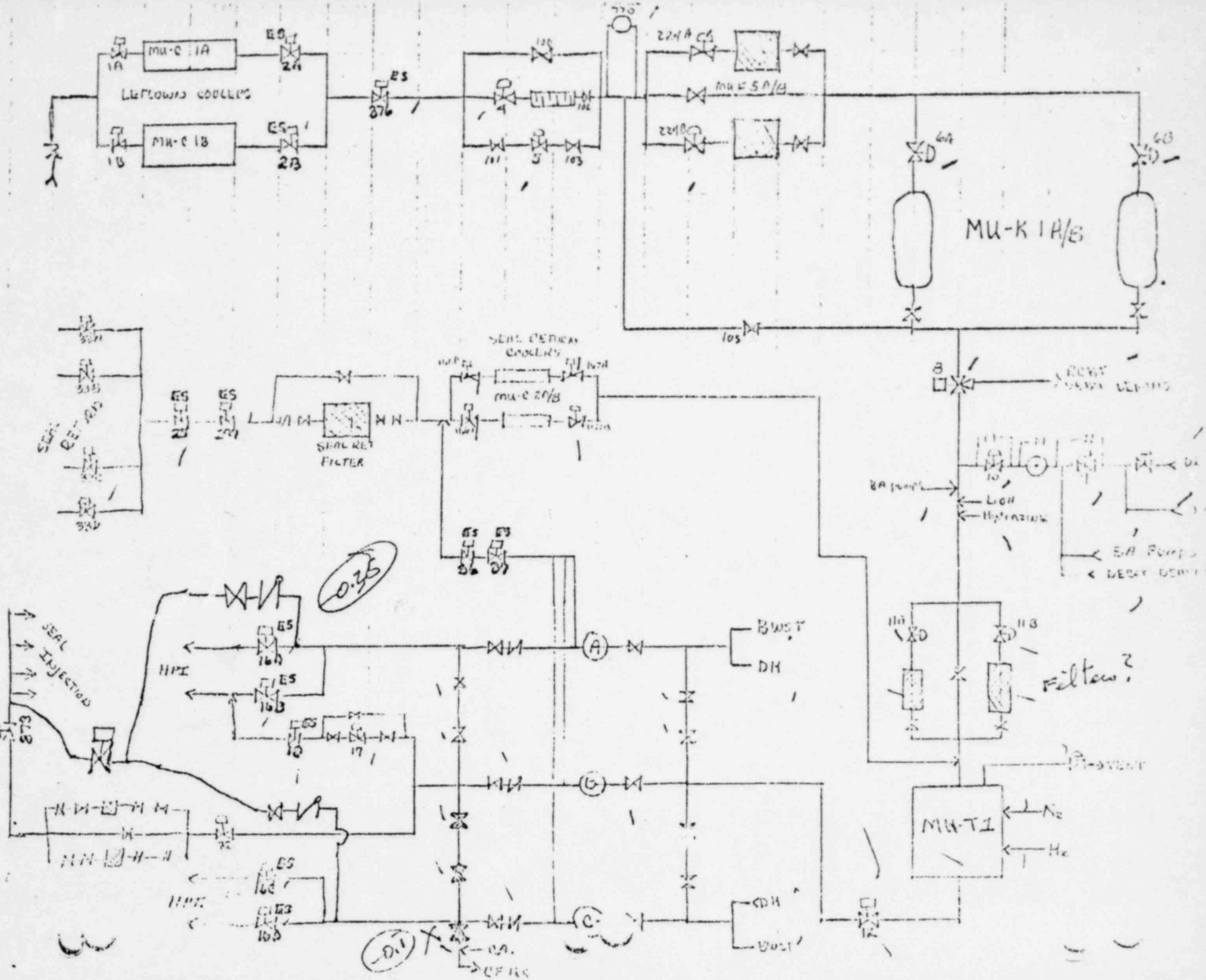
12. a) Hydrazine, ammonia
    b) Hydrazine is added for O_2 control.
    Ammonia is added for PH control.

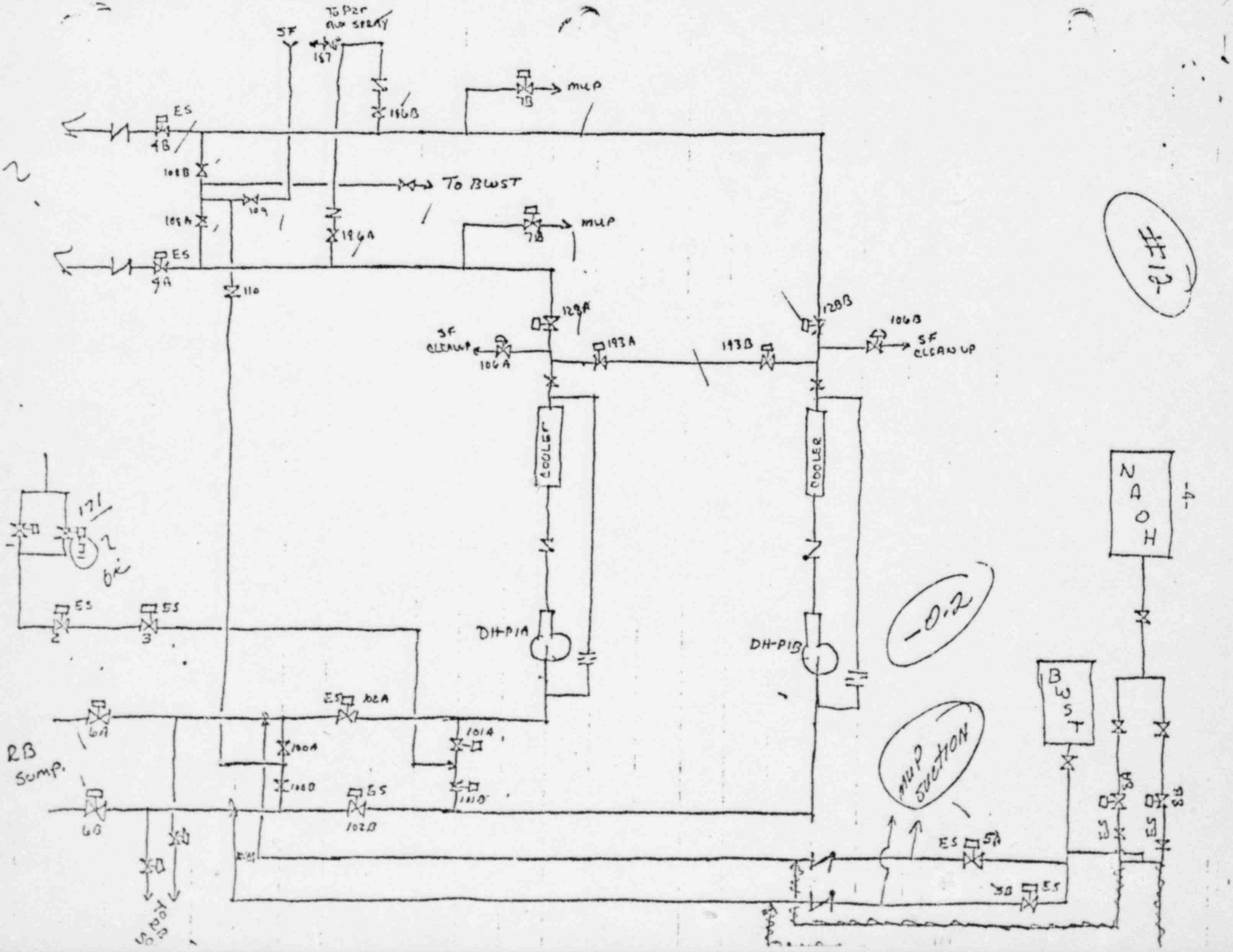
13. a) RC Pressure, RC Outlet Temp., Rx Power, RC Flow, Power Imbalance
    b) RC Pressure 2750 Kw/ft 21.0
    DNBR > 1.3

    The combination of above parameters are plotted out on graphs in STS. Operations is confined within these settings so none of the safety limits in part B are exceeded.

14. The turbine trip devices can be tested at the front standard of the turbine. There are two levers. One is the test lever, the other is a reset lever. The test lever must be held in the test position while performing the test. This prevents the turbine from actually tripping. The other lever will actually move to the tripped position when the trip device actuates. The tripped devise must be reset before the test lever is released.

15. The generator core monitor is a device which actually measure current flow. There is a alpha source which causes ionization of the H_2 gas. If the generator overheats and insulation breaks down small subparticles will be released into the H_2 gas. The small particles would attach themselves to the ions and cause detector output current to decrease. When current drops to 50% normal valve alarm is sounded. When alarm sounds the operator pushes button on front of monitor to route sample through the filter. If the alarm clears after sample is routed through the filter you have a problem in the generator and must take it off the line.


#2
LETDOWN COOLERS
MU-C 1A
MU-C 1B
MU-K 1A/B
SEAL RETURN COOLERS
SEAL RET FILTER
BWST
DH
HPI
SEAL INJECTION
MU-T1
Filters?
0.35
0.1



To PZR AUX SPRAY
SF
167
MUP
7B
ES
4B
186B
108B
TO BWST
109
108A
186A
MUP
7A
ES
9A
110
128A
SF CLEANUP
106A
193A
193B
128B
106B
SF CLEAN UP
COOLER
COOLER
171
DH-P1A
DH-P1B
ES
ES
2
3
ES
102A
101A
100A
100B
101B
6A
6B
RB SUMP.
ES
102B
TO RB SUMP
-0.2
MUP SUCTION
ES
5A
5B
ES
BWST
NAOH
ES
ES
8A
8B
#12

TRAINING PROGRAM ADMINISTRATIVE FORM

1 3
2 2 A

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. 4 8	NAME	EMPLOYEE NO. 4 8
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1 4	5	0 8	0 1 6	B E

TOTAL COURSE DURATIO

HOURS
27 31

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.00 Rev 3

MODE PREFIX 32 34

35 COMMENT 59

SHIFT CYCLE 2 HALF 2

TOTAL EXAM POINTS 52 MIN POINTS TO PASS 36.4

EXAM SCORE ______ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

______ INSTRUCTOR SIGNATURE ______ DATE

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ______ DATE ______

Total Points 52

Name: ______________________
Score: ____________

UNIT II
CATEGORY IV CRO
CYCLE 2-2 EXAM

(2.0) 1. What are the BWST Tech. Spec. Requirements for achieving Criticality?

(2.0) 2. Describe the interlocks associated with DH-V-1.

(1.0) 3. What cooling system cools BS-P-1A?

(1.0) 4. When are we required to reduce CF-T-1A & 1B pressure to atmospheric?

(1.0) 5. At what RC pressure do we close CF-T-1A/1B on Plant Cooldown?

(1.0) 6. When do we need seal injection flow to all 4 RCP's?

(1.0) 7. What is the CRO accomplishing by placing the NDTT Switch in the auto position?

(1.0) 8. What is done with the chart paper on the ATR's (computer) used during a plant heatup and cooldown?

(5.0) 9. Draw the TMI Tech. Spec. Heatup Curve and explain all limits. Superimpose a typical heatup plot.

(2.0) 10. Why do we maintain approx. 200°F feedwater temperature during plant heatup and cooldown operations?

(3.0) 11. Define "Containment Integrity".

(2.0) 12. What is "Critical Data" and when is it logged?

(2.0) 13. What are the monitoring requirments for Imbalance and Quadrant Power Tilt?

(1.0) 14. When do we secure 13th Stage Heating on a plant startup?

(3.0) 15. Why do we have a power level cutoff?

(2.0) 16. What are the Tech. Spec. Thermal Discharge Limits?

(1.0) 17. When are we required to open the Generator Disconnect Switches?

(5.0) 18. Draw the Tech. Spec. RCS Cooldown Curve. Explain all limits. Superimpose a typical plant cooldown plot.

(3.0) 19. How would you know you had a Reactor Coolant System leak inside the Reactor Building? List all indications.

(4.0) 20. List the Automatic and Manual actions required for a load rejection.

(6.0) 21. Draw the Emergency Core Cooling System - include HPI, LPI, and Core Flooding Systems. (Do not Include instrumentation).

22. Concerning the Core Flood Tanks, what limits apply for:

(0.5) a) Boron Concentration

(0.5) b) Borated Water Volume

(0.5) c) Nitrogen Overpressure

(1.5) 23. When and how during Plant Cooldown are the Automatic Emergency Feed pumps starts defeated? (Be specific)

UNIT II
CATEGORY IV CRO
CYCLE 2-2 EXAM
KEY

1. BWST

   Level 53'6" to 56'
   Boron 2270 to 2370 ppm
   Temp $\geq$ 40°F
   Flowpath from BWST to MU&P or DH to RCS

2. DH-V 1 or 171 cannot be opened with RC pressure > 320#. If RC pressure goes above 320 psig DH-V1 or 171 will close.

3. Normal cooling for BS-P1A is NSCCW. Emergency supply is NSRW.

4. When the RC system is being cooled down and depressurized for reactor head removal CF-V 1A/B must be closed, their breakers open and DNO tagged and the pressure reduced to atmospheric.

5. CF-V 1A/B are closed on cooldown at RC pressure < 750 psig but > 700 psig.

6. RC pressure > 200 psig and RC temp. > 200°F.

7. By placing the NDTT switch to auto reduces the pressure setpoint of the electromatic relief valve to 500 psig. If temp. < 275° F and RCR2 Mis in auto.

8. The chart paper from the ATR, marked with time/date/scales and attached to the completed heatup or cooldown procedure. This procedure is then returned to the file cabinet.

9. See attachment.

10. Feedwater is heated to ≈200°F for O_2 removal from water.

11. Containment integrity is defined as all penetration to the reactor building which are required to be closed during accident condition are in their closed position, or capable of being closed by automatic devices or closed by manual valves or flanges. Rx. bldg. air locks are closed and meet Tech. Spec. leakage requirements. Equipment hatches are closed and sealed. Rx. bldg meets leakage specs. Each penetration into the Rx bldg. with a sealing system is operable.

12. Critical data = boron concentration, R.C. temperature, rod positions, time, date. This data is logged on startup and shutdowns at 10^{-8} amps in the I.R.

13. Quadrant power tilt is required to be monitored at least once every 12 hours when above 15% power. This is by procedure. By STS it must be monitored at least once per 7 days. Axial power imbalance is required to be monitored at least once every 12 hours when above 40% rated thermal power. If the computer monitoring system for imbalance is OOC the imbalance must be calculated at 1 hour intervals.

14. 13th stage feedwater heating is secured after the turbine is on the line carrying 20% load and sufficient extration steam is available.

14. 13th stage feedwater heating is secured after the turbine is on the line carrying 20% load and sufficient extraction steam is available.

15. To insure we do not exceed our power peaking limits.

16. Max discharge temp 87°F
+12° ΔT Nov 1 thru April 30
-7° ΔT May 1 thru Oct. 31
+12° ΔT during cooldown
5° ΔT/hr. Max change per hour
-3° ΔT Unit I Tech. Spec.
2° ΔT/hr Change Unit I Tech. Spec.

17. When in mode 3 and intending to go into mode 4, open generator disconnects switches as directed by dispatcher.

18. See attached.

19. Hi RB Temp alarm
Hi RB sump level alarm
Hi Radiation alarm in Rx Bldg.
Rx Bldg. Pressure Increasing
RB cooling fan drip pan level hi alarm
Atmospheric Monitor

20. ICS to track because turbine goes to manual on header pressure error.
ICS runs back in tracking mode to a Rx power corresponding to new load.
Safety valves could open.
RC-RV 2 could open.

Verify feedwater flow and Rx power are being reduced. Amount of runback will depend on amount of load rejection.

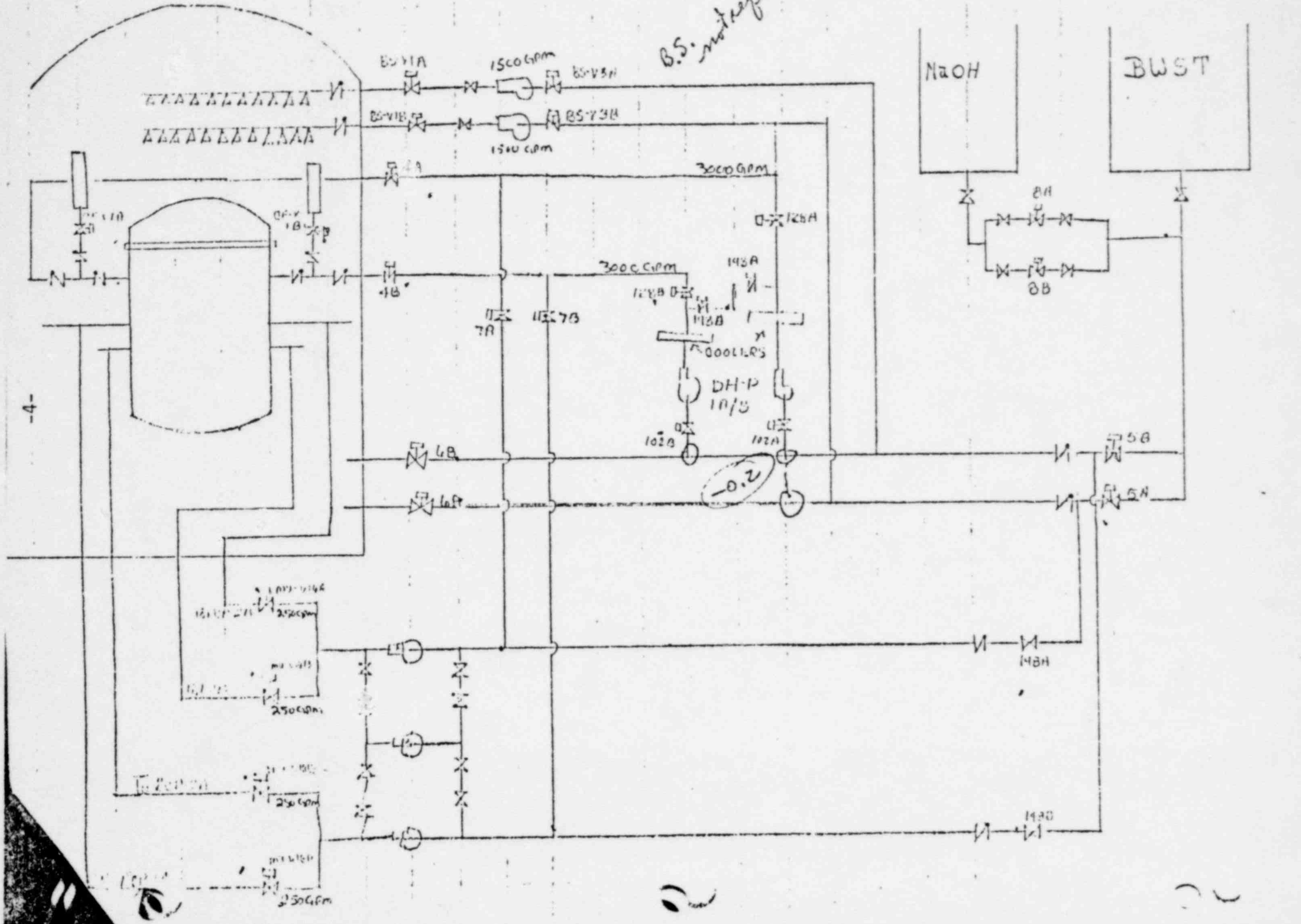
If diamond on Rx master are in hand drive in rod manually to correspond to new load limit.

If any feedwater station is in hand reduce feed water flow manually to correspond to new load limit.

21. See attached sheet.

22. Boron concentration = between 2270 ppm and 3500 ppm.
Borated Water Volume = between 1010 and 1070 ft.^{3}
N_2 Overpressure = 600 ± 25 psig.

23. Prior to reachind a steam header pressure of 600#. The auto start signals are defeated by placing in PTL the control switches for MS-V207 (steam valve), EF-P2A/B control switches.


B.S. not required
NaOH
BWST
BS-V1A
1500 GPM
BS-V3A
BS-V1B
BS-V3B
1500 GPM
4A
3000 GPM
128A
8A
8B
300C GPM
148A
128B
148B
4B
7A
7B
COOLERS
DH-P
1A/B
102B
102A
-0.2
4B
4A
5B
5A
148A
250 GPM
250 GPM
250 GPM
250 GPM

TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2, 2 A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO. 15	CATG	TYPE	SUBJECT 22	LESSON ID 23–26
1 4	5	0 8	0 1 6	F

TOTAL COURSE DURATION

HOURS 27–31

4. LECTURE HOURS ________ OTHER HOURS ________ EXPLAIN ________

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.003 Rev 3

MODE PREFIX 32–34

COMMENT 35–59

SHIFT CYCLE 2 HALF 2

TOTAL EXAM POINTS N/A MIN POINTS TO PASS N/A

EXAM SCORE N/A #2 ORAL RESULTS ________

COMMENTS AND REASSIGNMENTS:

________________ INSTRUCTOR SIGNATURE ________ DATE

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ________ DATE ________

NAME ______________________

0 ONLY UNIT I CRO ANSWER
* ONLY UNIT II CRO ANSWER
UNMARKED BOTH UNIT I & II CRO ANSWER

GRADE	AREA/COMMENTS
	1. FIRE a. Your responsibility b. Difference if on third floor c. Fire protection at the turbine COMMENTS:
)	2. PROCEDURES a. Reactor Trip b. Loss of Decay Heat Removal c. Power Ops 1. Index 2. Power level cutoff d. Heatup/Cooldown 1. Figure 1a explain 2. Pumps on/off COMMENTS:
)	3. MAKEUP AND PURIFICATION a. Bleed and feed (interlocks) b. Mut overpressure (Hot/Cold) c. Switch pumps d. MUP start (Manual/Auto) e. MUP Suction on LOCA COMMENTS:

GRADE	AREA/COMMENTS
	4. EMERGENCY CORE COOLING a. Coreflood 1. Normal parameters 2. Tech Spec requirements b. LPI/HPI 1. Initiation - setpoints c. Boric acid system 1. Flow paths d. Building spray 1. Flow paths 2. Start (auto) COMMENTS:
	5. CHEMISTRY a. Secondary 1. Chemicals added (CO,CW,Turb. Gen) 2. Why added (Limits if any) b. Primary 1. Chemicals added to which systems 2. Why are these added 3. What limits are imposed COMMENTS:
	6. TECH SPECS a. Safety Limits 1. Area defined 2. Protection b. Equipment out of service 1. Testing 2. Duration c. Minimum conditions for criticality

GRADE	AREA/COMMENTS
	6. TECH SPECS (Con't) COMMENTS:

SUMMARY SHEET

1. __________ 6. __________

2. __________ 7. __________

3. __________ 8. __________

4. __________ 9. __________

5. __________ 10. __________

OVERALL __________

COMMENTS:

______________________________ DATE

______________________________ SIGNATURE OF TRAINING COORDINATOR

TRAINING PROGRAM ADMINISTRATIVE FORM

1 – 3
2,2,A

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO.
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO. 15	CATG	TYPE	SUBJECT 22	LESSON ID 23–26
1,4	5	0,8	0,1,6	B,G

TOTAL COURSE DURAT

HOURS 27–31

4. LECTURE HOURS ________ OTHER HOURS ________ EXPLAIN ________

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.C Rev 3

MODE PREFIX 32–34

COMMENT 35–59

SHIFT CYCLE 3 HALF 1

TOTAL EXAM POINTS 30 MIN POINTS TO PASS 21

EXAM SCORE ________ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ________ DATE ________

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ________ DATE ________

Total Points 30.0

Name:____________________________
Score________________

UNIT II
CATEGORY IV CRO
CYCLE 3-1 EXAM

(1) 1. How is EHC fluid temperature controlled? What are the (a) minimum, (b) normal, (c) maximum fluid temperatures?

(1) 2. How many EHC pumps are available? Required? What is the source of power for each?

(1) 3. Describe how EHC HP supply header pressure is maintained. Include setpoints, alarms, and automatic interlocks.

(1) 4. Describe the function and operation of the LVDT's associated with the TV and GV actuators.

(1) 5. Which valves will trip closed following actuation of the OPC Solenoids? Physically, what prevents all valves from closing?

(1) 6. Concerning the AEH Controller, what is meant by "Speed Control" and "Load Control"? What determines which mode the controller is functioning in?

(2) 7. The AEH controller is in "OPER AUTO", "SPEED CONTROL", and "TV CONTROL":

a) What signal controls the GV's? Why?

b) Describe two (2) methods of changing GV position in this condition.

(1) 8. How, by design, does the AEH controller prevent valve movement when changing from "OPER AUTO" to "TURBINE MANUAL" control?

(1) 9. What effect, if any, does the speed error signal have on the AEH Controller when operating in "LOAD CONTROL"?

(2) 10. Explain how the AEH Controller (a) operation and (b) indications change when selected to "IMP IN" versus "IMP OUT" during a loading transient.

(1) 11. Explain the function and operation of the Throttle Pressure Controller.

(1) 12. At what speed do we normally transfer control to the GV's? Describe how the system performs this manipulation.

(1) 13. Briefly describe the function and operation of the IOPS. Include setpoints and a discussion of the various solenoid valves actuated by the system.

(2) 14. Describe the various flowpaths to, within, and from the MSR's. Include:

a) sources of steam

b) drain paths

(1) 15. Concerning the MSR controller, explain the difference between the 400°F and "HOT START" modes. When is each used?

(2) 16. Describe the function and operation of the extraction steam stop-check valves in the following situations:

a) turbine reset for operation

b) turbine trip

c) FW heater high-high level

(1) 17. Following a prolonged shutdown, how and why (by design) do we insure the turbine casings are free of water?

(2) 18. Draw a block diagram of the generator excitation system.

(1) 19. Briefly explain how the output of the Trinistat Power Amplifier is varied.

(2) 20. What is the major difference between operating with the "Base Adjust" versus the "Volts Adjust" controls? What precautions must be observed when using the "Base Adjust" while the generator is on the line?

(2) 21. Outline the response of the WTA Regulator ot a decreasing teminal voltage.

(2) 22. Briefly explain how the generator is synchronized in the "manual" and "auto" modes.

TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2, 2, A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1,4	5	0,8	0,1,6	B,J,

TOTAL COURSE DURATI

HOURS
27 31

4. LECTURE HOURS ________ OTHER HOURS ________ EXPLAIN ________

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.0
Rev 3

MODE PREFIX 32 34

35 COMMENT 59

SHIFT CYCLE 4 HALF 1

TOTAL EXAM POINTS 34.6 MIN POINTS TO PASS 24.22

EXAM SCORE ________ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ________ DATE ________

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING COORDINATOR ________ DATE ________

Total Points 34.6

Name: ____________________
Score: ________

UNIT II
CATEGORY IV CRO
CYCLE 4-1 EXAM

(1.75) 1. List (7) seven conditions which will cause an automatic trip of a reactor coolant pump.

(2.0) 2. Briefly explain how the weight of a fuel assembly is supported in the reactor core.

(1.5) 3. List the automatic actions that occur if the pressurizer level indication fails low.

(2.0) 4. Breifly describe the system (component(s)) that are employed to prevent reverse rotation of a reactor coolant pump.

(3.6) 5. Label the attached drawing. Figure 1

6. a) Explain (define) the following terms:

(0.5) 1. NPSH
(0.5) 2. NDTT

(1.0) b) Explain (briefly) the consequences of operating in violation of each.

7. The pressurizer spray line has a bypass valve with a nominal flow.

(0.25) a) What is the nominal flow through the pressurizer spray bypass line?

(1.0) b) List two advantages of this nominal bypass line flow.

(1.5) 8. What conditions must be met to reduce the RCS boron concentration while subcritical?

(2.0) 9. List (4) four methods of determining Reactor Coolant System leakage into the Reactor Building.

10. The reactor coolant pump has a thermal barrier.

(0.5) a) What is the purpose of the thermal barrier?

(0.25) b) What system cools the RCP seal water following a loss of normal seal injection?

(2.0) 11. List the interlocks which must be satisfied to start a Reactor Coolant Pump.

(1.5) 12. List the required manual actions if the pressurizer pilot operated relief fails open.

13. The CRDM must be vented during a plant heatup.

(0.25) a) At what pressure is this to be accomplished?

(0.5) b) Briefly explain why this venting is required.

(1.0) 14. Briefly describe the reactor coolant pump leakage detection system. (Include in description control room indications of excess leakage).

(2.5) 15. List the conditions which required the Intermediate Closed Cooling System to be in operation.

(2.0) 16. Describe the interlock(s) between MU-V-1A/1B and the intermediate closed cooling system. Include any applicable setpoints..

(2.0) 17. a) Explain the reasons for the 85-120^{o}F ICCWS cooler outlet temperature band in Limits and Precautions.

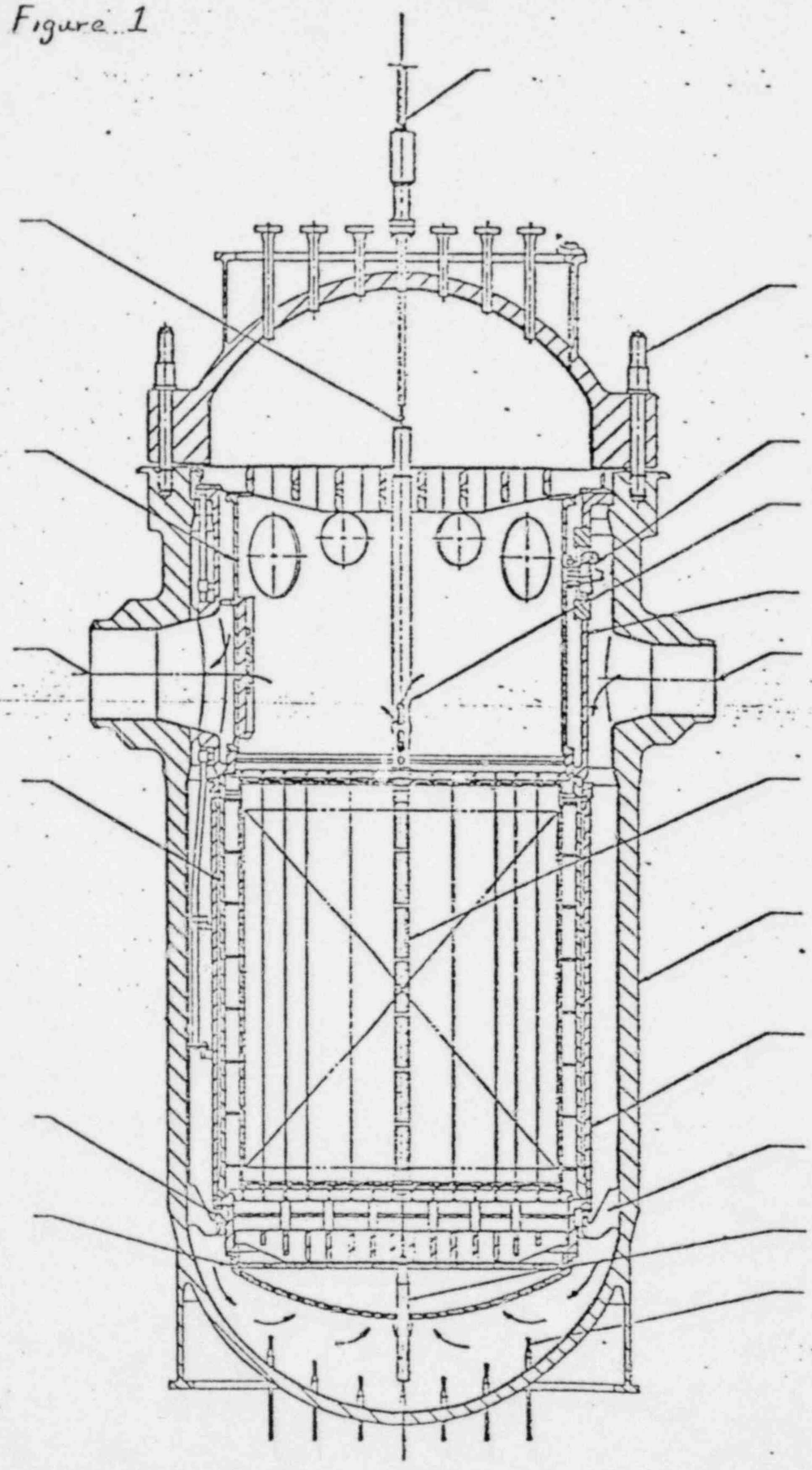
(0.5) b) At what temperature is the ICCWS cooler outlet normally maintained?

(4.0) 18. Describe the response of the ICCWS upon actuation of a 4 psig ES signal concurrent with undervoltage.

(2.5) 19. List all Immediate Automatic and Immediate Manual Actions required following loss of Instrument Air Pressure.

(0-2 each)

Figure 1



TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2.2.A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	0		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
1 4	5	0 8	0 1 6	B H

TOTAL COURSE DURATION

HOURS
27 31

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.0
Rev 3

MODE PREFIX (32–34)

COMMENT (35–59)

SHIFT CYCLE 3 HALF 2

TOTAL EXAM POINTS 35 MIN POINTS TO PASS 24.5

EXAM SCORE ______ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ______ DATE ______

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ______ DATE ______

Total Points 35.0

Name: ______________________

Score: __________

UNIT II
CATEGORY IV CRO
CYCLE 3-2 EXAM

1. There are three ranges of OTSG level indication.

(1.5) a) Explain when each range is used.

(1.5) b) Explain how each range is measured.

(0.75) c) List the range of measurement for the three level indications.

(2.0) 2. a) List the Reactor Protection System (RPS) trips. (Include setpoints).

(2.0) b) List the RPS trips in effect when in the shutdown bypass mode.

(2.0) 3. List the required manual actions in the event evacuation of the Control Room is necessary.

(2.0) 4. Draw a simple block diagram of a power range channel (label all blocks).

5. The RPS has Pressure and Temperature Trips.

(1.0) a) Given a hot leg temperature of 600°F, determine the Variable Pressure/Temperature Trip Point.

(1.0) b. Why is this a Variable Trip?

(1.0) c. What protection does it provide the reactor?

(1.5) 6. a) Briefly describe how Unit Tave is originated.

(1.0) b) How is Unit Tave used in the Integrated Control System?

7. The Integrated Control System uses Feedwater Flow.

(1.0) a) How is feedwater flow used in the ICS?

(1.0) b) What limiting function does it have in the ICS and what are the limits for the limiting function?

8. The discussion of Nuclear Instrumentation often includes the terms "Compensation and Discrimination".

(2.0) a) Briefly describe these two terms.

(1.0) b) Give an example of where compensation and discrimination are used.

9. Provide the following information about Pressurizer level indication.

(1.0) a) List the range(s) of indication and the number of transmitters used per range.

(0.75) b. Describe (briefly) how the pressurizer level is temperature compensated.

(1.0) c. Briefly describe temperature compensation.

(1.0) d. Could the loss of a pressurizer level transmitter cause the reactor to trip? Explain your answer.

(0.5) 10. a) What type of detector is used to measure Reactor Coolant Flow?

(1.5) b) List where the reactor coolant flow is used (indication and control)

(1.5) c) Describe how RC flow is used (control)

(1.0) 11. Briefly describe how an incore detector operates.

12. There are 52 locations in the core for Incore Assemblies:

(0.25) a) How many detectors are in the core?

(0.25) b) What is the minimum number of incores which must be operable above 80% full power?

13. One advantage of an Incore detector is that it is very accurate.

(0.5) a) Explain why this accurate system is <u>not</u> used for protective functions.

14. The Station Blackout Emergency Procedure states in the manual actions section that certain DC pumps and certain standby equipment are to be verified as automatically starting, assuming the Diesel Generators operate properly.

(1.5) a) List the standby equipment and DC pumps which are to be verified as automatically starting.

15. Following a station blackout:

(1.5) a) List the steps required to restore RC pump seal injection.

16. There are provisions to monitor tilt and imbalance using the incore detectors.

(0.25) a) How long after a power change should you wait to use the Incore instrument?

(0.25) b) Why should you wait this long a time period?

TRAINING PROGRAM ADMINISTRATIVE FORM

1	3
2,2,A	

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. (4–8)	NAME	EMPLOYEE NO. (4–8)
	9		

COMPLETION DATE

MO	DAY	YR
9		14

CATALOG NUMBER

FILE NO.				LESSON ID
15	CATG	TYPE	SUBJECT 22	23 26
14	S	08	016	BK

TOTAL COURSE DURATI

HOURS
27 31

4. LECTURE HOURS ________ OTHER HOURS ________ EXPLAIN ________

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

GPF 0007.0(
Rev 3

MODE PREFIX 32 34

35 COMMENT 57

SHIFT CYCLE 4 HALF 2

TOTAL EXAM POINTS 25 MIN POINTS TO PASS 17.5

EXAM SCORE ________ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ________ DATE ________

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ________ DATE ________

Total Points 25.0

Name:______________________________
Score:_______________

UNIT II
CATEGORY IV CRO
CYCLE 4-2 EXAM

(2.0) 1. List the conditions which will put ICS in the tracking mode.

2. The turbine bypass valves and the atmospheric dump valves have various setpoint for different modes of operation.

(2.0) a) List the setpoints for the different modes of operation for the turbine bypass valves and the atmospheric dump valves.

(2.0) b) Briefly explain why these setpoints are used for the different modes.

(1.0) 3. a) What plant parameters are used in determining BTU limits?

(1.0) b) What is the purpose of BTU limits?

(1.0) 4. When will the control fo Tavg shift from the primary to the secondary mode?

(3.0) 5. Describe how the ICS reacts to reducing plant load from 100% to 80%, using the unit load demand.

6. Discuss the response of the ICS to the following failures:

(1.0) a) NI input fails low at 100% power (assume no auto transfer)

(1.0) b) One feedwater valve fails full open at 100% power (assume main feedwater valve).

7. There are two prin..iple methods to indicate control rod position.

(2.0) a) Briefly describe how each position indication is developed.

(1.0) b) Briefly describe the effect on these two modes of indication if a trip occurs while operating at 100% power.

(1.0) 8. List the conditions which will cause the Diamond Control Panel to revert to manual.

9. Provide the following information:

(0.5) a) Rod speed with Diamond in Auto.
(0.5) b) Rod Speed with Diamond in Manual.
(0.5) c) % of misalignment for Rod Fault.
(0.5) d) % of misalignment for asymmetric rod.
(0.5) e) Rod overlap limits

10. When all power is removed form the control rod drives all rods except group 8 insert.

(1.0) a) What prevents the group 8 rods from inserting? (Explain)

(0.25) b) What system provides cooling for the control rod drives?

(0.5) c) When is the cooling required to the control rod drives?

(2.0) 11. List 4 conditions which require prompt notification of the NRC if they occur.

(0.25) 12. How long must the control room operators log book be kept?

(0.5) 13. When may you as a CRO trip the reactor without Shift Foreman/ Supervisor approval?

UNIT II
CATEGORY IV CRO
CYCLE 4-2 EXAM
KEY

1. a) Turbine in manual.
   b) Both generator breakers open.
   c) Cross limits.
   d) Both feedwater demand stations in hand.
   e) Rx demand station in hand.
   f) Diamond rod control in hand.
   g) SG/Rx master station in hand.
   h) Rx Trip.

2. a) Bypass valve setpoints are 885#, 935#, 1010#, 1050#. Atmospheric valves setpoints are the same. The atmospheric relief valves will only open when the bypass valves are not capable of controlling the pressure (low vacuum of $<$ 7" or $<$ 3 CW pump). They will open independently of the bypass valves if OTSG increases to 1050#.

   b) 885# is used when the turbine is not capable of accepting header pressure control.

   935# is used to provide a high pressure relief when turbine header pressure exceeds its setpoint by 50#.

   1010# is used as a independent high pressure relief setpoint that will open the valves (both bypass and atmospheric) in proportion to OTSG pressure in excess of 1050#.

3. a) Th, OTSG pressure, FW temp, RCS flow.

   b) To prevent removing more energy from the OTSG's than is available so as to always have a minimum of 35°F superheat.

4. a) Manual control

   Automatic control (Rx master and diamond in auto)
   Feedwater Control (Rx master or diamond in manual)

   b) Control of Tave will shift from primary to secondary when either the diamond rod control or Rx demand station is shifted to manual. Feedwater subsystem can only accept control of Tave under certain conditions, both S/G cannot be low level limited, neither OTSG can be on a BTU limit, and both feedwater demand stations cannot be in manual.

5. The ULD is decreased from 100% demand to 80% demand. This new demand signal bleeds through the rate of change control at the rate the operator has set in. The new demand is compared to generated MW and produces a MW error signal. The MW error signal is used to modify the header pressure setpoint so it appears low. This causes the turbine control valves to close down to increase header pressure to its setpoint. MW error is also used to modify the ULD signal which is feeding forward to the SG/RX master. When the turbine control valves are closed down because of MW error, the actual header pressure is compared to actual header pressure setpoint. Actual header pressure is high so a pressure error signal is generated. This signal is inverted so as to subtract from the ULD move. The modified ULD is fed to the SG/Rx master which feeds two parallel signals to the feedwater subsystem and Rx subsystem. The signal to feedwater goes through the feedwater demand calculator which generates a feedwater demand. Actual feedwater flow is still greater

than demand so a feedwater f[illegible] error is generated. This signal causes the feedwater valves to close down (and also causes the feedwater pump speed to decrease so as to maintain feedwater valve ΔP at $\approx$ 35 PSI. "FW error does not go to FP's".) This signal which is fed to Rx subsystem goes through a low limiter which will not pass anything less than 15% demand. The signal then goes to a Rx demand calculator. The Rx demand calculator generated a neutron error signal. Since actual neutron power is greater than demand the neutron error signal causes the control rods to insert. The control rods will continue to bump in until the neutron power is at the 80% demand from ULD. Control rod insertion doesn't happen until nuetron error is $>$ 1.1% and stops when neutron error is $<$ .9%.

6. a) NI input to ICS fails to zero. This causes a very large neutron error signal (+). The unit goes into cross limits and tracking. The reactor has a 100% demand signal. Neutron power indicates zero. The rods pull to correct neutron power. The cross limits cause feedwater to decrease rapidly. The reactor trips on high flux or high pressure.

   b) Main feedwater valve fails open at 100% power. Valve ΔP decreases. Feedwater pumps see this low ΔP and increase speed. Feedwater flow increases. Valve ΔP does not come back to normal. Feedpumps go to high speed stops. OTSG with failed valve becomes high level limited. Feedwater flow is now greater than demand. Demand decreases to the affected OTSG. Valve does not respond. Demand continues to decrease such that the startup feedwater valve closes down. When valve gets to 50% the main block valve closes. Feedwater flow decreases. Flow becomes less than demand and startup valve begins opening. Feedwater flow increases. This cycle would continue if, Rx did not trip on hi. power or low pressure due to overfeeding OTSG and dropping temperature (Tave) causing rod to pull.

7. a) Absolute position is develop by a magnet actuating a series of reed switches in the PI tube. The magnet is attached to the upper end of the lead screw. As the magnet passes the reed switch it causes it close. When the reed switch closes the voltage changes due to the resistors in the circuit. As each reed switch is passed the voltage continues to change. This voltage is then converted to % withdrawn.

   Relative position is developed by using a three phase stepping motor connected to three of the six phases of the CRDM. When a command is sent to the CRDM the stepping motor is also energized. The stepping motor drives a potentiometer which indicates control rod position in % withdrawn.

   b) During a reactor trip the absolute position indication goes to zero because of the magnet passing through the reed switches and causing them to actuate. The relative position indication stays where it was due to the CRDm being deenergized thus position stays where it was.

8. Motor fault.
   Loss of ICS auto power.
   Rx trip.

9. a) 30" minute
   b) Whichever is selected 3" min or 30" minute.
   c) 7" from group average.
   d) 9" from group average.
   e) 25 ± 5% overlap.

10. a) There are pins installed in the latch arms of the group 8 CRDM. When the CRDM are deenergized, and the latch arms pivot the pin limits the amount of travel to prevent the roller nuts from becoming disengaged from the lead screws, therefore the control rods cannot drop.

    b) Intermediate closed cooling water.

    c) 2 GPM minimum to each CRDM or 138 GPM total flow.

11. Failure of the RPS or other systems to limit a safety system setting.
    Fuel caldding failure.
    SDM less conservative than specified in tech. specs.
    Unplanned criticality.

12. Lifetime per Admin. Procedure.

13. The CRO may trip the reactor anytime that he feels it is necessary to put the plant in a safe condition - to protect personnel from injury and or equipment damage from occurring.

2.2.A

1. LESSON/COURSE: CRO LICENSE TRAINING EXAMINATION

2. LOCATION: TMI

3. PERSONNEL ATTENDING: (PLEASE PRINT):

NAME	EMPLOYEE NO. 4–8	NAME	EMPLOYEE NO. 4–8
	9		

COMPLETION DATE

MO	DAY	YR

9–14

CATALOG NUMBER

FILE NO (15)	CATG	TYPE	SUBJECT (22)	LESSON ID (23–26)
1 4	5	0 8	0 1 6	B M

TOTAL COURSE DURATION

HOURS (27–31)

4. LECTURE HOURS ______ OTHER HOURS ______ EXPLAIN ______

5. ENTER THE PREFIX FOR THE APPROPRIATE MODE:

	PREFIX		PREFIX
CORRESPONDENCE	(CCS)	REVIEWER	(RVR)
FILM	(FLM)	SCHOOL	(SCH)
LECTURE	(LEC)	SEMINAR	(SEM)
OJT	(OJT)	VIDEOTAPE	(VTP)
ORIGINATOR	(OGR)		

MODE PREFIX 32–34

35 COMMENT 59

GPF 0007.0 Rev 3

SHIFT CYCLE 5 HALF 1

TOTAL EXAM POINTS 52 MIN POINTS TO PASS 36.4

EXAM SCORE ______ ORAL RESULTS N/A

COMMENTS AND REASSIGNMENTS:

INSTRUCTOR SIGNATURE ______ DATE ______

SIGNATURE OF SUPERVISOR OF TRAINING/TRAINING CORDINATOR ______ DATE ______

Total Points: 52

Name ____________________

Score ____________

UNIT II
CATEGORY IV CRO
CYCLE 5-1 EXAM

1. Define the following terms:

(1.0) a) Contaminated Area
(1.0) b) High Radiation Area
(1.0) c) Clean Area
(1.0) d) Controlled Area

(2.0) 2. Equipment removal from a controlled area requires that a smear survey and B dose rate be taken. What are the limits associated with unconditional release of equipment from a controlled area?

(2.0) 3. When is respiratory protection required to be worn according to the Radiation Protection Manual?

(2.0) 4. Upon monitoring yourself with the hand and foot monitor at the access control you find your right shoe is contaminated and the monitor alarms. What actions are required of you? Include documentation in your discussion.

(1.0) 5. Explain the term "MPS" as applied in 10CFR20.

6. Define the following terms:

(1.0) a) Curie
(1.0) b) Radiation
(1.0) c) Contamination
(1.0) d) Effective Half-Life

(1.0) 7. List two conditions requiring processing of a person's TLD.

(2.0) 8. Discuss the normal removal procedure for protective clothing.

(1.0) 9. What is a Standing Radiation Work Permit and how are they used?

(1.0) 10. a) What is the "Initiator" of an RWP indicating when he signs the RWP?

(0.5) b) When does the "Initiator" sign the RWP?

(1.0) 11. How is a man who is not on an RWP (when first initiated) added to the RWP's "Authorized Personnel" list. Be Specific.

(1.5) 12. Explain the difference between an "HP" labeled ID Badge and an unlabeled badge, concerning access to controlled areas.

(2.0) 13. List the exposure limits requiring immediate notification of the NRC.

(2.0) 14. List the exposure limits requiring 24 hour notification of the NRC.

15. Define each of the following and give CRO required actions for each:

(NOTE: Definitions may be given as symptoms)

(2.0) a) Local Emergency
(2.0) b) Site Emergency
(2.0) c) General Emergency

(2.0) 16. a) What are the different ways in which tritium can enter the body?

(2.0) b) What are the hazards associated with Tritium?

(2.0) 17. Explain the RO-2 detector operation, types of radiation detected, detector readout (Units and Range).

(1.5) 18. What is the major source of radiation inside the OTSG compartments during power operation? Explain how this radiation is produced.

(1.0) 19. Describe the sample air flowpath through HPR219.

(2.5) 20. List all the automatic interlocks associated with the atmospheric monitors Indicate which channel (P, I, G) initiates the interlocks.

(2.0) 21. What is the purpose of the two ranges of indication on the letdown monitor.

(2.0) 22. What are the functions of the green pushbutton/indicator on the RMP modules?

(1.0) 23. List all the Interlocks initiated by the liquid process monitors.

(2.0) 24. Outline the thermal discharge limits as specified in Environmental Tech Specs.

(1.0) 25. Does Environmental Tech. Specs. allow release of an Evaporator Condensate Storage Tank with the release rate flow recorder OOS? If so, are there any additional resprictions imposed?

Name______________________

UNIT II
CATEGORY IV CRO
CYCLE 5-2 EXAM

Score__________

1. When operating at 100% power the secondary side heat balance is used to calibrate the nuclear instrumentation. Assume the feedwater temperature input failed high.

(0.5) a) Would the resultant calibration be conservative or nonconservative?

(1.0) b) Explain your answer to part "a".

(2.0) 2. Briefly explain how you as a control room operator control the plant effluent temperature within the limits of the environmental Tech. Specs. (NOTE: Base your answer on the section of Environmental Tech. Specs. which are in effect.)

(1.5) 3. a) Briefly describe the required actions you as a Control Room Operator shall take in the event a site emergency exists.

(1.0) b) List the symptoms which would alert you to a site emergency.

4. A point source reads 5R/hr at one foot.

(2.0) a) How much radiation would you be exposed to at 5 feet?

b) How long could you work at this 5 foot distance without exceeding the following:

(1.0) 1. Weekly exposure limit?

(2.0) 2. 10CFR20 quarterly limits?

5. A radiation work permit is required if; radiation limits, contamination limits or airborne radioactive limits are exceeded.

(1.5) a) Provide 2 (two) conditions for each of the above mentioned limits.

6. Certain radiation monitors have interlocks associated with them.

(1.5) a) Which monitors have interlocks?

(3.0) b) What are the interlocks for the monitors?

7. During a reactor startup the ECP is exceeded by 20 inches.

(0.25) a) Is further rod withdrawal allowed?

(1.75) b) Prove your answer.

(3.0) 8. Given the following information, calculate the ECB. Using the appropriate forms from (OP 2103-1.9) current revision.

Desired ECP is 35% on GP 6/7.
Groups 1-4@ 100% w/d
Group 8 @ 30% w/d
Tavg @ 535°F
Pressure @ 2155 psig
All four (4) RCP running
EFPD @ 240
Reactor shutdown from 100% 15 days before
Boron 1100 ppm

9. What would be the effect on the ECP calculated in question 8 if:

(0.5) a) One RCP was stopped?

(0.5) b) A FW reg. valve failed open?

(0.5) c) One of the 4 turbine bypass valves being used failed closed?

10. A swipe survey was conducted in the Auxiliary Building near the seal injection filters.

(1.5) a) Given the following information determine how the area is to be classified (i.e. clean, controlled, contaminated)

1875 counts in 5 minutes	BKG = 25 counts per minute
Counter efficiency 22%	Fixed radiation 0.35 Mr/hr @ 1"

CATEGORY IV CRO EXAM MAX. POINTS 21

6TH CYCLE 1ST HALF

UNIT II CRO

(2.0) 1. List the conditions which will auto-close the plant effluent release valve (WDL-V-99)

(2.0) 2. One indication an operator has of being at the point of adding heat is the sustained startup rate dropping off.

a. List (4) four other indications.

3. Technical Specifications require a source of borated water other than the Borated Water Storage Tank.

(0.5) a. List (2) other sources.
(0.5) b. In what procedure would you find directions for emergency feed of Boric Acid from the sources in part "a"?

4. Assuming your reactor was shutdown with a Keff of 0.9.

(1.0) a. What is your shutdown margin? (%)
b. If 5% of reactivity (P) is added to this shutdown reactor:

(1.0) 1. What is your new shutdown margin?
(1.0) 2. What is your new Keff?
(1.0) 3. What is your new count rate assuming with a Keff of 0.9 the counts were 25? NOTE: SHOW ALL WORK AND STATE ALL ASSUMPTIONS.

5. The Borated Water Storage Tank has certain requirements per Technical Specifications:

(2.0) a. List those requirements.

(2.0) 6. Briefly explain why the regulating control rod groups are withdrawn with a 25% overlap.

(2.0) 7. a. Plot the Xenon trace for the following power history: (SHOW REPRESENTATIVE VALUES)

1. Hot, clean, zero power
2. 20% power 2 days
3. 50% power 2 days
4. Rx trip
5. Rx shutdown 2 days
6. Rx power 20% 1 day
7. Rx power 90% 2 days
8. Rx power 100% 5 days
9. Rx trip
10. Rx shutdown 10 days

7. b. Briefly discuss the control rod movement for the above power history.

8. The reactor coolant system has over pressure protection with the two code safety valves and the electromatic relief valve when at power.

0) a. Briefly describe the overpressure protection employed when the plant is in cold shutdown (Include All Applicable Setpoints)

9. One of the modes of operation for a Waste Gas Decay Tank is Re-use.

(1.0) a. What conditions must be met to allow Re-use?
(1.0) b. Briefly explain how it is accomplished (Be Specific)

10. There are two (2) major reactivity coefficients, in addition to the Moderator Temperature Coefficient, which will act to terminate a power excursion.

(1.0) a. Briefly describe how each of the two (2) will accomplish this.

UNIT II

CATEGORY IV CRO
CYCLE 6-2 EXAM

NAME:____________________
TOTAL POINTS: 34
SCORE:________

(1.5) 1. List the "Manual" actions for a blackout, with diesels.

(1.0) 2. Provide the four (4) setpoints for the reactor protection system pressure-temperature trip envelope.

(2.0) 3. List four (4) situations which would require Emergency Boration, if they occurred.

(1.75) 4. List seven (7) conditions which will cause an "auto" trip of a reactor coolant pump <u>motor</u>.

(2.0) 5. List the precautions which must be taken and the conditions which must be met to allow a man to receive a 3Rem dose in one quarter.

(4.0) 6. A man must work six (6) feet from a five (5) curie Co^{60} point source.

a. How many pieces of lead shielding will be required to limit the exposure to the man to 300 mrem/week?

b. How many pieces of lead shielding will be required to limit the exposure to the man to 100 mrem in 8 hours?

NOTE: Half thickness of Pb = 0.6 inches
Tenth thickness of Pb = 2.0 inches
Co^{60} emits 2γ's simultaneously; 1.17 Mev and 1.33 Mev

(1.5) 7. a. Give the Tech. Spec. limits for Oxygen, Flourides and Chlorides.

b. Provide the actions to be taken from discovery until 24 hours later assuming the situation is not corrected for the out of limit condition.

8. Define the following:

(0.5) a. Imbalance

(0.5) b. Hot Standby

(0.5) c. Cold Shutdown

(0.5) 9. a. Give the e[illegible]ation for Quadrant Power Tilt

(1.5) b. Provide the tilt limits and the method of measurement.

(2.0) 10. If 0.05% $\Delta k/k$ is added to a critical reactor what is the resultant startup rate? (Beta = 0.00513)

(1.5) 11. a. If a reactor is shutdown with a K=0.9 and the Source Rnage instrumentation reads 30 cps what will be the new count rate after adding 5% $\Delta k/k$?

(0.25) b. What will be the new Keff?

(1.5) c. What will be the final shutdown margin?

12. Pertaining to the Integrated Control System (ICS)

(2.0) a. List eight (8) conditions which will place the ICS in track.

(1.0) b. List four (4) conditions which will cause a runback.

(2.0) 13. List the conditions which must be met if E.S. equipment is to be taken out of service.

(1.5) 14. List the auto closure interlocks for WDL-V-257/99.

15. Provide the following pressure setpoints in PSIG:

(0.25) a. Decay tank relief valves

(0.25) b. Decay tank high pressure alarm

(3.0) 16. List the automatic actions associated with the RMS process monitors.

(1.5) 17. List the "Manual" actions required in the event of a steam generator tube rupture.

APPENDIX G

NRC FORM 157 (10-75) U.S. NUCLEAR REGULATORY COMMISSION

EXAMINATION REPORT

LICENSE APPLIED FOR: RO ☐ SRO ☐

CURRENTLY A LICENSED OPERATOR HERE? YES ☐ NO ☐

APPLICANT'S NAME	REACTOR	LOCATION

WRITTEN EXAMINATION

OPERATOR (SECTION 55.21)	ADMINISTERED BY:	DATE	WAIVED ☐
	GRADED BY:	GRADE %	EVALUATION PASSED ☐
	CATEGORY GRADES A____% B____% C____% D____% E____% F____% G____%		FAILED ☐
SENIOR OPERATOR (SECTION 55.22)	ADMINISTERED BY:	DATE	WAIVED ☐
	GRADED BY:	GRADE %	EVALUATION PASSED ☐
	CATEGORY GRADES H____% I____% J____% K____% L____%		FAILED ☐

OPERATING TEST

(SECTION 55.23)	ADMINISTERED BY:	DATE	WAIVED ☐ PASSED ☐ FAILED ☐
			HOT ☐ COLD ☐

COMMENTS

RECOMMENDATION	APPROVE FOR SENIOR LICENSE ☐ OPERATOR LICENSE ☐	SIGNATURE
	DO NOT APPROVE FOR SENIOR LICENSE ☐ OPERATOR LICENSE ☐	EXAMINER / DATE
ISSUE LICENSE	SENIOR LICENSE ☐ OPERATOR LICENSE ☐	SIGNATURE Chief, Operator Licensing Branch

NOTE: The operator and oral examination check sheet must be completed for each applicant. If applicant has failed the operating and oral test at the Senior Level, the check sheet should be completed to indicate applicant's evaluation at the operator level.

OPERATING AND ORAL EXAMINATION SUMMARY REPORT

If an SRO applicant is unsatisfactory at the SRO Level, complete the RO column to evaluate applicant's adequacy at the RO Level.

**For each unsatisfactory ("U"), list the page number(s) of the operating oral examination notes on which the unsatisfactory responses are explained.*

	EVALUATION		
	SRO	RO	*PAGE NUMBER FOR "U"
1. OPERATING DEMONSTRATION			
1.1 Pre-startup and Instrument Checks			
1.2 Console Operation			
a. Manipulations			
b. Understanding			
2. FACILITY EQUIPMENT			
a. Major			
b. Auxiliary			
c. Engineered Safeguards Systems			
3. INSTRUMENTATION			
a. Nuclear			
b. Process			
4. REACTOR PROTECTION			
5. PROCEDURES			
a. Normal			
b. Abnormal			
c. Emergency			
6. REACTIVITY EFFECTS (Except Console Operation)			
7. ADMINISTRATIVE REQUIREMENTS			
8. EMERGENCY PLAN			
9. RADIATION PROTECTION			
10. RESPONSIBILITIES			

COMMENTS

NRC FORM 157
(10-75)

OPERATING AND ORAL EXAMINATION NOTES

A. OPERATING DEMONSTRATION	EVALUATION
1.1 Pre-startup and Instrument Checks	
Type of checkout: *(specify)*	
1.1.1 Familiarity with check sheet	
1.1.2 Accuracy when reading instruments	
1.1.3 Understanding of what is being checked	
1.1.4 Understanding of reasons for checkout	
1.1.5 Effects of malfunctions	
1.1.6 Knowledge of Control Room reference data	
1.1.7 Method of ECP determination	
1.2 Console Operation	
a. Initial conditions:	
b. Program:	
1.2.1 Follows procedures	
1.2.2 Ability to predict response for specified program	
1.2.3 Observes and checks instrumentation	
1.2.4 Understanding of instrument response	
1.2.5 Ability to follow specified program accurately	
1.2.6 Dexterity and "feel" for console controls	
1.2.7 Knowledge of reactivity effects	

COMMENTS: *(Required for "U")*

NRC FORM 157
(10-75)

B. CONTROL ROOM
(Major, Auxiliary and Engineered Safeguards Systems)

	SYSTEMS							
	A	B	C	D	E	F	G	H
2.0 EQUIPMENT								
2.1 Purpose								
2.2 Flow Path								
2.3 Normal Parameters								
2.4 Components								
2.5 System Behavior and Response								
3.0 INSTRUMENTATION								
3.1 Detector								
3.2 Malfunction								
3.3 Control Room Indication								
4.0 REACTOR PROTECTION								
4.1 Alarms/Setpoints								
4.2 Safety System Input								
4.3 Interlocks								
5.0 PROCEDURES								
5.1 Normal Procedures								
5.2 Abnormal Procedures								
5.3 Emergency Procedures								
6.0 REACTIVITY EFFECTS								
7.0 ADMINISTRATIVE REQUIREMENTS								
7.1 Technical Specif tions								
7.2 Facility Requirements								

COMMENTS: *(Required for "U")*

☐ CONTINUED ON REVERSE

B. CONTROL ROOM
(Nuclear and Radiation Instruments)

	SYSTEMS A	B	C	D	E
3.0 INSTRUMENTS					
3.1 Detectors					
3.2 Malfunctions					
3.3 Control Room Indications					
3.4 Channel Components					
3.5 Compensation/Discriminator					
3.6 Input to Control System					
4.0 REACTOR PROTECTION					
4.1 Alarms/Setpoints					
4.2 Safety System Input					
4.3 Interlocks					
5.0 PROCEDURES					
5.1 Normal Procedures					
5.2 Abnormal Procedures					
5.3 Emergency Procedure					
7.0 ADMINISTRATIVE REQUIREMENTS					
7.1 Technical Specifications					
7.2 Facility Requirements					

COMMENTS: *(Required for "U")*

NRC FORM 157
(10-75)

B. CONTROL ROOM *(Electrical)*	SYSTEMS A	B	C	D
2.0 EQUIPMENT				
2.1 Purpose				
2.2 Flow Path				
2.3 Normal Parameters				
2.4 Components				
2.5 System Behavior or Response				
3.0 INSTRUMENTS				
3.2 Interlocks				
3.4 Control Room Indication				
5.0 PROCEDURES				
5.1 Normal Procedures				
5.2 Abnormal Procedures				
5.3 Emergency Procedures				
7.0 ADMINISTRATIVE REQUIREMENTS				
7.1 Technical Specifications				
7.2 Facility Requirements				

COMMENTS: *(Required for "U")*

NRC FORM 157
(10-75)

C. REACTOR AND AUXILIARY BUILDINGS (*Major, Auxiliary, Electrical Safeguards, Fuel Handling, Rad Waste*)	SYSTEMS					
	A	B	C	D	E	F
2.0 EQUIPMENT						
2.2 Flow Paths						
2.3 Normal Parameters						
2.4 Equipment Location						
2.5 System Behavior and Response						
3.0 INSTRUMENTS						
3.8 Local Instrumentation						
5.0 PROCEDURES						
5.1 Normal Procedures (Local)						
5.2 Abnormal Procedures (Local)						
5.3 Emergency Procedures (Local)						
6.0 REACTIVITY EFFECTS						
7.0 ADMINISTRATIVE REQUIREMENTS						
7.1 Technical Specifications						
7.2 Facility Requirements						
9.0 RADIATION PROTECTION						
9.1 Radiation Control Procedures						
9.2 Portable Instruments – Location						
9.3 Portable Instruments – Use						
9.4 Portable Instruments – Characteristics						
9.5 Personal Practices						
8.0 EMERGENCY PLAN						
8.1 Equipment Locations						
8.2 Equipment Use						
8.3 Duties						

COMMENTS (*Required for "U"*)

NRC FORM 157
(10-75)

D. DISCUSSIONS *(Integrated Plant Response)*

		SYSTEMS A	B	C	D
2.0	EQUIPMENT				
	2.8 Components Response				
3.0	INSTRUMENTS				
	3.4 Control Room Indications				
	3.8 Automatic Control				
	3.9 Ability to Manipulate Manual Control				
4.0	REACTOR PROTECTION				
	4.1 Automatic Actions				
	4.2 Alarm/Setpoints				
5.0	PROCEDURES				
	5.1 Normal Procedures				
	5.2 Abnormal Procedures				
	5.3 Emergency Procedures				
6.0	REACTIVITY EFFECTS				
	6.3 Coefficient Effects				
	6.6 Transient Analysis				
7.0	ADMINISTRATIVE REQUIREMENTS				
	7.1 Technical Specifications				
	7.2 Facility Requirements				

COMMENTS *(Required for "U")*

D. DISCUSSION	EVAL-UATION
5.0 REACTIVITY EFFECTS *(Nuclear Theory)*	
6.1 Subcritical Multiplication	
6.2 Delayed Neutrons Effect	
6.3 Coefficients	
6.4 Poison Effects	
6.5 Long Term Exposure Effects	
9.0 RADIATION PROTECTION	
9.1 Radiation Control Procedures	
9.4 Source and Types of Radiation	
9.6 Contamination	
9.7 Exposure Limits *(10 CFR 20) (Facility)*	
10.0 RESPONSIBILITY (QA, NON-RAD SAFETY, AP's, SECURITY)	

COMMENTS *(Required for "U")*

NRC FORM 157
(10-75)

TMI MOCK NRC REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: ______________________

REACTOR TYPE: ______________________

DATE ADMINISTERED: ______________________

APPLICANT: ______________________

EXAMINER: ______________________

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers, staple question sheet on top of the answer sheets. Points for each question are indicated in parenthesis after the question. An overall score of 70% or greater is passing.

CATEGORY VALUE	% OF TOTAL	APPLICANTS SCORE	% OF CAT. VALUE	
11.0	15.83	_____	_____	A. Principles of Reactor Operations.
11.0	15.83	_____	_____	B. Features of Facility Design.
9.0	12.95	_____	_____	C. General Operating Characteristics
11.0	15.83	_____	_____	D. Instruments and Controls
9.5	13.66	_____	_____	E. Safety and Emergency Systems
8.5	12.22	_____	_____	F. Standard and Emergency Operating Procedures
9.5	13.66	_____	_____	G. Radiation Control and Safety
69.5	100	_____	_____	FINAL GRADE

APPROVED: ______________________
Supervisor of Operations

____
Supervisor of Training

A. PRINCIPLES OF REACTOR OPERATION (11.0)

A-1. Assume the reactor is at 5×10^{-10} amps (just critical) and is placed on a 0.8 DPM SUR.

a. Plot Rx Power on the attached graph paper to 10^{-8} amps. (1.0)
b. Is the level-off time to insert rods equal to, greater than, or less than the time required to withdraw the rods and place the reactor on this startup rate? (0.5)
c. If you did not level off at 10^{-8} amps, plot and explain the shape of the curve. (1.5)
d. Assume that at 10^{-6} amps the reactor trips. Plot and explain the shape of the curve. (1.5)

A-2. Give two reasons for using burnable poison in a reactor core. (1.0)

A-3. Assume a reactor tripped from 100% power.

a. Plot the resulting Xenon curve for 100 hours after the trip. (0.5)
b. Using a dash line plot Xenon if the reactor was started up eight hours after the trip and raised to 50% power. (1.0)
c. Discuss the problems on startup 8 hours after a trip. (1.0)

A-4. Discuss how Pu-239 is formed and its effect on reactor operation. (2.0)

A-5. It is determined that the RCS will be deborated to achieve criticality and the boron concentration must be decreased by 200 PPM. The initial countrate is 30 to 37 CPS. Immediately after the first bleed and feed operation is completed for the first 100 PPM decrease the count rate is 62 to 70 CPS. Would you continue to boron dilute? Explain. (1.0)

B. FEATURES OF FACILITY DESIGN (11.0)

B-1. a. What is the position of the internals vent valves for steady state operations? (0.5)
b. When and why are these valves required to open? (1.5)

B-2. a. What are the sources of gases in the reactor coolant system? (1.0)
b. What methods do you have for reducing gas concentration? (1.0)
c. Why is there a gas limit on the CRD's? (1.0)

B-3. A number of facilities have experienced damage to main and auxiliary piping due to "water hammer."

a. What is a water hammer and how can damage occur? (1.5)
b. Give two methods to reduce or eliminate this condition. (1.0)

B-4. List the Feedwater Pump trips. (1.0)

B-5. The procedure for loss of all reactor coolant pumps requires in the immediate actions that emergency feedwater establish natural circulation cooling.

a. Explain emergency feed to OTSG's on loss of all RCP's. (1.5)
b. Why is natural circulation required? (1.0)

C. GENERAL OPERATING CHARACTERISTICS (9.0)

C-1. Regulating rods are withdrawn with approximately ___ overlap.

a. What is the value for normal overlap, and what are the limits associated with this parameter? (0.5)

b. What characteristics associated with the reactor and control rods make it desirable to operate with overlap? (1.5)

C-2. a. How is superheat accomplished in the OTSG? (2.0)

b. How and why does superheat vary from 15% to 100% power? (1.5)

C-3. Explain how OTSG level is controlled for the following Unit Startup conditions:

a. 0% to 5% power. (0.5)

b. 5% to 10% power. (0.5)

c. 10% to 30% power. (0.5)

C-4. You are increasing reactor power from 10^{-8} amps. What observations would indicate that you have reached the point of adding heat to the reactor coolant system? (1.0)

C-5. Control Rod positions will normally be maintained in the Steady State Operating or Transient Rod Position Band. Is operation allowed between the two bands? Explain. (1.0)

D. INSTRUMENTS AND CONTROLS (11.0)

D-1. List the conditions which cause the ICS to go into the tracking mode of operation. (2.0)

D-2. What is the function for each of the following?

a. DC Hold Power Supply (1.0)
b. Auxiliary Power Supply (1.0)

D-3. What is the ICS response to the start of the fourth RCP? Assume reactor power is 25%. (2.0)

D-4. A D/P Cell is used for pressurizer level indication.

a. Sketch and explain how a D/P Cell works. (1.0)
b. What happens if the D/P Cell fails? Discuss indication observable by the operator as well as effects on plant controls if it is selected. (1.0)

D-5. a. Sketch the effects of over - and under - compensation during a reactor trip. (1.0)
b. How does each condition affect overlap with source range instruments? (1.0)
c. Could you restart the reactor with either of the above conditions? (1.0)

E. SAFETY AND EMERGENCY SYSTEMS (9.5)

E-1. Sketch a simplified drawing of the High and Low Pressure Injection Systems. Include all major Tanks, Pumps, Valves, etc. (2.0)

E-2. Assume oil from a reactor coolant pump reservoir leaks out and ignites on a hot pump casing during power operation.

a. List all the symptoms that warn the operator. (1.0)
b. What types of fire fighting equipment are available to extinguish the fire? (1.0)
c. Is it necessary to shut down the reactor? (0.5)

E-3. During a station blackout the diesel generators start and re-energize the necessary buses.

a. Draw a one line diagram of the 6900 volt and 4160 volt switchgear distribution. Include transformers and breakers. (1.5)
b. Indicate which breakers open on loss of station power with an "O". Indicate which breakers close with a "C". (0.5)
c. What indications does the operator have that the diesel generators are operating properly? (1.0)

E-4. List the automatic actions that take place following actuation of the Feedwater Latching System. (1.0)

E-5. List the Emergency Feedwater Pumps starting interlocks. (1.0)

F. STANDARD AND EMERGENCY OPERATING PROCEDURES (8.5)

F-1. Assume a primary to secondary leak starts at one GPM and doubles every two minutes to 130 GPM:

a. List all systems affected by this leak. (1.0)
b. Outline the actions the operator must take in this situation. (1.5)

F-2. List the Automatic and Manual actions in the event of a Turbine trip. (1.5)

F-3. a. What is the normal flowpath for emergency boration, should it be required? (1.0)
b. What conditions require emergency boration? (1.0)

F-4. List the operator actions required prior to evacuating the Control Room. (1.0)

F-5. The Unit Shutdown procedure repeatedly says to maintain the control rods in the Transient Rod Band during power reduction. Explain how you, the operator ensure this requirement is satisfied. Be specific. (1.5)

G. RADIATION CONTROL AND SAFETY (9.5)

G-1. You've been working two hours next to a hot spot which has a field intensity of 1200 mrem at one foot. You note that your dosimeter has pegged high and you leave the controlled access. You were working two feet from the hot spot.

a. What was your exposure? (1.5)
b. If you've already received 900 mrem this quarter, what is your total quarterly dose? (1.0)
c. What limits have you exceeded? (1.0)

G-2. What are the TMI entry requirements for areas with greater than 100 mrem/hr. doserate? (1.0)

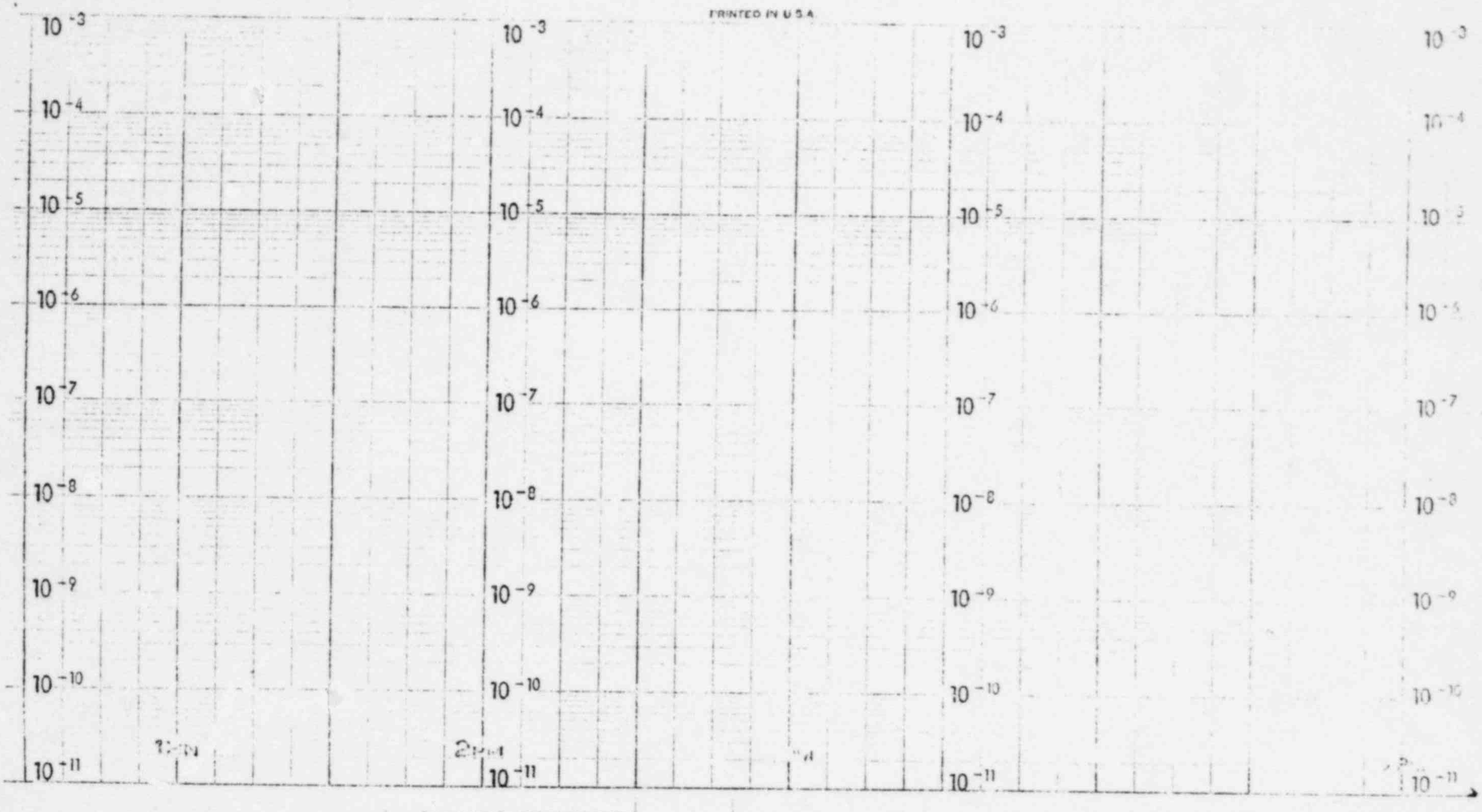
G-3. For each of the following list i) monitor(s) that would sense the problem, ii) monitor location(s), and iii) automatic actions associated with the monitor(s).

a. High level liquid radwaste release.
b. Spent Fuel Element failure.
c. High level Waste Gas Decay Tank release. (2.5)

G-4. You're exiting the controlled access area and you discover the sole of your shoe is contaminated. A buddy hands you a piece of tape and you remove the contamination. What further actions should you take before leaving the access area entrance? (1.5)

G-5. What is the difference between a RAD and a REM? (1.0)

Question A-1



Time - one inch/minute