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

EXAMINATION REPORT NO. 85-34 (OL)

FACILITY DOCKET NO. 50-322

FACILITY LICENSE NO. NPF-36

LICENSEE: Long Island Lighting Co.
P.O. Box 618
Wading River, N.Y. 11792

FACILITY: Shoreham Nuclear Power Station

EXAMINATION DATES: September 16, 1985 to September 20, 1985

CHIEF EXAMINER: David J. Lange — 1/22/86
Dave Lange, Lead Reactor Engineer (Examiner) — Date

REVIEWED BY: RM Keller — 1/27/86
Robert M. Keller, Chief, Projects Section 1C — Date

APPROVED BY: H B Kister — 1/29/86
Harry B. Kister, Chief, Projects Branch No. 1 — Date

SUMMARY: Operator and Senior Operator Initial Cold License Exams were conducted at Shoreham Nuclear Power Station from September 16, to September 20, 1985. Four (4) Reactor Operator, four (4) Senior Reactor Operator, and one (1) Instructor Certification candidates were examined. All candidates passed the written and oral examinations.

REPORT DETAILS

TYPE OF EXAMS: Initial

EXAM RESULTS:

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

1. CHIEF EXAMINER AT SITE: D. Lange, USNRC

2. OTHER EXAMINER: F. Crescenzo, USNRC

1. No generic strengths or deficiencies were noted on the written and oral exams administered.

2. Personnel present at Exit Interview:

   NRC Personnel

   D. Lange, Chief Examiner
   F. Crescenzo, Operator Licensing Examiner
   J. Berry, Senior Resident Inspector (Shoreham)

   Facility Personnel

   J. Scalice, Operations Manager, LILCo
   L. Calone, Nuclear Training Manager, LILCo
   K. Rottkamp, Training Supervisor, LILCo
   J. L. Smith, Manager, Nuclear Operations Support Dept., Shoreham

3. Summary of NRC Comments made at exit interview:

   None

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

   None

5. Changes made to written exam during examination review:

   (See Attachments 3 and 4)

Attachments:

1. Written Examination and Answer Key (RO)
2. Written Examination and Answer Key (SRO)
3. Facility Comments on Written Examinations
4. NRC Resolution of Facility Comments on Written Examinations

Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: SHOREHAM

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/09/17

EXAMINER: BANAVITCH,L./LANGE,D

APPLICANT: MASTER

INSTRUCTIONS TO APPLICANT:

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

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

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

QUESTION 1.01 (2.50)

a. Why is conductivity measured on a continuous basis in the reactor coolant system, and why is it maintained within specified limits? (1.0)

b. Will conductivity increase, decrease, or remain unchanged if:
1. Chloride concentration increases
2. Ionic impurities increase
3. pH decreases from 7.0. (0.5 ea)

QUESTION 1.02 (1.50)

A variable speed centrifugal pump is running with its drive motor at 1800 rpm. The initial flow rate is 1000 gpm, total head is 110 feet, and work input is 500 hp.
The flow rate is then changed to 1200 gpm. Determine:

a. The new drive motor speed (0.5)
b. The new total head (0.5)
c. The new work input (0.5)

QUESTION 1.03 (2.50)

Consider conducting a start up at SNPS shortly after a scram from full power, with the moderator still near operating temperature and pressure. A reduced rod worth procedure is used, which has rods in the center of the core withdrawn before edge rods to 'shift' the neutron flux to the outside area of the core.

Briefly explain why this is a good idea. (2.5)

QUESTION 1.04 (2.50)

Water enters a centrifugal pump at 300 deg F and a pressure of 60 psig. Based on the available NPSH , do you expect cavitation to occur? (2.5)
SHOW ALL WORK

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

QUESTION 1.05 (2.50)

a. In terms of reactor power level control, explain why Shoreham's temperature coefficient is negative instead of positive. (1.0)

b. How will the Moderator Temperature Coefficient change (ie., MORE or LESS negative, or no effect) for the following:
   1. SBLC is initiated
   2. moderator temperature increases
   3. as the core ages. (0.5 ea)

QUESTION 1.06 (2.00)

With all other parameters held constant, if Recirculation Flow increases, how will the following parameters respond initially? (Increase, Decrease, or remain constant.) (0.5 ea)

a. Thermal neutron population
b. Thermal diffusion length
c. Void Fraction
d. Reactor Water Level

QUESTION 1.07 (1.50)

Why does core flow initially increase to approximately 110% of normal following a scram from full power? (1.5)

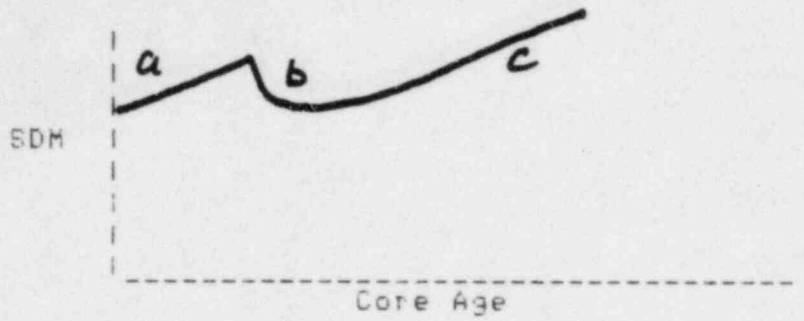
QUESTION 1.08 (2.50)

a. Approximately what percentage of neutrons produced from the fission of U-235 are born delayed? (0.5)
b. How does this percentage change over core life? Why? (1.0)
c. How do the delayed neutrons affect the control of the reactor? (1.0)

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

QUESTION 1.09 (1.50)

For each section marked on the graph below, state the reason for the change in Shutdown Margin (SDM) as core age increases. (1.5)



QUESTION 1.10 (2.50)

a. For a tubular heat exchanger, with all other parameters held constant, would each of the following changes (considered separately), INCREASE, DECREASE, or have NO EFFECT on the heat transfer rate? (0.5 ea)
   1. Tube failure
   2. An increase in flow velocity
   3. Fluid phase change within the heat exchanger

b. State two reasons for a reduction in heat transfer rate when corrosion products build up on the tube surfaces. (1.0)

QUESTION 1.11 (2.50)

The reactor has been operating at 100% power for one month when a scram occurs in which several control rods FAIL TO FULLY INSERT. Enough rods DO insert to bring the reactor subcritical at the time of shutdown. If reactor moderator temperature is maintained CONSTANT, and control rods are NOT moved, about HOW LONG will the operator have to wait before he can be reasonably sure that the reactor will remain subcritical? EXPLAIN. (2.5)

QUESTION 1.12 (1.00)

Although steam is known to be a poorer heat conductor than water, NUCLEATE BOILING is a BETTER heat transfer mechanism than SINGLE PHASE CONVECTION. Explain this apparent contradiction. (1.0)

(****** END OF CATEGORY 01 ******)

QUESTION 2.01 (1.50)

Figure 2 is a flow diagram of the HPCI system. Upon auto initiation, state the final position (OPEN OR CLOSED) of the following valves.

a. MOV-047 Inboard Steam Isolation Bypass Valve (0.3 ea)
b. MOV-042 Outboard Steam Isolation Valve
c. MOV-039 Lube Oil Cooling Water Valve
d. AOV-081 Steam Line Drain Valve
e. LCV-095 Cond Pump Discharge to RW Level Control

QUESTION 2.02 (2.00)

a. The RCIC system is in standby when the minimum flow valve (MOV-036) inadvertently opens. What would be the consequences of this situation if it went unnoticed by the operators? (1.0)

b. Why should operation of the RCIC turbine at speeds of less than 2200 rpm. be avoided ? (1.0)

QUESTION 2.03 (3.00)

a. How is feedwater flow controlled during ;
   1. Normal Operations (between 10 and 100% power) ? (0.5)
   2. Startup of the reactor (between 0 and 10% power) ? (0.5)

b. List three indications you have in the control room that can be used to verify proper feed pump operation. (1.0)

c. 1. When is steam blanketing of the MSR, (moisture separator reheater), necessary ? (0.50)
   2. Why is this done? (0.50)

(***** CATEGORY 02 CONTINUED ON NEXT PAGE *****)

QUESTION 2.04 (3.00)

Concerning the ADS System:

a. What is the purpose of the SRV discharge line vacuum breakers to the torus? (1.0)
b. What is the purpose of the interlock that prevents ADS initiation unless a low pressure ECCS pump is running? (1.0)
c. If the automatic ADS initiation fails when required, it must be manually initiated.
   1. What should you specifically verify or do before depressing the four armed push button switches S15 A through D? (0.5)
   2. After depressing the armed push buttons, will the 105 second timer still have to time out before the valves will open? Explain (0.5)

QUESTION 2.05 (1.00)

Following an accident in which the core geometry is suspected to be damaged, state the best way to determine if core geometry is still intact. (1.0)

QUESTION 2.06 (2.00)

State the specific design function provided by each of the following reactor safeguards, and briefly discuss how it achieves its function (2.0)

a. Main Steam Line Flow Restrictors
b. Containment Inerted by Nitrogen

QUESTION 2.07 (3.00)

a. What signals will automatically cause the Emergency Diesel Generators to INITIATE ? (1.5)
b. What signals will automatically cause the EDGs to TRIP if they are operating under NON-Emergency conditions ? (1.5)
(NOTE: for both a and b, include set points where applicable.)

modify

(***** CATEGORY 02 CONTINUED ON NEXT PAGE *****)

QUESTION 2.08 (1.50)

Other than a LPCI initiation, what three (3) automatic actions will occur by depressing the LPCI manual initiation pushbuttons ? (1.50)

QUESTION 2.09 (3.00)

a. List four (4) Nuclear Safety Related system loads that are cooled by RBCLCW. (1.0)

b. What is an RBCLCW "system split", and when does it occur? (.75)

c. List five (5) station loads that are isolated from cooling water due to an RBCLCW system split. (1.25)

QUESTION 2.10 (1.00)

State the normal operating value for the following parameters in the Control Rod Drive System. (Assume no rod motion) (1.0)

a. CRD Cooling Flow
b. CRD Cooling Water dP
c. CRD Drive Water dP
d. CRD Drive Water Flow
e. CRD System Flow

QUESTION 2.11 (2.00)

With regard to the Remote Shutdown Panel (RSP), 1C61*PNL-001:

a. HOW would you, as a control room operator, know if a transfer switch was taken to the emergency position on the RSP (2 indications required)? (1.0)

b. List FIVE (5) systems that have selected components which may be operated from the Remote Shutdown Panel (1.0)

(***** CATEGORY 02 CONTINUED ON NEXT PAGE *****)

QUESTION 2.12 (2.00)

For each of the following statements regarding the High Pressure Coolant Injection System (HPCI), indicate whether the statement is TRUE or FALSE, and EXPLAIN your answer.

a. In the event Low Pump Suction Pressure is sensed during HPCI system operation, the turbine will trip, and the signal must be manually reset before the turbine will restart, if initiation signals are still present. (1.0)

b. If the HPCI turbine trips due to an overspeed condition, it will restart when the speed coasts down to between 3000 and 4000 RPM. (1.0)

(***** END OF CATEGORY 02 *****)

QUESTION 3.01 (2.00)

What are the purposes of the following two precautions from Sp 23.609.01, " Rod Sequence Control System" ?

a. "Do not bypass any control rod in the RSCS having a failed "FULL IN" or "FULL OUT" limit switch unless the actual rod position is known" (1.0)
b. "While in the transition zone (LPSP to LPAP), the operator must verify the alignment of the rods within each group" (1.0)

QUESTION 3.02 (1.50)

Following a valid RCIC initiation, you receive a subsequent RCIC turbine trip from high reactor water level. Will the RCIC auto start, with no operator action, if the water level again decreases to the low level set point? Explain (1.5)

QUESTION 3.03 (2.00)

The Reactor Water Cleanup System suction line is provided with auto acting isolation valves (MOV 33 & 34). These valves auto close on leak detection. List the auto close signals and their setpoints. (2.0)

QUESTION 3.04 (2.00)

When will the following Reactor Protection System scram signals be bypassed ?

a. MSIV closure
b. TSV Fast Closure
c. Mode Switch to Shutdown
d. SDV High Level

QUESTION 3.05 (3.00)

With respect to the 120 VAC Uninterruptible Power Supply (UPS)

a. What automatically happens within the system in the event of an inverter failure? (1.0)
b. If the vital bus inverter (1NV - 01) is lost, how will the Main Generator exciter switchboards be affected? (2.0)

(***** CATEGORY 03 CONTINUED ON NEXT PAGE *****)

QUESTION 3.06 (1.50)

Upon a loss of Feedwater Control Signal from the M/A transfer station to the Reactor Feed Pump Turbine control logic:

a. What will be the status of the speed of the affected RFPT? (0.5)
b. Will the operator be able to manually vary the speed of the affected RFPT? If no, why not. If yes, how. (1.0)

QUESTION 3.07 (3.00)

Three runbacks are provided in the Load Control Unit of the EHC System. List each of the three runbacks, and state to what level each runback will reduce load. (3.0)

QUESTION 3.08 (3.00)

With regard to the Reactor Recirculation System.

a. Why does the Recirc Pump discharge valve have an auto close feature? (Provide approximate actuating setpoint(s)). (1.5)
b. RPT breakers serve three (3) functions. List the functions and setpoints which will actuate them. (1.5)

QUESTION 3.09 (2.00)

Consider the Rod Block Monitor (RBM)

a. List the conditions which will cause a RBM to be bypassed. (1.0)
b. A rod block will result from a "Failure To Null". Explain what 'Failure to Null' means. (1.0)

(***** CATEGORY 03 CONTINUED ON NEXT PAGE *****)

QUESTION 3.10 (2.50)

The following plant conditions exist:

- Reactor Vessel Level is -140" (confirmed, both channels) and decreasing.
- The RHR System is operating with a pump discharge pressure of >125 psig in system A and B.
- Reactor Vessel Pressure is 1000 psig and steady.
- All ADS INIT INHIBIT switches in NORMAL position.
- ADS Timers have timed out (both A & B).
- On the Automatic Blowdown Relay Panels (1H11*PNL-628 and 1H11*PNL-631), the white indicating lights above each of the SRVs show - ONE light OUT and ONE light LIT BRIGHTLY, for all valves.

a. What has happened ? EXPLAIN. (1.5)
b. What are your actions in this situation? (1.0)

QUESTION 3.11 (1.00)

What are the five (5) NON-SAFETY RELATED LOADS that can be reenergized with a LOCA signal present and the respective EDG Breaker closed for DIVISION I? (1.0)

QUESTION 3.12 (1.50)

The reactor is operating at 100% power when a small area break occurs. HPCI is out of service. RCIC fails to start automatically and cannot be started manually. All signals are present and valid for auto blowdown system actuation except the timer has NOT timed out.

a. RCIC is now started and water level is raised to above the low-low setpoint. What effect does this have on auto blowdown initiation if the timer HAS NOT timed out? If the timer HAS timed out? Briefly explain BOTH. (1.0)
b. If the 125 VDC Electrical Distribution System is lost will auto blowdown occur ? EXPLAIN (0.5)

(***** END OF CATEGORY 03 *****)

QUESTION 4.01 (2.00)

Explain whether either of the following situations describes a case where 10CFR20 Limits for individuals working in restricted areas have been violated. (Both men have updated NRC Form 4s on file)

a. A skin dose of 7000 mrem is received by a 44 year old male over a full quarter. His lifetime dose is 55 rem. (1.0)
b. A whole body dose of 1500 mrem is received by a 44 year old male over a three (3) month period. His lifetime dose is 22 rem. (1.0)

QUESTION 4.02 (2.50)

Concerning SP 29.012.01, "Loss of Condenser Vacuum":

a. List the four (4) Automatic Actions which occur on a loss of condenser vacuum. (Setpoints NOT required) (1.0)
b. Step 4.9 of this procedure instructs you to "Maintain surveillance of Turbine Building airborne radiation levels". Why? (2 required) (1.0)
c. Why are the condenser vacuum breakers (1N11-MOV-013A & B) opened if sealing steam is lost? (0.5)

QUESTION 4.03 (2.00)

According to Procedure SP 20.004.01, "Emergency Use of SLC":

a. WHO is responsible for determining if Standby Liquid Control initiation is necessary? (0.5)
b. Name five (5) items which should be checked in the control room to verify that the SLC tank contents are being injected into the vessel. (1.0)
c. What is the purpose of the heat tracing that is provided on the SLC system piping? (0.5)

QUESTION 4.04 (2.00)

According to SP 23.116.01, "Main and Auxiliary Steam", there are nine (9) indications in the control room that can be used to verify that an SRV is open. Name these nine indications. (2.0)

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.05 (3.00)

List the Immediate Operator Actions required for the Emergency Shutdown Procedure, SP 29.010.01. (3.0)

QUESTION 4.06 (2.00)

Concerning Procedure SP 29.023.01, 'Level Control Emergency Procedure':

a. List the entry conditions and setpoints for this procedure. (1.0)
b. List the three items you should verify as occuring consistent with entry conditions, after you enter the procedure. (1.0)

QUESTION 4.07 (2.50) ✓

a. Fill in the blanks in the following:
'According to SP 29.023.02, 'Cooldown Emergency Procedure', you are cautioned NOT to secure or place an ECC system in the manual mode unless misoperation in automatic is confirmed by _____(1)_____ or _____(2)_____.' (1.5)
Note: MORE THAN ONE WORD IS REQUIRED IN EACH BLANK

b. In your own words, define 'misoperation' as it is used above. (0.5)

QUESTION 4.08 (2.00)

According to Sp 23.604.01, 'APRM System':

a. When is an APRM channel defined as inoperable? (1.0)
b. During shutdown, when should the operator switch the IRM/APRM recorder switches to the IRM position? (1.0)

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.09 (3.00)

a. List the five (5) entry conditions and setpoints for SP 29.023.03, "Containment Control Emergency Procedure". (1.0)
b. According to the procedure, what three actions should you take if drywell temperature approaches 296 degrees F? (1.0)
c. 1. If Suppression Pool temperature is 190 degrees F, and RPV pressure is 600 psig, have you exceeded the heat capacity limit of the ATTACHED figure 1? (0.5)
   2. Under these conditions, would the procedure direct you to open all ADS valves? (YES or NO) (0.5)

QUESTION 4.10 (2.00)

According to SP 23.116.01, "Main and Auxiliary Steam":

a. What should be your immediate actions if you have an inadvertant MSIV closure and the Mode Switch is NOT in 'RUN'? (1.5)
b. According to the procedure, waht is the limit on differential pressure across the MSIVs prior to opening them? (0.5)

QUESTION 4.11 (2.00)

a. SP 22.001.01, "Startup-Cold Shutdown to 20% Power", states that both recirulation pumps must be running during startup. Why? (1.0)
b. Name the three locations at which reactor coolant system temperature must be maintained within 5 degrees F, once heatup power is achieved. (1.0)

(***** END OF CATEGORY 04 *****)
(********** END OF EXAMINATION **********)

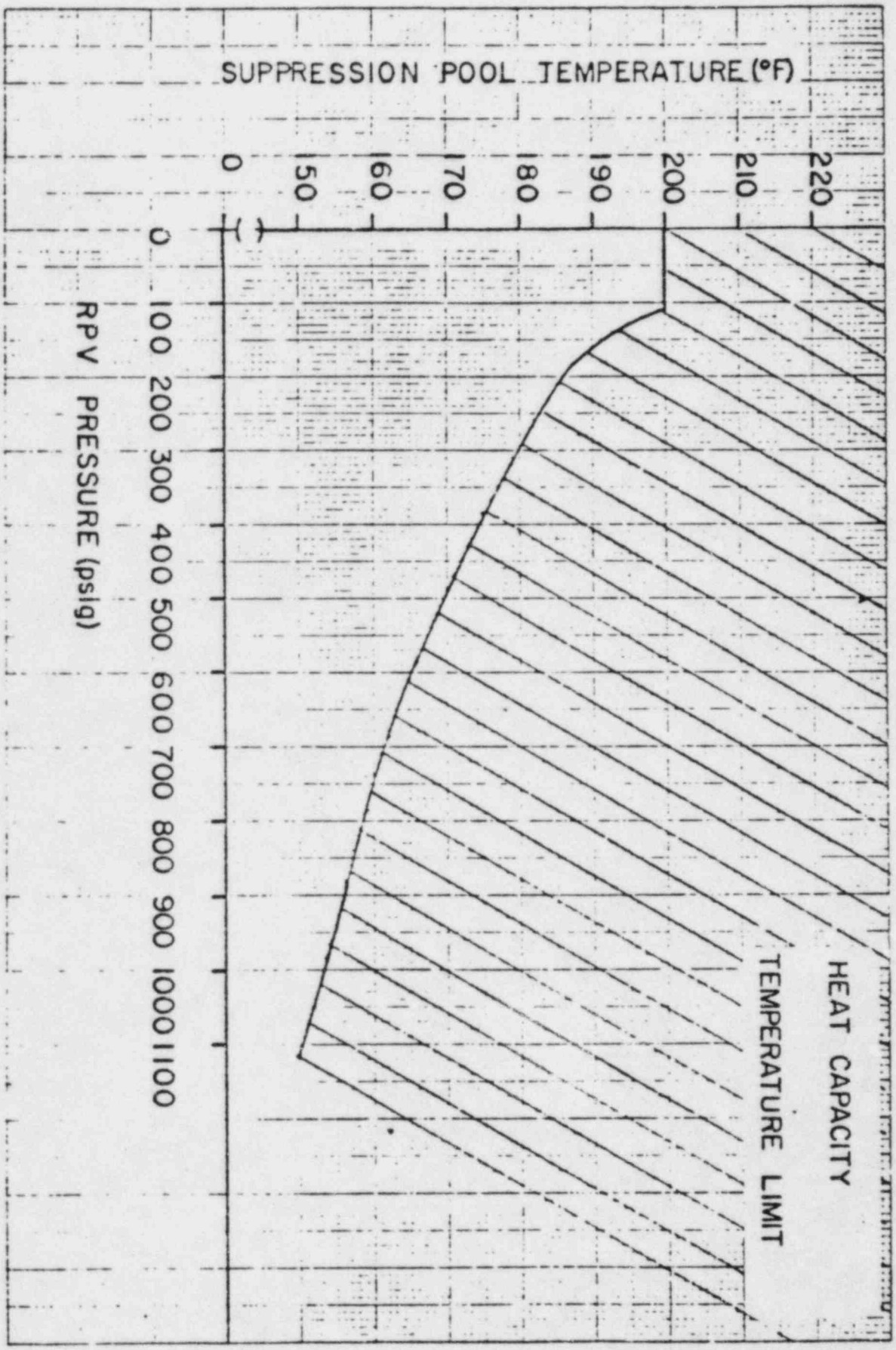
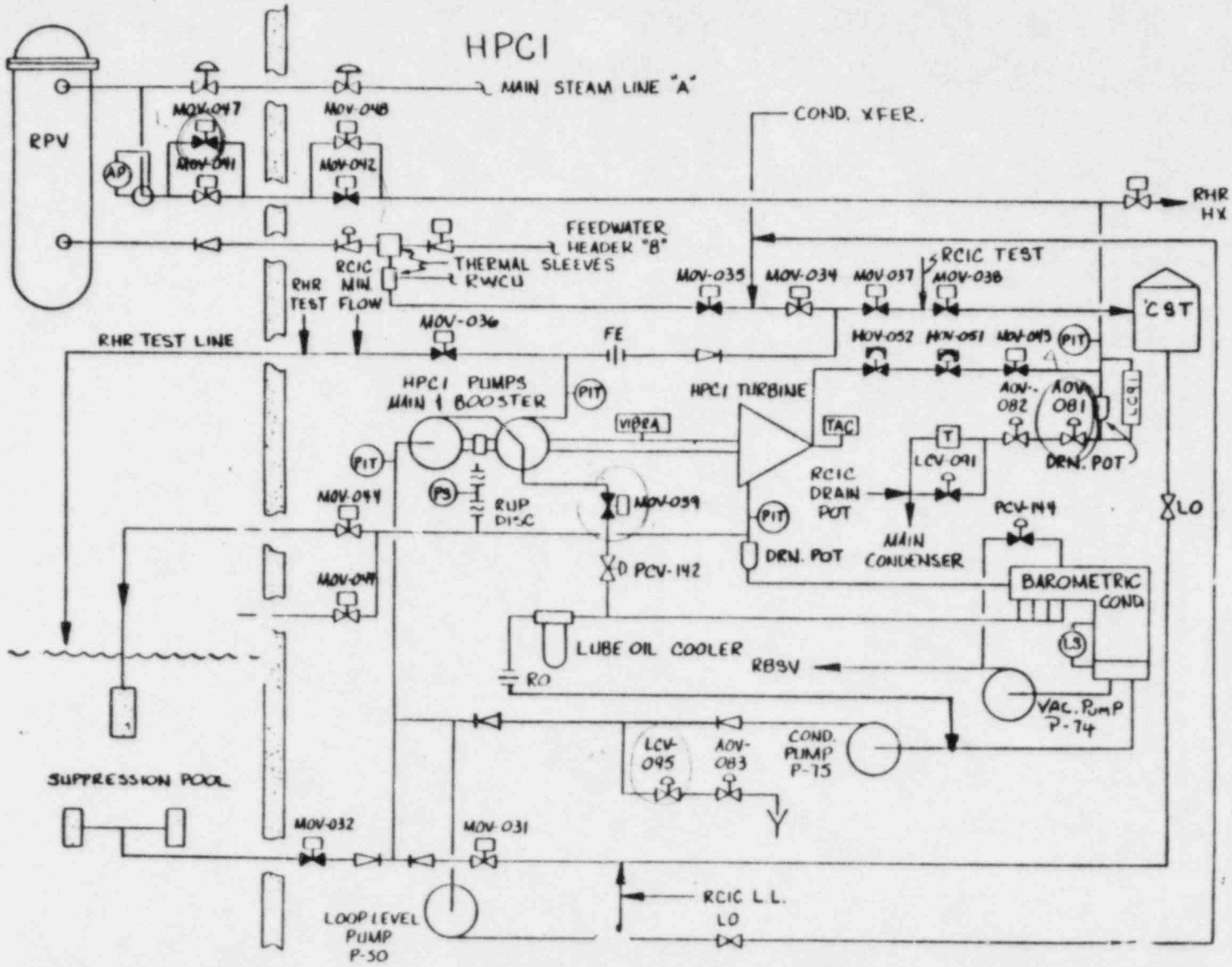

SUPPRESSION POOL TEMPERATURE (°F)
0
150
160
170
180
190
200
210
220
RPV PRESSURE (psig)
0
100
200
300
400
500
600
700
800
900
1000
1100
HEAT CAPACITY
TEMPERATURE LIMIT

FIG 1

Figure 2


HPCI
MAIN STEAM LINE "A"
COND. XFER.
RPV
MOV-047
MOV-048
MOV-041
MOV-042
AP
RHR HX
FEEDWATER HEADER "B"
THERMAL SLEEVES
RWCU
RCIC MIN FLOW
RHR TEST
RCIC TEST
MOV-035
MOV-034
MOV-037
MOV-038
CST
MOV-036
RHR TEST LINE
FE
MOV-052
MOV-051
MOV-043
PIT
HPCI PUMPS MAIN & BOOSTER
HPCI TURBINE
VIBRA
TAC
AOV-082
AOV-081
LCV-091
DRN. POT
RCIC DRAIN POT
MOV-044
PS
RUP DISC
MOV-039
PCV-144
LO
MAIN CONDENSER
MOV-049
PCV-142
BAROMETRIC COND.
LUBE OIL COOLER
RBSV
RO
VAC. PUMP P-74
LCV-095
AOV-083
COND. PUMP P-75
SUPPRESSION POOL
MOV-032
MOV-031
RCIC L.L. LO
LOOP LEVEL PUMP P-50

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 1.01 (2.50)

(a) Changes in conductivity indicate abnormal conditions. When conductivity is within limits, the pH, chlorides, and other impurities must also be within their limits. (0.5)

Exceeding any of these limits could cause higher corrosion rates which would jeopardize reactor components. (0.5)

(b) 1. Increase
2. Increase
3. Increase (0.5 ea)

REFERENCE
(a) SNPS TS Bases 3/4 4.4 Chemistry
(b) Chemistry Final Exam, question 4, SNPS

ANSWER 1.02 (1.50)

(a) Because flow rate varies directly with driving speed:

speed' = speed (flow'/flow)
= 1800 (1200/1000) rpm
= 2160 rpm

(b) (N*N) is proportional to the total head:

Head' = Head (speed'/speed)**2
= 110 (2160/1800)**2 psi
= 158.4 psi

(c) N**3 is proportional to the work input:

P' = P (speed'/speed)**3
= 500 (2160/1800)**3 hp
= 864 hp (0.5 ea)

REFERENCE
SNPS Fluid Mechanics Module, page 3-74

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 1.03 (2.50)

Prior to the scram, most of the neutron flux is concentrated in the center and bottom portion of the core. Xenon will be most predominant in these areas because its concentration is a function of power level. Xenon will therefore supress the flux in these areas, and the top and edges of the core will be the most reactive areas.

This is opposite of the normal case; if edge rods were pulled first, excessively high incremental rod worths would be created in areas which usually have low worth. Pulling rods from the center first increases the flux there and therefore lowers the edge rod worths. (2.5)

REFERENCE
SNPS Reactor Physics Module, page 7-207

ANSWER 1.04 (2.50)

Saturation pressure from the steam tables: 67.01 lbf/in2
= 9649.4 lbf/ft2 (0.5)

rho = 1/0.0175 = 57.14 lbf/ft3 (0.5)

P1 = (60 + 14.7) = 74.7 psia = 10756.8 lbf/ft2 (0.5)

NPSH = (P1 - Ps)/rho = (10756.8 - 9649.4) lbf/ft2 / 57.14 lbf/ft3 (0.5)
= 19.38 ft

Cavitation will NOT occur because the NPSH is a large, positive number. (0.5)

REFERENCE
SNPS, Fluid Mechanics Module page 3-84

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 1.05 (2.50)

(a) If the moderator temperature increases, the negative temperature coefficient will cause a negative reactivity insertion which will decrease the power level. If the coefficient were positive, an increase in moderator temperature would cause a positive reactivity insertion which would increase the power and therefore temperature level. This series of increases would continue unless there were outside intervention. (1.0)

(b) 1. LESS negative
2. MORE negative
3. LESS negative (0.5 ea)

REFERENCE
(a) SNPS Reactor Physics Module, page 7-175
(b) Reactor Physics Final Exam, question 23

ANSWER 1.06 (2.00)

a. Increase (0.5 ea)
b. Decrease
c. Decrease
d. Decrease

REFERENCE
SNPS Fluid Mechanics and Reactor Physics Modules

ANSWER 1.07 (1.50)

Flow increases because there is less two phase flow resistance due to the power reduction after the scram which reduces the void fraction. (1.5)

REFERENCE
SNPS Fluid Mechanics Module, page 3-61

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 1.08 (2.50)

(a) 0.641% (0.5)

(b) DECREASES (0.5), due to Plutonium production which has a lower delayed neutron fraction than U-235. (.5) (1.0)

(c) Delayed neutrons increase the core average generation time which allows better control of the reactor. (1.0)

REFERENCE
SNPS Reactor Physics Module, Lesson 15: Transient Reactor Respons

ANSWER 1.09 (1.50)

a. Increases initially due to fission product poison buildup. (0.5ea)
b. Decreases due to poison burnout rate greater than fuel depletion rate.
c. Increases due to fuel depletion rate greater than poison burnout rate.

REFERENCE
SNPS Reactor Physics Module, page 7-222,223

ANSWER 1.10 (2.50)

(a) 1. decrease (0.5 ea)
2. increase
3. increase

(b) 1. Water flow is restricted; mass flow rate drops.
2. The layer acts as an insulator to heat transfer. (0.5 ea)

REFERENCE
SNPS Heat Transfer and Thermodynamics Module, Lesson 6: Heat Exchangers

ANSWER 1.11 (2.50)

70 hours (1.0)
It will take approx. 70 hours for the Xenon to peak and then decay after the scram. If the positive reactivity inserted by the decay of Xenon is less than the shutdown reactivity due to rods, then the reactor will remain subcritical. (1.5)

THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

REFERENCE
Reactor Theory - Xenon Transients

ANSWER 1.12 (1.00)

The bubbles caused by nucleate boiling serve to agitate the stagnent fluid film next to the surface, thus improving thermal conductivity.[0.5] Also, each bubble, as it leaves the surface, carries off more energy than is possible by natural convection.[0.5]

REFERENCE
SNPS Heat Transfer and Thermodynamics Module - Lessons 5, 7, and 8
Student Objective #1, Lesson 5
Student Objective #1, Lesson 7
Student Objective #1, Lesson 8

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 2.01 (1.50)

1. ~~Open~~ Closed.
2. Open
3. Open
4. Closed
5. Closed (0.3 ea)

REFERENCE
SP 23.202.01 Rev 9 page 6

ANSWER 2.02 (2.00)

(a) A drain path would be established from the CST to the Suppression Pool. (1.0)
(b) 1. Water hammer may result in the exhaust line. (0.5)
2. At lower speeds, adequate cooling and lubrication of the turbine may not be ensured. → Did not ask for (2) ((0.5)

REFERENCE
a- Handout 119 Section 8.5.2.1
b- SP 23.119.01 page 4

ANSWER 2.03 (3.00)

(a) 1. By controlling the speed of the feed pumps (0.5)
2. By two startup feed water level control valves (0.5)
(b) Verify: flow indication, turbine speed, and discharge pressure (0.33 ea)
(c) 1. Blanketing steam is supplied to the inside of the reheater tubes from the Aux Boiler during shutdown. (0.75)
2. This is done to reduce corrosion of the heater tubes. (0.75)

REFERENCE
a- SP23.109.01 Rev 5 page 2
b- lesson plan R109, page 7
c- lesson plan 110, page 5, Learning Objective C.

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 2.04 (3.00)

(a) To prevent water from being drawn back into the discharge pipes due to steam condensing in the pipes after an SRV actuation (1.0)
(b) To ensure a method is available to pump water into the vessel once the lower pressures are reached and before vessel level is further decreased by ADP actuation. (1.0)
(c) 1. Verify started or start at least two RHR pumps or one (1) CS pump.
2. NO- the timer is bypassed by the armed pushbuttons. (0.5 each)

REFERENCE
HL 201: a- page 4, b- page 13, c- page 8.

ANSWER 2.05 (1.00)

Core geometry is still intact if the SRMs and the IRMs can inserted and withdrawn successfully. (1.0)

REFERENCE
SNPS Mitigating Core Damage Exam, Class 5

ANSWER 2.06 (2.00)

(a) 1. To limit steam flow to a maximum of 200% of rated steam line flow folllowing an MSL break. (0.5)
2. By limiting the dP across the steam dryer and other vessel internals as well as the mass flow rate from the vessel. (0.5)
(b) 1. To prevent reaching a flammable or explosive drywell atmosphere following a LOCA. (0.5)
2. By keeping the oxygen concentration in the drywell below the Tech Spec limit of 4% by volume. (0.5)

REFERENCE
a- HL 116 page 7
b- HL 654 page 7, TS Bases Section 3/4 6.6

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 2.07 (3.00)

(a) Undervoltage on respective 4160v emergency bus (1.5)
High Drywell Pressure (+1.69 psig)
Low Reactor Water Level (-132.5")

(b) Overcurrent (neutral ground) (1.5)
Generator phase differential
Overspeed (517 rpm increasing)
Mode selector switch in LOCKOUT position
Manual push button (Local or from Control Room)
Manual push button on DG skid "STOP" depressed

Loca
greate To non emerg.

REFERENCE
SP 23.307.01 Rev 10 page 13

ANSWER 2.08 (1.50)

(a) 1. EDG start
2. Emergency Bus Loading Program
3. Feed water check valve isolation (0.~~33~~ 5 ea)

REFERENCE
SP 23.204.01 Rev 2, page 2

ANSWER 2.09 (3.00)

(a) RHR pump seal coolers (0.25 ea)
Spent fuel pool cooling water Hx
Reactor Recirc Pump: Seal Cooler, Motor Winding, Bearing Coolers
(Four needed for full credit.)

(b) During a LOCA signal or lo lo head tank level, the system is auto separated into two independent loops. (0.75)

(c) During an accident, the non-nuclear safety related loads are isolated by MOVs:
Reactor Recirc Pump MG Set Oil Cooler
RWCU Nonregenerative HX
RWCU Pump Coolers
Drywell Equipment Drain Cooler
CRD Pump: Bearing Cooler and Gear Oil Cooler
Drywell coolers
(0.25 ea) (Five needed forfull credit)

. Rx bldg sample panel
. AUX Boiler Sample panel

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

REFERENCE
a,b- Lesson Plan 118, page 5/ c- LP 118, page 6 and Learning Objective 7.8

ANSWER 2.10 (1.00)

1. 30-46 gpm
2. 20 psid
3. 260 psid
4. 0 gpm
5. 30-46 gpm (0.2 ea)

REFERENCE
HL 106 Learning Objective F, page 2 of Student Handout Supplement

ANSWER 2.11 (2.00)

a. -Alarm in the control room[0.5]
-Loss of indicating lights in the control room for the affected component[0.5] (1.0)

b. -ADS or SRV, Press. Sens ADS Components
-Recirc
-RHR
-RCIC
-Fuel Pool Cooling
-Service Water System
-RBCLCW
Compressed Air System
[5 required at 0.2 each] (1.0)

REFERENCE
SNFS Procedure SP 29.022.01, Rev 4

ANSWER 2.12 (2.00)

a. False [0.5] - Once the low suction pressure signal is clear, the turbine will auto restart if the initiation signals are still present.[0.5]

b. True [0.5] - The oil pressure will be restored when the turbine coasts down, thereby causing the stop valve to open.[0.5]

REFERENCE
HPCI
SP 23.202.01

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 3.01 (2.00)

a. The purpose of this precaution is to prevent crossing tips and ensuring reactor engineering is aware of a possible rod in an abnormal position for the selected sequence. (1.0) -check ref. + L.P.

b. This must be accomplished before going below the LPSP to avoid generating an insertion or withdrawal block. (1.0)

REFERENCE
a. Lesson Plan 607/609, Learning Objective D.
b. SP 23.609.01, page 6

ANSWER 3.02 (1.50)

~~yes~~ (0.5)

The operator must reset the trip and throttle valve (MOV - 44) by closing and reopening it. (1.0)

+1 water level is only one. check ref.

REFERENCE
SP 23.119.01

ANSWER 3.03 (2.00) T.S

RWCU Area Hi Temperature (~~134~~ 155 degrees F)
RWCU High Flow (44 gpm)
Low Low Reactor Water Level (-38") T.S
Main Steam Tunnel Piping Area High Temperature (~~200~~ 175 degrees F)

(0.25 for parameter, 0.25 for setpoint)

REFERENCE
Student Handout 709, page 5

ANSWER 3.04 (2.00)

a. Mode switch in other than 'RUN'
b. Power < 25%
c. 10 seconds after Mode Switch placed in S/D
d. By the bypass switch or Mode Switch in S/D or Refuel

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

REFERENCE
Student Handout 312/611, Learning Objective 7.5

ANSWER 3.05 (3.00)

a. The static transfer switch will auto transfer the AC Vital bus loads to alternate AC source (1.0)
b. Generator amps, volts, and temperature indications are lost (1.0) Generator field ground detection trip and it's associated alarm are dissbled. (1.0) Consider during grading for alt ans

REFERENCE

Lesson Plan 313, pages 5 & 9, Learning Objective D

ANSWER 3.06 (1.50)

a. Speed is locked at the last requested speed (0.5)
b. RFPT speed can be reduced from the RFPT EHC panel, but it cannot be increased. (1.0) limit not above failure set point

REFERENCE
Student Handout 656, page 8

ANSWER 3.07 (3.00)

1. Loss of Stator Cooling - 25% load
2. SYNC speed not selected - zero
3. Power Load Unbalanced - zero

REFERENCE

HL 657, EHC, pages 1-5

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 3.08 (3.00)

a. The auto close feature is provided to close the discharge VLV in the event of a LOCA and reactor pressure is <309 psig to ensure that if the break is between the suction and discharge VLV's, to allow LPCI to inject to the reactor vessel and not flow back and out the break. (1.5)

b. Functions:
   1. Open on ATWS conditions of high reactor pressure of 1120 psig or low low Rx level -38" (0.5)
   2. Open on turbine trip when at greater than 25% power. (0.5)
   3. Provide redundant fault protection for primary containment electrical penetrations. (0.5)

REFERENCE 4.5.6C Turbine Trip @ 30% (T.S)

Recirculation System

ANSWER 3.09 (2.00)

a. 1. Manual operation of bypass switch (0.33) 2. Reference APRM downscale (<30% power) (0.33) 3. Edge rod selected. (0.33)

b. A failure to null results if flux is so severly depressed around the selected rod that even with the maximum gain change the RBM output cannot be made greater than or equal to the reference APRM. (1.0)

REFERENCE alt, Failure To Bring indicated Local Power ≥ ind. Avg. Power

LP 606

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 3.10 (2.50)

a. All parameters are normal for an ADS intiation, but the ADS system has not initiated. The status of the white indicating lights on the Automatic Blowdown Panels indicates that only one of the 2 channels in each of the 2 logic systems energized. Since the logic systems are 2 out of 2 once, the valves did not open. (1.5)

b. Attempt to manually initiate the system by verifying that at least two RHR or one CS pump is running, and try to open the ADS valves using the individual control switches. (1.0)

REFERENCE
1. Automatic Depressurization/Safety Relief Valve System Student Handout # HL-201
   Student Objectives # 3 & 10
2. SP 23.201.01

ANSWER 3.11 (1.00)

1. RFP 'A' lube oil pump
2. RFP 'A' turning gear
3. Bearing Lift Pumps A & C
4. 24V Battery Charger
5. Emergency Lighting Distribution Panel
6. A CRD Pump
(5 at 0.2 pts each)

REFERENCE
Emergency Electrical Distribution Student Handout Supplement
Objective No. 7.13 N6 29.015,01 rev. 11, pg 3 step 4.6

ANSWER 3.12 (1.50)

a. - Auto blowdown will not initiate if the timer has not timed out [0.2] because the timer will reset and not restart until level drops below the setpoint [0.3].
   - If the timer has timed out, auto blowdown will be initiated [0.25] and will continue until completion (or reset) [0.25]

b. No. [0.25] Power to the DC solenoids and logic initiation circuitry is powered from 125 VDC. [0.25]

alt. ans., Explain Div. 1 & 2 Logic for Auto Blowdown.

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

REFERENCE
ADS Student Handout
Objectives 3 & 6

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 4.01 (2.00)

44 = N 5(N-18) = 130 rem.
Neither case has exceeded the lifetime dose under 10CFR21 (1.0)

a. 7000 mrem to the skin does not exceed the 7500 mrem limit/qtr. (0.5)
b. The 1250 mrem/qtr whole body limit has not been exceeded because he has an updated NRC Form 4 (0.5)

REFERENCE

10 CFR 20, Section 20.101

ANSWER 4.02 (2.50)

a. MSIV and MSL drains isolate
Turbine BPVs close or remain closed
Main Turbine trips
Reactor Feed Pump turbines trip (0.25 each)
b. 1. If condenser air removal pumps are used to help maintain vacuum, their exhaust is not treated by gaseous radwaste so it must be monitored.
2. Condenser outgassing could increase the turbine building rad levels.
c. To prevent excessive cooling of the turbine shaft and seals as air is drawn in at these locations.

REFERENCE

SP 29.012.01

ANSWER 4.03 (2.00)

a. The Watch Engineer (0.5)
b. - Squib valve loss of continuity alarm
- SLC pump discharge pressure >= reactor pressure
- Both squib valve lights out
- Selected pump running light on
- SLC Tank level decreasing
- Reactor power decreasing (5 of 6 @ 0.2 pts each)
c. to prevent precipitation and crystallization of the solution in the pump suction lines (0.5)

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

REFERENCE

SP 29.004.01 and Student Handout 'Standby Liquid Control'

ANSWER 4.04 (2.00)

1. SRV leaking annunciator
2. Hi temperature on SRV discharge tailpipe
3. Hi pressure on tailpipe pressure indicator
4. Relief Valve Open annunciator
5. Suppression Pool Temperature increase
6. Suppression Pool water level increase
7. FW Flow > Steam Flow
8. Decrease in Turbine Generator Load
9. Temporary increase in Reactor water level prior to SF/FF mismatch

(0.22 each) Consider all 7 correct.

REFERENCE Ref. ADS H.L -201 rev 3 pg. 17

SP 23.116.01, page 10

ANSWER 4.05 (3.00)

1. Place the Mode Switch to Shutdown
2. Verify a rapid flux decrease
3. Verify all rods inserted
4. If not - refer to Transient with Failure to Scram Procedure
5. Monitor reactor vessel level
6. Initiate level control procedure if necessary

Six components to answer from 4 immediate actions - Each component .5 each

Check prod Chage

REFERENCE

SP 29.010.01, Page 1

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 4.06 (2.00)

a. RPV water level less than 12.5 inches
Drywell pressure > 1.69 psig
An isolation condition which requires or initiates a scram
(0.33 each)
Rx Scram.

b. Group isolations
Auto initiation of ECCS systems
D/Gs start
(0.33 each)

3 of 6 req'd.

REFERENCE

SP 29.023.01, page 1

ANSWER 4.07 (2.50)

a.1. at least two independent indications (~~0.5~~ 1.0)

a.2. adequate core cooling is assurred by at least two independent indications. (~~0.5~~ 1.0)

b. If it does not meet the Technical Specification definition of Operability. CAF FOR OTHER ACCEPTABLE ANSWERS. (0.5)
Initiation without valid initiation sig
Consider all ans

REFERENCE

SP 29.023.02, page 2

ANSWER 4.08 (2.00)

a. When there are less than 2 LPRM inputs per level or less than 11 LPRM inputs total to the APRM (1.0)

b. When the first APRM Downscale alarm light illuminates (1.0)

REFERENCE
SP 23.604.01, pages 2 and 4

ANSWERS -- SHOREHAM -85/09/17-BANAVITCH,L./LANGE,

ANSWER 4.09 (3.00)

a. Suppression Pool Temperature > 90 degrees F
   Drywell Temperature > 145 degrees F
   Drywell Pressure > 1.69 psig
   Suppression Pool Level > +6 inches
   Suppression Pool Level < -6 inches (0.2 each)
b. Shutdown Recirc Pumps
   Shutdown Drywell Fans
   Initiate Drywell Spray (0.33 each)
c.1. NO (0.5)
c.2. NO (0.5)

REFERENCE

SP 29.023.03, pages 1 and 5

ANSWER 4.10 (2.00)

a. Monitor and maintain reactor pressure using control rods to adjust power as required (0.75)
   Start RCIC to assist in controlling reactor pressure and level (0.75)

b. 200 psid (0.5)

REFERENCE

SP 23.116.01, page 10 , new 5. pg.6 8.1.2.13.

ANSWER 4.11 (2.00)

a. Natural circulation startups impose excessive stress on the control rod housing. (1.0)
b. Reactor Vessel Bottom Drain
   Recirc Loops A and B
   Reactor Vessel Bottom Head (0.33 each)

REFERENCE

SP 22.001.01, pages 5 and 7

QUESTION	VALUE	REFERENCE
01.01	2.50	BAJ0000733
01.02	1.50	BAJ0000734
01.03	2.50	BAJ0000735
01.04	2.50	BAJ0000736
01.05	2.50	BAJ0000737
01.06	2.00	BAJ0000738
01.07	1.50	BAJ0000739
01.08	2.50	BAJ0000740
01.09	1.50	BAJ0000741
01.10	2.50	BAJ0000742
01.11	2.50	BAJ0000771
01.12	1.00	BAJ0000772
	25.00	
02.01	1.50	BAJ0000743
02.02	2.00	BAJ0000744
02.03	3.00	BAJ0000745
02.04	3.00	BAJ0000746
02.05	1.00	BAJ0000747
02.06	2.00	BAJ0000748
02.07	3.00	BAJ0000749
02.08	1.50	BAJ0000750
02.09	3.00	BAJ0000751
02.10	1.00	BAJ0000752
02.11	2.00	BAJ0000773
02.12	2.00	BAJ0000774
	25.00	
03.01	2.00	BAJ0000764
03.02	1.50	BAJ0000765
03.03	2.00	BAJ0000766
03.04	2.00	BAJ0000767
03.05	3.00	BAJ0000768
03.06	1.50	BAJ0000769
03.07	3.00	BAJ0000770
03.08	3.00	BAJ0000775
03.09	2.00	BAJ0000776
03.10	2.50	BAJ0000777
03.11	1.00	BAJ0000779
03.12	1.50	BAJ0000778
	25.00	
04.01	2.00	BAJ0000753
04.02	2.50	BAJ0000754
04.03	2.00	BAJ0000755
04.04	2.00	BAJ0000756
04.05	3.00	BAJ0000757

QUESTION	VALUE	REFERENCE
04.06	2.00	BAJ0000758
04.07	2.50	BAJ0000759
04.08	2.00	BAJ0000760
04.09	3.00	BAJ0000761
04.10	2.00	BAJ0000762
04.11	2.00	BAJ0000763
	25.00	
	100.00	

Attachment 2

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

FACILITY: SHOREHAM

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/09/17

EXAMINER: LANGE, D.

APPLICANT: MASTER

INSTRUCTIONS TO APPLICANT:

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

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	~~25.00~~ 24.56 25.00			a. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	~~25.00~~ 25.00			G. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00	100.00			TOTALS

FINAL GRADE _____%

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

APPLICANT'S SIGNATURE

QUESTION 5.01 (2.50)

Control rods which are positioned close to the intermediate/shallow rod boundary may exhibit a "reverse power response".

a. What will happen to the local flux and core average flux when such a rod is withdrawn. (1.00)

b. Why does the reactor respond this way? (1.50)

QUESTION 5.02 (3.00)

Feedwater subcooling affects the reactor power response.

(a) As reactor power increases, what happens to the inlet feedwater subcooling and WHY ? (1.00)

(b) For a given gross power level, how does an increase in inlet feedwater subcooling affect the axial power distribution and WHY ? (1.00)

(c) For a given electrical output, does the plant operate more efficiently with inc. or dec. inlet feedwater subcooling and why ? (1.00)

QUESTION 5.03 (2.25)

Heat balance calibrations of the APRM's are normally performed by the process computer, but may need to be performed by hand.

(a) What are the five sources of energy inputs required for a heat balance calculation? (1.25)

(b) What are the three energy outputs or losses required for a heat balance calculation? (1.00)

QUESTION 5.04 (3.00)

a. At EOL how much delta K/K must be added to place a critical reactor on a 60 second period. (State all or any assumptions.) (1.5)

b. Explain why reactor power will decrease on a -80 second period shortly following a reactor scram. (1.5)

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

QUESTION 5.05 (1.50)

Describe how rod worth is affected by the following;
(Indicate with: increase, decrease or stays the same)

a. Moderator temperature increase (0.50)
b. Void content increase (0.50)
c. Neutron flux increase (0.50)

QUESTION 5.06 (2.25)

For each situation described below, determine if an SNPS Safety or Thermal Limit has been violated. Name the limit and its value. (0.75 ea)

(a) Core flow = 25%, Steam dome pressure = 950 psig, MCPR = 1.10
(b) Core flow = 60%, Steam dome pressure = 780 psig, Thermal power = 70%
(c) CMFLPD = 1.001

QUESTION 5.07 (2.00)

With all other parameters held constant, if Recirculation Flow increases, how will the following parameters respond initially?
(Increase, Decrease, or remain constant.) (0.66 ea)

a. Thermal neutron population
b. Thermal diffusion length
c. Reactor Water Level

QUESTION 5.08 (2.50)

The reactor has been operating at 100% power for one month when a scram occurs in which several control rods FAIL TO FULLY INSERT. Enough rods DO insert to bring the reactor subcritical at the time of shutdown. If reactor moderator temperature is maintained CONSTANT, and control rods are NOT moved, about HOW LONG will the operator have to wait before he can be reasonably sure that the reactor will remain subcritical? EXPLAIN. (2.50)

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

QUESTION 5.09 (3.00)

Following a reactor scram, from 100 % power, explain what happens initially to the following parameters (increase, decrease, or remain the same) AND WHY ?

a. Flow through the core. (0.75)
b. Flow through the control rod drive pumps. (0.75)
c. Control rod drive temperature. (0.75)
d. Pressure drop in the steam lines. (0.75)

QUESTION 5.10 (3.00)

For each of the following events, or changes in plant status, state whether the change will bring the system CLOSER TO, FARTHER FROM, or HAVE NO EFFECT ON the point at which the Reactor Recirculation pumps will cavitate. GIVE A BRIEF EXPLANATION FOR EACH.

a. Increase in reactor water level (1.0)
b. Loss of a feedwater heater (1.0)
c. Increase in Recirculation Pump speed (1.0)

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

QUESTION 6.01 (2.50)

The uninterruptible AC power supply, (UPS), provides continuous AC power to non-safety related controls and instrumentation.

(a) Under what conditions will power be supplied to the vital bus, (UPS #1), directly from the battery source ? (1.00)

(b) When would power be supplied to the vital bus from the alternate AC source ? (1.00)

(c) What is the purpose of the manual, (Alternate Source) by-pass switch. (0.50)

QUESTION 6.02 (2.50)

For each of the following Nuclear Steam Supply Shutoff System isolation signals, briefly state, (1) the condition for which protection is provided, (2) the concern requiring this protection, and (3) the setpoints and reasons for selection of the setpoint values.

(a) Main Steam Line High Area Temperature (1.25)

(b) Reactor Vessel Low-Low Level (1.25)

QUESTION 6.03 (2.50)

The APRM s receive and average signals from individual LPRM's.

(a) How many LPRMs are used in each of the APRM channels? (0.50)

(b) How would you determine the flux level for a single LPRM? Give three methods. (0.75)

(c) What are the minimum LPRM inputs for each APRM channel according to the Tech Specs, and how are they enforced? (1.00)

(***** CATEGORY 6 CONTINUED ON NEXT PAGE *****)

QUESTION 6.04 (2.50)

a. List two conditions which will automatically bypass the Rod Block Monitor and for each condition briefly explain why ? (2.00)

b. How many LPRM inputs are required to prevent an RBM instrument inoperative alarm ? (0.50)

QUESTION 6.05 (2.50)

The recirculation pumps are provided with two sets of mechanical/ cartridge type seals for its seal assembly.

(a) Explain the purpose of both the Control Rod Drive and RBCLCW water that is provided to the seals. After leaving the seal assembly where does water discharge to ? (0.75)

(b) At 100 % power :
What is the normal flow rate through the seal cavity ? (0.50)
What is the pressure in each seal cavity ? (0.50)

(c) What would the pressures and flow rates be, and what alarms would be received, if only the No. 1 (internal) seal were to fail ? (0.75)

QUESTION 6.06 (2.00)

Core Spray and RHR loop level system pumps should be kept in service at all times during standby status to assure that the RHRS discharge piping remains full. WHERE and by WHAT INDICATION can an operator verify that the discharge piping is indeed full. (2.00)

QUESTION 6.07 (2.50)

Explain the response of the LPCI injection mode of the RHR system if a low-3 level initiation signal occurs during operation of the RHRS in the shutdown cooling mode. Your answer should include the response of the pumps, valves, and any operator action. (2.50)

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

QUESTION 6.08 (2.50)

Concerning the RBCLCW system ;

a. What three automatic conditions will cause a split of RBCLCW loops. (1.00)

b. List six indications an operator has to verify that a split of the RBCLCW loops has occured. (1.50)

QUESTION 6.09 (1.50)

Concerning the Safety Relief Valves ;

a. How will a safety relief valve ~~bellows~~ PISTON ACTUATOR failure affect the operation of the valve. Consider all modes of operation. 1.50 (~~1.00~~)

~~b. What indication would you have of this failure.~~ delered D.J. (~~0.50~~)

QUESTION 6.10 (2.00)

What six (6) reactor protection system , (RPS) , trip functions are never bypassed regardless of MODE SWITCH position ?
NOTE: Do not include a manual scram. (2.0

QUESTION 6.11 (2.00)

Refer to the attached control panel diagram of the Control Rod Drive system to answer the following:

a. State what has happened, and list five indications which are off-normal with an explaination of each. (2.00)

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

QUESTION 7.01 (2.25)

During a reactor shutdown from 20 % power procedure 22.005.01 cautions you not to use the Vacuum Breakers except for emergency conditions. Explain the reason for this caution and state when vacuum is broken per procedure. (2.25)

QUESTION 7.02 (2.50)

a. List the immediate operator actions required upon reciept OFF- GAS High Radiation alarm. (1.00)

b. What three control room indications would you use to make a determination that an OFF- GAS EMERGENCY existed ? (1.50)

Annunciators considered during grading, only if correspond to records.
Ref HL-631 Student handout

QUESTION 7.03 (3.00)

(a) List the three entry conditions for the Level Control Emergency Procedure,(SP29.023.01). (2.00)

(b) Under what procedural conditions would you enter the Level Restoration Emergency Procedure,(SP29.023.04)? (1.00)

QUESTION 7.04 (3.00)

Temporary changes to approved station procedures shall be documented on the Temporary Procedure Change (TPC) Form. If during a startup on a backshift, a TPC is required to complete a CRD coupling check ;

(a) What approvals are required prior to implementing the temporary change, And how are these approvals to be indicated? (2.00)

(b) What is the maximum life of a TPC after approval and are there any additional reviews required prior to reaching end of life ? (1.00)

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

QUESTION 7.05 (2.00)

The reactor is at 70 % power when you receive a trip of "A" CRD pump due to low suction pressure. You direct your operator to start the " B " CRD pump. Two attempts to start the "B" pump fail. Should the reactor be scrammed at this time ? (briefly explain). (2.00)

QUESTION 7.06 (2.25)

According to procedure SP-23.204.01 (LPCI), a caution exists that states to maintain Suppression Pool temperature in accordance with the Tech. Spec. LCO. If no testing was in progress , list all available indications an operator would have to determine if the Supp. Pool temperature had exceeded its Tech. Spec. LCO. (2.25)

QUESTION 7.07 (2.00)

A step in the RPV Flooding Emergency Procedure (SP-29.023.01) directs you to the attached (Figure 1) maximum acceptable core uncovery time vs time after shutdown.

a. Which area of the graph is the unacceptable portion--above or below the curve? ~~(0.50)~~ .75 1.50

b. List the entry conditions to this procedure. ~~(1.50)~~ 1.25

QUESTION 7.08 (2.00)

According to procedure, SP-21.004.01 , Main Control Room-Conduct of Personnel :

What control room personnel can be designated to assume the control room command function during the absence of the Watch Engineer ? Does this requirement change for operational conditions 1 through 5 ?

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

QUESTION 7.09 (3.00)

a. Drywell temperature has exceeded 296 degrees F, and SP 29.023.05 requires the operator to open all ADS valves. While attempting to comply with this requirement, he discovers that only 2 SRVs can be opened. List six (6) alternate paths to help depressurize the reactor. (2.0)

b. As Drywell temperature was increasing, Emergency Procedure 29.023.03, Containment Control, directed that as temperature approached 296 degrees the Reactor Recirc. Pumps and Drywell Fans be Shutdown. WHY? (1.0)

QUESTION 7.10 (3.00)

a. List the five (5) entry conditions and setpoints for SP 29.023.03, 'Containment Control Emergency Procedure'. (1.50)

b. 1. If Suppression Pool temperature is 160 degrees F, and RPV pressure is 600 psig, have you exceeded the heat capacity limit of the ATTACHED figure 1? (.75)

2. Under these conditions, would the procedure direct you to open all ADS valves? (YES or NO) (.75)

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

QUESTION 8.01 (2.00)

The steady state MCPR limit given in Tech. Specs. is multiplied by a flow biasing correction factor Kf. Explain the bases for this correction factor including the events associated with it.

(2.00)

QUESTION 8.02 (2.00)

According to the Tech Specs, define PRIMARY CONTAINMENT INTEGRITY.

(2.00)

QUESTION 8.03 (2.50)

According to procedure SP-12.011.01 , Station Equipment Clearance Permit, specific Limitations/Actions must be adhered to. Answer the following statements either TRUE or False. If false, explain the proper clearance limitation.

a. The on duty Watch Engineer can delegate, to the on duty Watch Supervisor, approval or lifting of a SECP as long as he is kept fully informed of the system status. (0.50)

b. Caution tags may be placed by anyone who has been trained in the use of these cards. (0.50)

c. A Hold- Off Tag and a Caution Card shall not be affixed to a specific component at the same time. (0.50)

d. Equipment Information Cards may be placed by any LILCO employee with the Watch Engineers approval. (0.50)

e. A Hold-Off clearance and a Caution clearance shall not be issued for a piece of equipment at the same time. (0.50)

QUESTION 8.04 (3.00)

Describe the three conditions that would necessitate you to direct, or be directed to initiate the Standby Liquid Control System. (3.00)

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

QUESTION 8.05 (3.00)

Mid-way through the 4PM to midnight shift, you are informed that, while troubleshooting an EHC problem, the Instrument Technicians discovered that the Bypass Valve Control Unit on the EHC System is INOP, and the demand signal for the Bypass Valves is locked-in at ZERO demand. They estimate that it will take until tommorrow to repair the circuitry. The plant is presently operating at 80% power with direction from the Plant Manager to increase power to 100% at 10MW thermal/hour. USING THE ATTACHED TECHNICAL SPECIFICATIONS, determine what action(s) must be taken in this situation. (3.0)

QUESTION 8.06 (2.00)

There are numerous log's that you, as a Watch Engineer, must review before assuming the watch. What are these log's. (2.00)

QUESTION 8.07 (3.00)

According to the Radiation Work Permit Procedure (SP 12.012.01), there are six (6) conditions when an RWP should be initiated. List 5 of these 6 conditions, including radiation levels if applicable. (3.00)

QUESTION 8.08 (2.50)

Throughout the Shoreham Technical Specifications, in various sections, the following statement appears:

" The provisions of of Specification 3.0.4 are not applicable."

What is Specification 3.0.4 , and what does this statement mean? (2.50)

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

QUESTION ◆8.09 (3.00)

Using the attached containment control figures from SP.29.023.03, answer the following:

a. What is the minimum suppression pool water level given an RPV pressure of 500 psig and suppression pool temperature of 160 F? (1.0)
b. If suppression pool level cannot be maintained above this level, the procedure directs the operator to open all ADS valves and depressurize. What is the reason for this procedural step? (1.0)
c. During depressurization, what must be checked prior to depressurizing below 110 psig. (0.5)
d. Can the cooldown limit of 100F/hr be exceeded during this depressurization? (0.5)

QUESTION 8.10 (2.00)

During operations at power it is discovered that the 'A' RHR heat exchanger bypass valve is stuck open and will not close. During subsequent investigation, the outboard 'B' LPCI injection valve (MOV-37B) is found to be inoperable due to an electrical malfunction. Using the attached Technical Specifications, determine the allowable time the reactor may continue operation. REFERENCE sections in the tech specs used in your answer. (2.0)

(***** END OF CATEGORY 08 *****)
(********** END OF EXAMINATION **********)

EQUATION SHEET

$F = ma$

$v = s/t$

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

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

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

$PE = mgh$

$w = s/t$

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

$V_f = V_o + at$

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

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

$W = v\ \Delta P$

$\dot{m} = V_{av} A_o$

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

$\Delta E = 931\ \Delta m$

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

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

$Pwr = W_f \Delta h$

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

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$P = (\pi\rho V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$I_1 d_1 = I_2 d_2$

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

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

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

Water Parameters

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

Miscellaneous Conversions

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

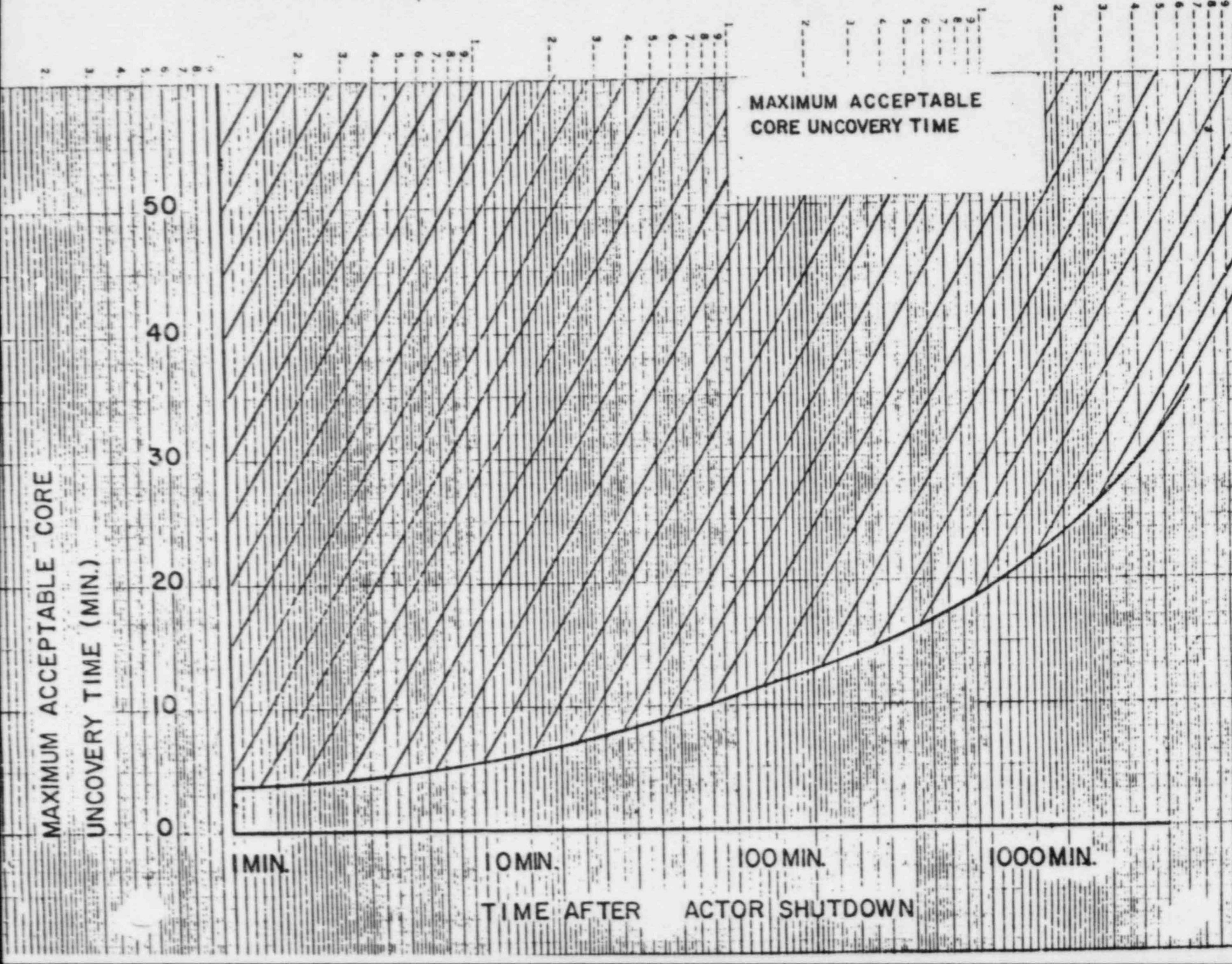


FIGURE 1

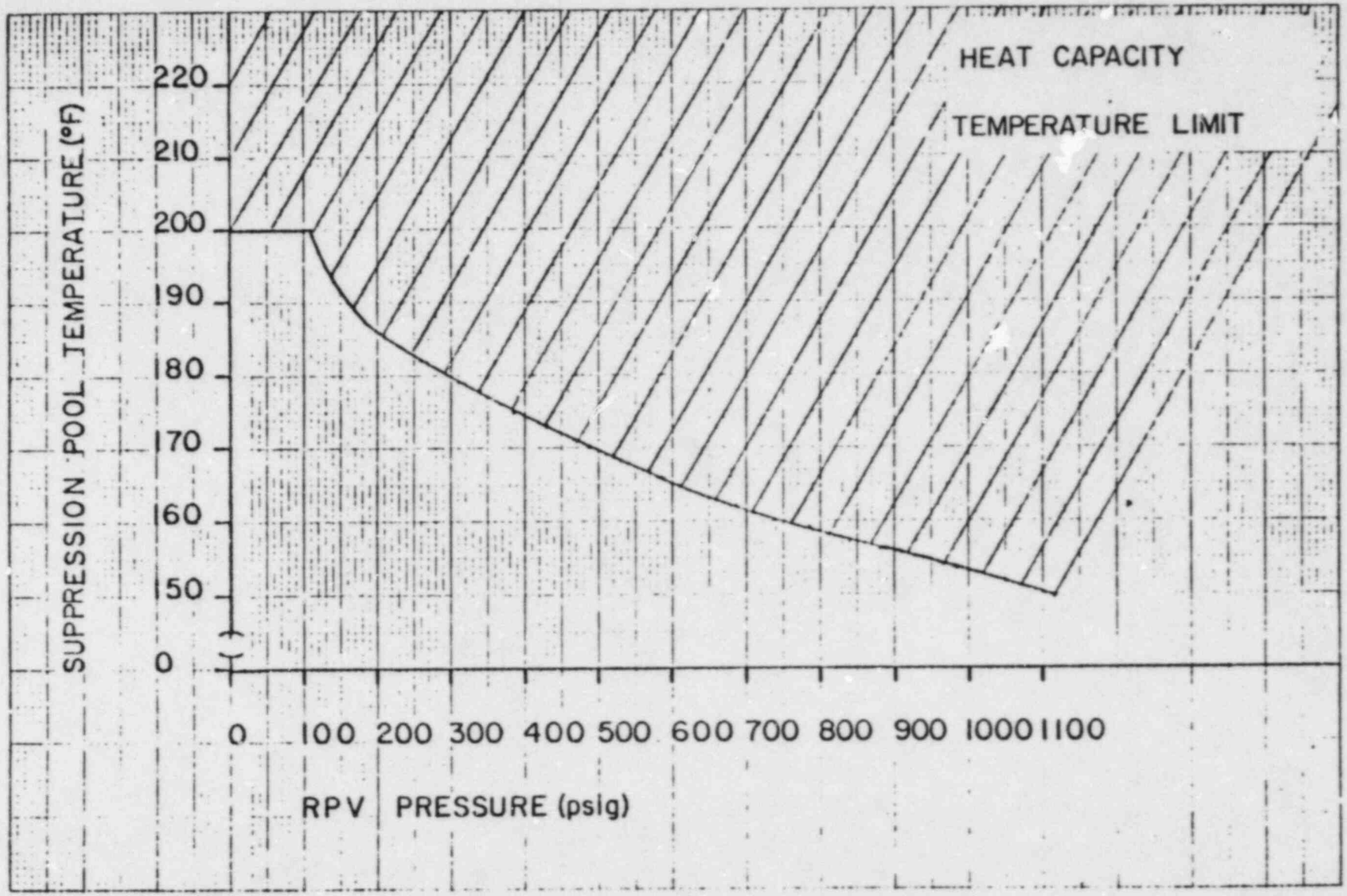

HEAT CAPACITY
TEMPERATURE LIMIT
SUPPRESSION POOL TEMPERATURE (°F)
220
210
200
190
180
170
160
150
0
0 100 200 300 400 500 600 700 800 900 1000 1100
RPV PRESSURE (psig)

FIG 1

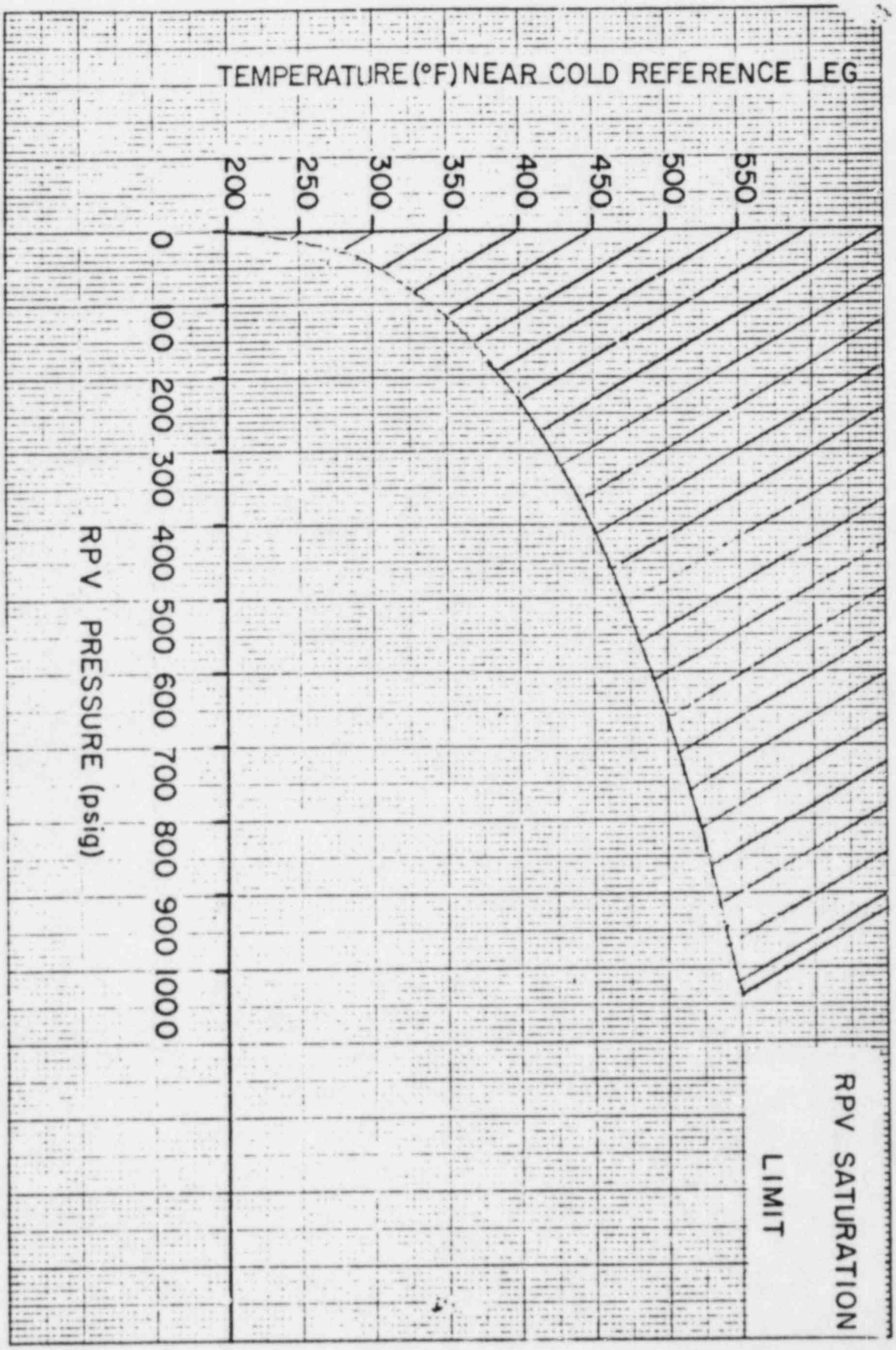

TEMPERATURE (°F) NEAR COLD REFERENCE LEG
200
250
300
350
400
450
500
550
0
100
200
300
400
500
600
700
800
900
1000
RPV PRESSURE (psig)
RPV SATURATION LIMIT

FIG 2

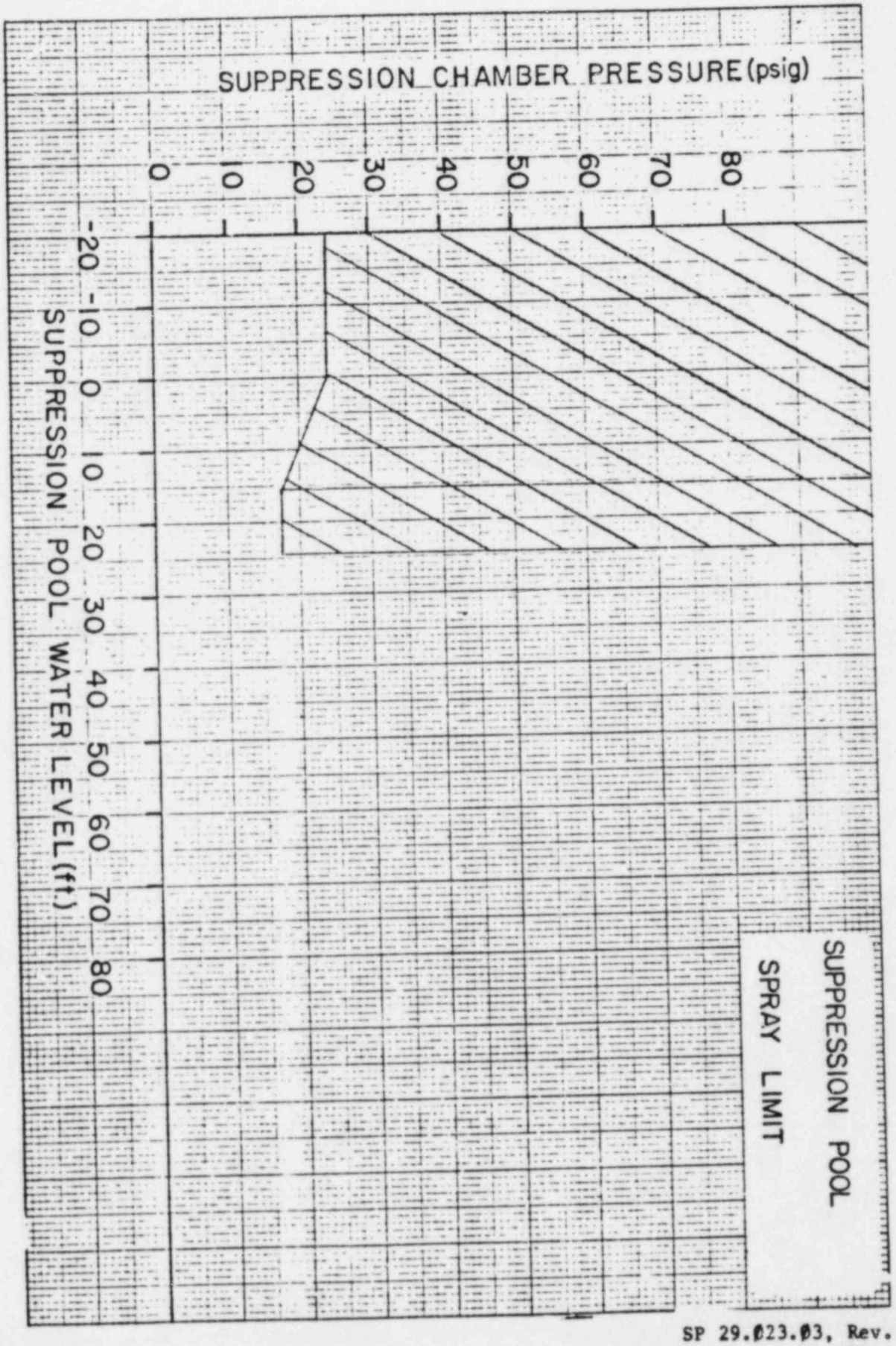

SUPPRESSION CHAMBER PRESSURE (psig)
0
10
20
30
40
50
60
70
80
SUPPRESSION POOL WATER LEVEL (ft.)
-20
-10
0
10
20
30
40
50
60
70
80
SUPPRESSION POOL
SPRAY LIMIT

FIG 3

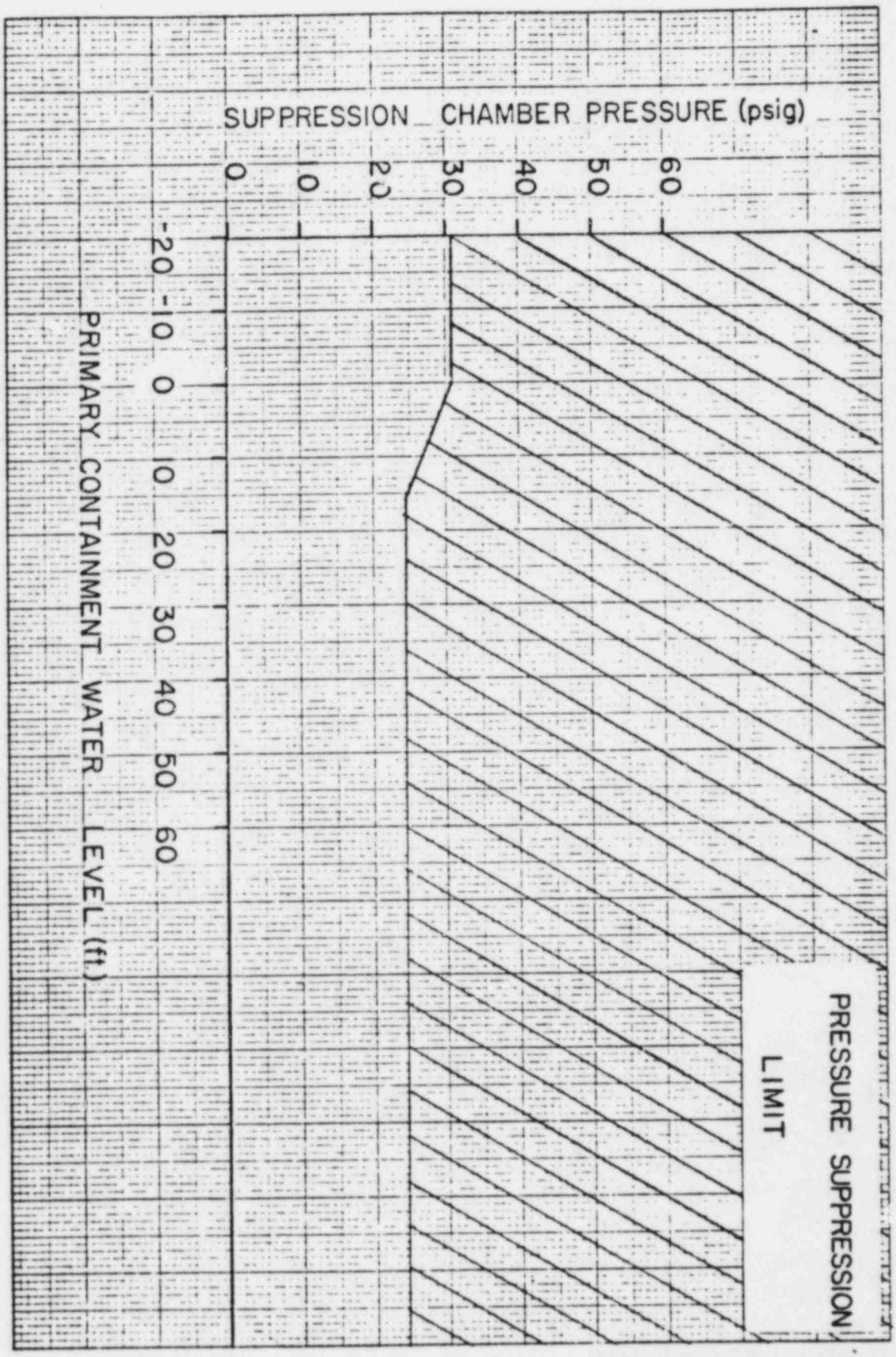

SUPPRESSION CHAMBER PRESSURE (psig)
0
10
20
30
40
50
60
-20
-10
0
10
20
30
40
50
60
PRIMARY CONTAINMENT WATER LEVEL (ft)
PRESSURE SUPPRESSION
LIMIT

FIG 4

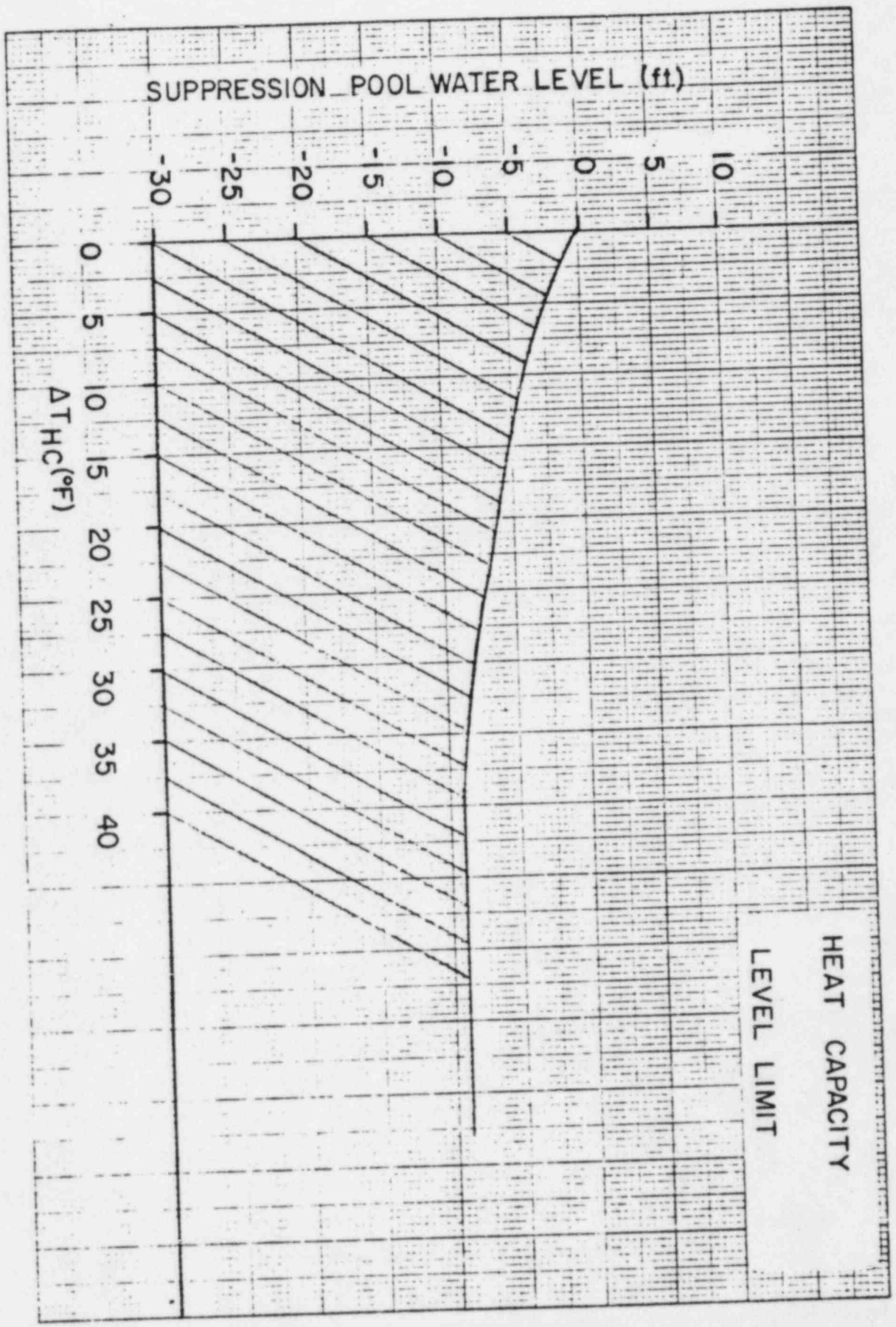

SUPPRESSION POOL WATER LEVEL (ft)
-30
-25
-20
-15
-10
-5
0
5
10
0
5
10
15
20
25
30
35
40
ΔT HC (°F)
HEAT CAPACITY
LEVEL LIMIT

FIG 5

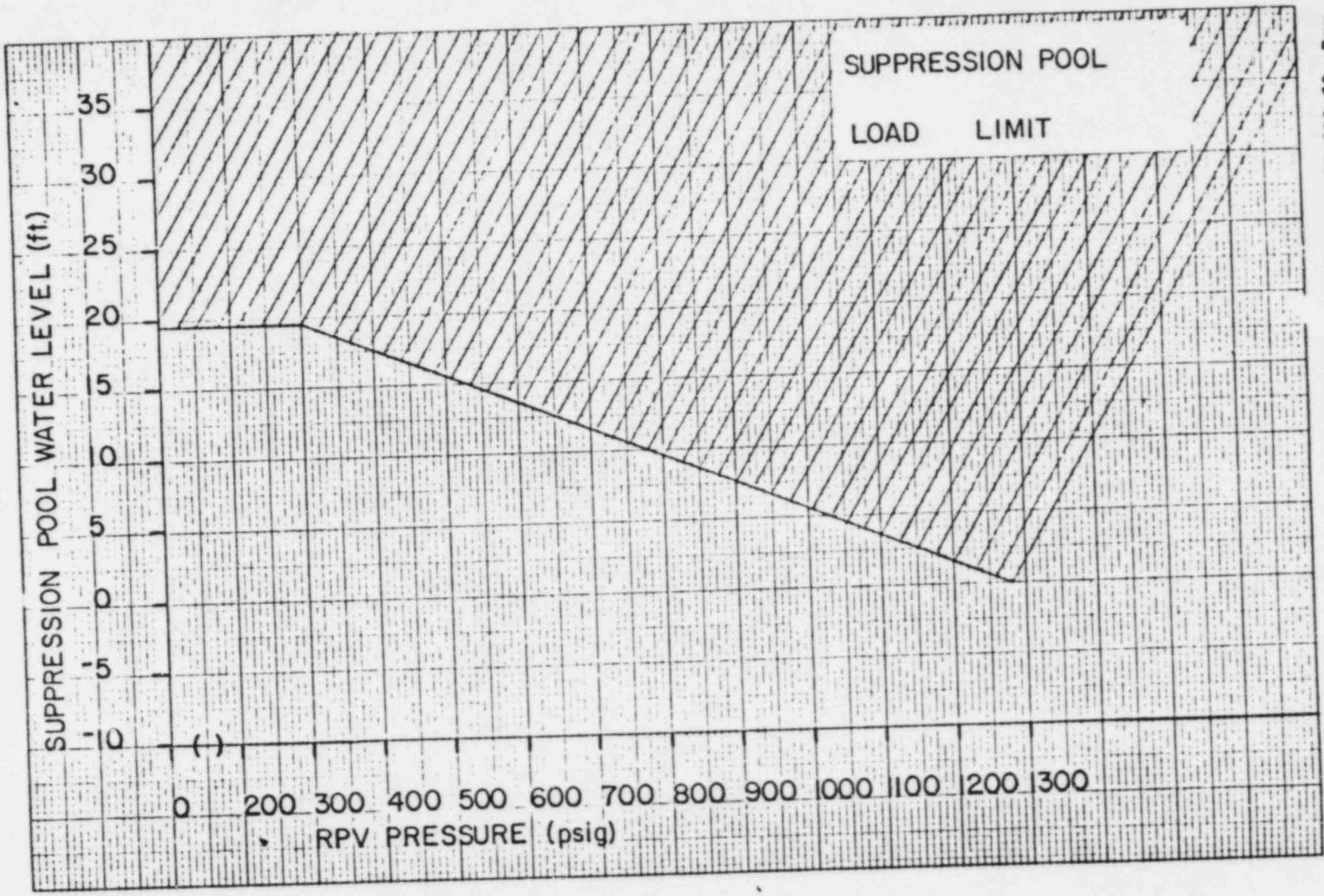


FIG 6

MASTER ANSWER Key.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 5.01 (2.50)

a. Local power will increase Average reactor power will decrease. (1.00)
b. This occurs because the negative reactivity added to the core due to increased boiling deeper in the core overcomes the positive reactivity added due to rod withdrawal. (1.50)

REFERENCE
SNPS Reactor Physics Module pg. 7-201

ANSWER 5.02 (3.00)

(a) It decreases.
As power increases, more extraction steam is available for feedwater heating (1.00)
(b) Increased subcooling will result in more power generation at the bottom of the core.
Becase of temperature coefficient of reactivity. (1.00)
(c) An increase in subcooling will require additional core heat to support a given electrical output. Decrease suocooling leads to increased efficiency. (1.00)

REFERENCE
SNPS Heat Transfer/ Thermodynamics Module.

ANSWER 5.03 (2.25)

(a) (1) Feedwater (2) CRD return (3) Cleanup return (4) Reactor (5) Recirc pump heat (1.25)
(b) (1) Steam (2) Cleanup system out (3) Losses to ambient (fixed heat losses) (1.00)
REF: LP Thermal & hydraluic Design pg 24-25

CHK ref. for energy input ⟶ (Ref. To current L.P.)

ANSWERS -- SHOREHAM -85/09/17-LANCE, D.

ANSWER 5.04 (3.00)

a. Using stable period equation T = lambda delta K/K
60 = (0.1)(delta K)
delta K = 8 x 10 -4 delta K/K (1.5)
NOTE: Req. to use EOL valve of Beta for full credit.
b. Following the scram delayed neutrons will continue to be produced by the longer lived precursors. The last remaining source will have a 55.6 second half life. Period is 1.44 times or 0.693 divided into the doubling time or half life.
Upsilon = 55.6 seconds/-0.693 = -80 seconds (Calculation not req. for full credit) (1.5)

REFERENCE
SNPS Reactor Physics Module.

ANSWER 5.05 (1.50)

a. Rod worth increases as moderator temperature increases. (0.50)
b. As void content increases rod worth decreases. (0.5)
c. The worth of a control rod is a direct function of thermal neutron flux to which it is expose so as flux increases, worth increases. (0.5)

REFERENCE
SNPS Reactor Physics, Ch. 10 & 13.

ANSWER 5.06 (2.25)

(a) NO safety limits or thermal limits violated.
(b) YES- the safety limit covering Thermal Power for Low Pressure has been violated. Steam dome pressure should not be less than 785 psig.
(c) YES- the thermal limit for LHGR has been violated. The LHGR LCO is violated somewhere in the core if CMFLPD is greater than 1.0.
(0.75 ea)

REFERENCE
SNPS Thermal Based Limitations Module, pages 10-36, 10-35, 10-44.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 5.07 (2.00)

a. Increase
b. Decrease
c. Decrease

(0.66 each)

REFERENCE
SNPS Fluid Mechanics and Reactor Physics Modules ✓

ANSWER 5.08 (2.50)

70 hours (1.0)
It will take approx. 70 hours for the Xenon to peak and then decay after the scram. If the positive reactivity inserted by the decay of Xenon is less than the shutdown reactivity due to rods, then the reactor will remain subcritical. (1.50)

REFERENCE
Reactor Theory - Xenon Transients

ANSWER 5.09 (3.00)

a. Increase. (0.25) Due to the void collapse when power decreases, causing less two phase flow & less flow resistance. (0.50)
b. Increase. (0.25) The charging water head decreases due to the recharging of the scram accumulators. (0.50)
c. Increases. (0.25) When the drive is in motion the cooling water flow is closed off by the ball check valve. (0.50)
d. Decreases. (0.25) Steam velocity decreases due to the scram, therefor the fluid head (pressure) losses are lower. (0.50)

REFERENCE
Fluid Flow and CRD System

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 5.10 (3.00)

a. Farther from cavitation (0.5). As the reactor water level increases, the static head of water component in the NPSH determination is also increasing which adds NPSH. (0.5)
b. Farther from cavitation (0.5). If a feedwater heater is lost, then the temperature of the water entering the reactor is lower, which brings the water farther from the saturation temperature. (0.5)
c. Closer to cavitation (0.5). As pump speed increases, the pressure in the eye of the impeller decreases, which will cause the pump to cavitate earlier with the same NPSH. (0.5)

REFERENCE
Thermodynamics

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 6.01 (2.50)

(a) (1) Loss of normal 480 V power supply
"The operator would consider a loss of pwr to be a rectifier failure." (0.50)
(2) Rectifier fails (0.50)
(b) (1) In event of inverter failure - lo inverter output (2) Manual push button depressed - "Alt. Source to Load" (1.00)
(c) It is in the system to permit maintenance work to be performed on UPS. (0.50)

REF: L.P. #313, pg 5, 8, 10, Fig. 1

ANSWER 6.02 (2.50)

(a) (1) Protects against a breach in MSL containment (2) Concern is release of radioactive material excessive loss of coolant (3) Setpoint is high enough above normal expected during operation to prevent spurious isolation, low enough to provide early indication of a break. (1.25)
185 degrees fahrenheit Shoreham also monitors main steam tunnel high delta T = 50 degrees fahrenheit
(b) (1) Protects against potential breach in nuclear primary pressure boundary (2) Concern is continued inventory loss core overheating radioactive materials release (3) Setpoint is low enough to allow heat removal for a predetermined time following a scram, and high enough to provide ECCS in event of a large leak -38" wide range (1.25)
REF: LP #650 Appendix I

ANSWER 6.03 (2.50)

(a) 17 in A, C, & E (RPS A) 14 in B, D, & F (RPS B) (0.50)
(b) (1) Select a control rod & observe 4 rod display (2) Select at back panel (3) Obtain a computer run (4) Run a TIP trace (5) Quadraul Symmetry (3 at .25 each)
(c) 11 min/channel. If < 11, get INOP 2 min/level. (0.50)
Administratively controlled (0.50)

REFERENCE
SNPS. LP #603 & 604.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 6.04 (2.50)

(a) (1) Reference APRM indicating < 30%. (0.50)
(2) Edge rod selected (0.50)
(1) If average core power is < 30%, local power conditions which could lead to fuel damage from single rod withdrawal cannot be achieved.
(2) At the edge of the core, local fuel thermal limits cannot be exceeded by rod withdrawal.
(b) 50% of expected inputs

REFERENCE
SNPS LP # 606, pg 1-16.

ANSWER 6.05 (2.50)

(a) (1) RBCLCW cools the seals, then goes to the RBCLCW Hx (.375)
(2) CRD provides seal purge and then leaks past the breakdown bushing into the Rx, or goes to the DWEDS (.375)
(b) 3-5 gpm of CRD water/pump
0.75 gpm is seal staging (0.50)
Seal #1 cavity pressure = 1000 psig Rx pressure
Seal #2 cavity pressure = 500 psig r 1/2 of #1 (0.50)
(c) (1) Pressures in both cavities would be at Rx pressure (.375)
(2) Flow rate would increase over design flow rate, and the 'Recirc Pump Seal Staging Flow Hi/Lo' would annunciate (at 0.9 gpm. (.375)

REFERENCE
SNPS LP-120 (Recirc.)
LP-118 (RBCLCW)
SNPS 120.01.1288, alarm response procedure.

ANSWER 6.06 (2.00)

Loop fill presure of approx. (40 psig) can be seen on 1E21-FI-001A, and B for the CSS on panel -601. (1.00), and by observing that annunciators, Line Fill Pump A/B discharge Low Pressure (1116) and Line Fill Pump A/B Flow High (1117) are not illuminated. (1.00)

REFERENCE
SP- 23.121.01 rev. 10 pg #3, precaution 4.2.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 6.07 (2.50)

The RHRS will automatically allign itself to the LPCI injection mode except the pumps will not start due to no suction path open from the suppression pool. (0.50). The Operator must close (MOV's 032 A-D) shutdown cooling suction, (0.75) , open MOV's 031 A-D upon which the pumps will automatically start, (0.75) and reset the SDC isolation logic for MOV-037 A/B by depressing the reset switch . (0.50)

REFERENCE
SP-23.121.01, pg.# 10 &11. Operation of RHRS in SDC.

ANSWER 6.08 (2.50)

a. RBCLCW splits on a LOCA signal (0.33), and on LO-LO Head Tank level(.33) and RX. Low level - 132.5. (0.33)
b. 1. RBCLCW pumps continue to run.
2. Non-safety related loops are isolated.
3. HX, that is out of service is put into service
4. Both RBCLCW outlet valves and service water valves auto open.
5. MG set cooler circ. pumps are isolated and trip on lo-suction.
6. PCV is isolated.
7. AOV check valves close.
8. HX outlet valves will open. (6 required at 0.25 each)

REFERENCE
RBCLCW lesson plan. # 118.

ANSWER 6.09 (1.~~50~~)

a. If the ~~bellows~~ has failed the self actuation (safety mode) is lost but relief mode is still operable. (1.0)
~~b. Bellows failure is indicated by an alarm (CAF) (0.5)~~

REFERENCE
SNPS. LP-116.
ADS - 201, handout

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 6.10 (2.00)

Scrams uneffected by mode switch.
1. Low Rx water level (.33) 2. High Rx pressure (.33) 3. High D.W. pressure (.33) 4. Main steam line high radiation (.33) 5. APRM flow biased HI (.33) 6. APRM INOP (.33)

REFERENCE
SNPS- LP # 611.

ANSWER 6.11 (2.00)

a. Reactor scram prior to reset. (0.25)
Off-normal indications, with explaination ;
1. Pump amps high due to high flow to SDV.
2. Pilot air header low alarm due to scram pilot valves deenergized
3. CRD sys flow is high due to high flow to SDV
4. Flow control valve closed due to high sys flow
5. CRD drive water D/P low due to flow control valve closed
6. CRD cooling water D/P low due to flow control valve closed
7. CRD cooling water flow low due to low colling flow.
(4 reqd @ 0.5 es)

REFERENCE
SNPS LP 106

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 7.01 (2.25)

(1) Opening the vacuum breakers imposes excessive loads on the turbine last stage buckets. (1.00)
(2) Vacuum shall not be broken until the unit shaft rotation has decreased to 1200 RPM. (It is in the procedure to be after reaching cold S/D (8.1.3.8).) (1.25)

REFERENCE
SNPS- SP-22.005.01. 8.1.9.7 & 8.1.3.8.

ANSWER 7.02 (2.50)

(a) 1. Verify the alarm on the Off-Gas radiation monitor recorder. (0.50)
2. Reduce reactor power to clear the alarm. (0.50)
(b) Whenever the HI-HI setpoint is reached in any of the following ;

1. Main Steam Line Radiation Monitor Recorder 2. Off-Gas Log Radiation Monitor Recorder (SJAE Outlet Rad Mon) 3. Off-Gas Vent Pipe Radiation monitor Recorder (Charcoal Ben Outlet or Off-Gas Outlet Rad Monitor) (0.50 each) HL.631 Annunciator To be graded.

REFERENCE
SNPS. SP- 29.002.01

ANSWER 7.03 (3.00)

a) The three conditions are any of the following
1. RPV water level less than 12.5" (0.66)
2. D/W pressure > 1.69 psig. (0.66)
3. An isolation condition exists which requires or initiates a Rx scram. (0.66)

REF: Proc #29.023.01

(b) Enter from 29.023.01 or 29.023.02 when (level control) (cooldown)
1. Level cannot be maintained above TAF = -158 on fuel zone. (0.50)
2. Level cannot be determined. (0.50)

Not required.
Check SP 29.023.04

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 7.04 (3.00)

a) Approval by
1. member of Plant Management Staff (PMS) 2. licensed SRO via signatures on the form.

not necessary → Verbal approval of PMS is OK if directly given to the SRO signing the TPC [and such is indicated on the TCP form.] - ng (2.00)

(b) 31 days - unless approved for permanent change. (0.50)
ROC review required within 14 days. (0.50)

REFERENCE
GP-12.006.01, pg# 9 & 10.

ANSWER 7.05 (2.00)

NO. (0.50)
The reactor must be scrammed after the second accumulator light is lit. (0.75)

At greater than 600 psig reactor pressure is suficcent to insert rods without accumulator pressure. (0.75) → Combile alt. are being graded

REFERENCE
GP-23.106.01, rev.8, pg# 15-16.

ANSWER 7.06 (2.25)

1. (0467 (8) Supp. Pool DIV. 1 (2) Instm. Temp. High. (0.75)
2. Supp. Pool temp. indicator, PNL-602. (0.75)
3. Temperature recorders on back panel. (0.75)

REFERENCE
SP. 23.204.01 (LPCI), Control Room Instrumentation, Alarm's.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 7.07 (2.00)

a. Above the curve. (0.~~75~~ .50)

b.(1)Temperature near the cold reference leg instrument vertical runs exceeds the RPV saturation limit and indicated RPV level is less than - 38. (0.~~75~~ .50)

(2) RPV water level cannot be determined. (0.~~75~~ .50)

(3) Suppression chamber pressure exceeding pressure suppression limit. (0.~~75~~ .50)

REFERENCE
SP-29.023.09

ANSWER 7.08 (2.00)

a.During operational condition 1-2-3, an individual, other than the STA, with a current SRO license. (1.00)

b. During operational condition 4-5, an individual with an RO or SRO current license. (1.00)

If candidate answers according to control room position, acceptable.

REFERENCE
SNPS- SP-21.004.01.

ANSWERS -- SHOREHAM -85/09/17-LANCE, D.

ANSWER 7.09 (3.00)

1. RCIC
2. HPCI
3. Main Turbine Bypass valves
4. Steam Jet Air Ejectors
5. RFPTs
6. Steam Seal Evaporator
7. Main Condenser Deaerating Syatem
8. RPV Head Vent
9. Main Steam Line Drains
10. RWCU Blowdown Mode
11. RHR Steam Condensing Mode

(ANY 6 @ .33 pts each)

b. This is in anticipation of the starting of the drywell sprays due to high temperature. [If spray occurs, you want to secure electrical equipment in containment to prevent damage to shorting out] (1.0)

REFERENCE
23.023.05 - Rapid RPV Depressurization Emergency Procedure

ANSWER 7.10 (3.00)

a. Suppression Pool Temperature > 90 degrees F
Drywell Temperature > 145 degrees F
Drywell Pressure > 1.69 psig
Suppression Pool Level > +6 inches
Suppression Pool Level < -6 inches (0.3 each)

c.1. NO (0.75)
c.2. NO (0.75)

REFERENCE

SP 29.023.03, pages 1 and 5

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 8.01 (2.00)

This flow adjustment factor increases the MCPR limit at core flows less than rated. Events such as loss of FW heating and turbine trip without bypass become less severe when initiated from power levels less than the design value. This is due to decreased steam flow. But events such as inadvertant start up of an idle recirc. pump, recirc. flow controller failure (increased flow) and FW flow controller failure (max) can become more severe than transients which are limiting at design conditions. Consider flow Control Failure (2.00)

Tech. spec bases only.

REFERENCE

SNPS - Thermal Limits, Student Module pg.10-22 .

ANSWER 8.02 (2.00)

PRIMARY CONTAINMENT INTEGRITY shall exist when:
a. All primary containment during accident conditions :
1. by an OPERABLE primary containment isolation system,
2. by at least one manual valve, blind flange, or deactivated automatic valve secured in its closed position, except as provided in Table(3.6.3-1\ of Specification, 3.6.3.
b. All primary containment are closed and sealed.
c. Each primary containment is in compliance with the requirements of to Specification 3.6.1.3. - both closed except when using - then one closed. Leakage rates within spec.
d. The primary containment are within the limits of Specification 3.6.1.2. - i.e. within spec.
e. The is in compliance with the requirements of Specification 3.6.2.1. - level, leakage, N2 seal
f. The ; e.g., welds, bellows or O-rings, is .
REF: T.S. pg 1-5

T.S. # not req. only dep. of P.C. integ.

ANSWER 8.03 (2.50)

a. TRUE
b. TRUE
c. TRUE
d. TRUE (0.50 each)
E.

REFERENCE
SF-12.001.01

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 8.04 (3.00)

SBLC would be initiated under following (3) conditions:
a. Either of the following two answers
1. The Rx is critical and/or power is increasing as indicated by neutron count rate or steam flow and the operator is unable to shutdown with control rods.
2. From ATWS procedure: If Rx power is above 6% or RPV level cannot be maintained above 12.5" or suppression pool temperature reaches 110 degrees fahrenheit. (1.0)
b. Criticality is predicted to occur within one hour based on cooldown and/or xenon decay. (1.0)
c. Hazard exits to plant personnel and the environment, and plant abandonment is required. (1.0)
REF: SNPS Lesson Plan #123 & SP 29.004.01

ANSWER 8.05 (3.00)

T.S. 3/4.7.10 requires that the turbine bypass system be operational when thermal power is greater than or equal to 25% of rated.
With the system INOP, and unrestorable within one hour, take the action required by T.S. 3.2.3
T.S. 3.2.3 requires MCPR to be determined to be greater than or equal to the MCPR limit as a function of average scram time as shown in Fig. 3-2.3-1 times the Kf shown in Fig 3.2.3-2
If these conditions are met, T.S. 3.0.4 is not applicable, and operation can continue.

REFERENCE
SNPS Technical Specifications 3/4.7.10 and 3.2.3

ANSWER 8.06 (2.00)

1. Outstanding LCO's
2. Temp. procd. log
3. Lifted lead log
4. MWR log
5. Outstanding RWP file (0.25 each)
6. SECF log
7. Night Orders
8. Watch Engineers log

REFERENCE
SF-21.002.01, rev. 10, pg.#6.

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 8.07 (3.00)

1. Maintenance in an area where radiation exposures are in excess of 5 mrem/hr
2. Entry into an area where radiation exposure rates are in excess of 100 mrem/hr
3. Entry into an airborne area
4. Entry into a contaminated area (500dpm/100 cms squared)
5. Work in an area with neutron dose rates greater than 2 mrem/hr
6. Where radiological conditions are unknown

[5 of 6 at 0.5 pts each]

REFERENCE

SP 12.012.01 'Radiation Work Permit'

ANSWER 8.08 (2.50)

Entry into an Operational Condition or other specified condition shall not be made unless the conditions for the LCO are met without reliance on provisions contained in the Action requirements. This provision shall not prevent passage through or to Operational Conditions as required to comply with Action requirements. Exceptions to these requirements are stated in the individual specifications.
The statement means that you can enter any operational condition with that LCO in an action statement status.

(2.50)

REFERENCE
Shoreham Technical Specifications

ANSWER 8.09 (3.00)

3 6-4.5

a. From fig 1 Thc=10 F, min level for Thc=10 from fig. 5 is -4 ft. (1.0)
b. To ensure the suppression chamber could absorb the energy released from the reactor and not exceed containment design values. (1.0)
c. Ensure motor driven pumps sufficient to maintain RPV water level are running and available for injection. (0.5)
d. Yes (0.5)

REFERENCE
SP 29.023.03. Containment Control

ANSWERS -- SHOREHAM -85/09/17-LANGE, D.

ANSWER 8.10 (2.00)

Must restore the inop bypass valve within 72 hrs or be shutdown in 12 hrs. Ref. TS 3.6.2.2 or 3.6.2.3. (2.0)

REFERENCE
TS 3.6.2.2 or 3

QUESTION	VALUE	REFERENCE
05.01	2.50	DJL0000404
05.02	3.00	DJL0000405
05.03	2.25	DJL0000407
05.04	3.00	DJL0000424
05.05	1.50	DJL0000425
05.06	2.25	DJL0000438
05.07	2.00	DJL0000439
05.08	2.50	DJL0000462
05.09	3.00	DJL0000463
05.10	3.00	DJL0000464
	25.00	
06.01	2.50	DJL0000408
06.02	2.50	DJL0000409
06.03	2.50	DJL0000410
06.04	2.50	DJL0000411
06.05	2.50	DJL0000413
06.06	2.00	DJL0000427
06.07	2.50	DJL0000428
06.08	2.50	DJL0000431
06.09	1.50	DJL0000459
06.10	2.00	DJL0000460
06.11	2.00	DJL0000473
	25.00	
07.01	2.25	DJL0000414
07.02	2.50	DJL0000415
07.03	3.00	DJL0000420
07.04	3.00	DJL0000423
07.05	2.00	DJL0000429
07.06	2.25	DJL0000430
07.07	2.00	DJL0000458
07.08	2.00	DJL0000465
07.09	3.00	DJL0000468
07.10	3.00	DJL0000470
	25.00	
08.01	2.00	DJL0000003
08.02	2.00	DJL0000421
08.03	2.50	DJL0000455
08.04	3.00	DJL0000457
08.05	3.00	DJL0000461
08.06	2.00	DJL0000466
08.07	3.00	DJL0000467
08.08	2.50	DJL0000469
08.09	3.00	DJL0000471
08.10	2.00	DJL0000472
	25.00	
	100.00	

Attachment 2

September 18, 1985 NTS-85-0239

Mr. David Lang
USNRC Region 1
631 Park Avenue
King of Prussia, PA 19406

Subject: NRC Reactor Operator Exam Comments (9/17/85)

Dear Mr. Lang:

Attached are our comments on the 9/17/85 NRC Reactor Operator Examination. Where necessary, we have included copies of applicable reference material to support our challenges on specific answers.

If you have any questions or comments, please contact me at (516) 929-6700.

Very truly yours,

Ken Rottkamp
Station Training Supervisor

KR/bw

Enc.

cc: NTS File
NOSF
SR2

September 18, 1985 NTS-85-0239

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USNRC Region 1
631 Park Avenue
King of Prussia, PA 19406

Subject: NRC Senior Reactor Operator Exam Comments (9/17/85)

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1.4 Change existing answer key: steam tables supplied to candidates: work may consist of finding SAT pressure and comparing with available pressure with no calculation required.

2.2 For part b) give full credit for either answer listed since exam question did not specifically ask for 2 answers.

2.6 a) Accept either answer, "limit p on internals" or "limit mass flow rate", as question did not ask for multiple reasons.

2.8 Rather than listing bus program, the candidates may list actual actions caused by the bus loading program.
Ref - Student Handout #309

3.5 b) Accept "loss of generator indications".

4.3 Accept precipitation and/or crystalization.

4.4 Add to answer key the following:

1. If solenoid actuated the SRV, red indicating light will be on.

2. Turbine control valves will close down.

3. Rx power will decrease and then return to its original valve.

4. A steady state level off-set from feedwater controller setpoint.
Ref ADS Student Handout HL-201 Rev 3 Page 17

4.8 a) Candidate may also give:

1. Low high volts.
2. Switch out of operate.
3. Module unplugged
and should not lose credit for these.

b) Also accept prior to going to startup with mode switch.

4.11 a) Add the following alternative answers:

1. Tech. Spec. recirc pump LCO requires both loops in operation.

2. As per Tech. Spec. bases for recirc LCO, there is no ECCS analysis for single recirc pump operation.

b) Question is confusing to candidate as there is no requirement to maintain any temperatures within five degrees of each other, during S/U as per SP 22.001.01 Rev 11. SP 22.000.01 Rev 11 does require temperatures to be logged on SPF 22.001.01-3 during startup. Therefore, any three temperatures listed on the SPF should be acceptable for full credit.

5.3 Delete answer "Reactor" from answer key. Heat balance is done to solve for reactor power and therefore is not generally considered an energy input.

5.7 For Part B - either remain the same or decrease should be acceptable for full credit due to the fact that at the bottom of the core diffusion length will decrease however at the top of the core little if any effect will be seen.

6.10 Add to answer key the scram discharge volume high level scram, Main Turbine Stop Valve closure, Main Turbine Control Valve fast closure, APRM fixed flux and IRM hi hi because these are not bypassed by the mode switch position alone.

7.3 Delete part 'B' completely. This procedure is entered from either Level Control or Cooldown Emergency Procedures and should not be entered directly. Entering Level Restoration directly could result in bypassing important steps in the previously mentioned Emergency Procedures.

8.4 At SNPS six (6) conditions require the use of SBLC, any three (3) of these six should be acceptable. Three are contained as symptoms of SP 29.004.01-2 and the remaining three are contained in SP 29.024.01-4 Step 3.6.

8.8 When grading question, please take into account the fact that the question can be interpreted as either:

1) What does 3.0.4 mean?

or

2) What does "3.0.4 not applicable" mean?

Depending upon the interpretation the candidate took, the answer to 1) above should be, "The statement means that you can not enter any operational condition with that LCO in an action statements status", the answer to 2) above should be, "The statement means that you can enter any operational condition with that LCO in an action statement status." In addition the definition of 3.0.4 should not be required since the question did not ask for it.

ATTACHMENT 4

The following represents the NRC resolution to those comments made by the facility as a result of the current exam review policy.

Only those comments resulting in significant changes to the master answer key, or were "not accepted" by the NRC, are listed and explained below. Comments made that were insignificant in nature and resolved to the satisfaction of both the examiner and the licensee during the post exam review are not listed. i.e.: typo errors, relative acceptable terms, minor set point changes.

1.4 Not Accepted. If candidate arrives at correct answer, he/she will have to validate. All calculations will be graded.

2.2 Not Accepted Two correct answers required for full credit.

2.6 (a) Not Accepted Question specifically asked for 1) the design function and 2) how it achieves its function. Both parts needed for full credit.

2.8 Accepted Only if candidate answers correct actual actions caused by bus prog.

3.5 (b) Not Accepted Alternate answers considered during grading only in addition to correct answers.

4.3 Accepted And/or crystallization graded.

4.4 Not Accepted Alternate answers considered for partial credit during grading.

4.8 Accepted Candidate will not lose credit for these answers, only in addition to correct answer.

4.11 (a) Not Accepted Will consider Technical Specification requirement for partial credit.

(b) Not Accepted Question was not confusingly worded. Question specifically asked for three locations where temperature must be maintained. Answer Key remains as is.

5.3 Not Accepted Question asked for inputs and outputs. Heat generated from the reactor must be considered.

5.7 (b) Not Accepted Decrease is the correct answer.

6.10 Not Accepted Question asked, "regardless of mode switch position", not regardless of mode switch position alone".

7.3 Not Accepted The NRC realizes the concern of bypassing procedural steps in previous procedures. Question asked for procedural conditions, and answer is correct as stated.

8.4 Accepted Candidate will be required to state the symptoms and the procedure they are addressing.

8.8 Not Accepted Question explicitly asked, "What is the meaning of specification 3.04, and What does NOT applicable mean in various LCO's." The definitions (word for word) was not asked for, only the meaning of it.