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

EXAMINATION REPORT NO. 50-334/86-16(OL)

FACILITY DOCKET NO. 50-334

FACILITY LICENSE NO. DPR-66

LICENSEE: Duquesne Light Company
Post Office Box 4
Shippingport, Pennsylvania 15077

FACILITY: Beaver Valley Unit 1

EXAMINATION DATES: July 22-31, 1986

CHIEF EXAMINER: [signature] 9/3/86
G. S. Barber, Reactor Engineer (Examiner) Date

REVIEWED BY: [signature] 9/3/86
R. M. Keller, Chief, Projects Section 1C Date

APPROVED BY: [signature] 9/15/86
Harry B. Kister, Chief Date
Projects Branch No. 1

SUMMARY: Oral, written and simulator examinations were administered to twelve reactor operator and three senior reactor operator and one senior reactor operator retake candidate. In addition, just the oral and simulator portion was administered to one senior reactor operator retake candidate. Seven reactor operators passed all portions of their examinations and will be issued licenses. Both senior reactor operator retake candidates passed all required portions of their exams and will be issued licenses. Of the three remaining senior reactor operator candidates, one passed all portions of the exam and will be issued a license. The specific details of the candidates that failed all or portions of their exam can be found in the examination results table on the following page.

REPORT DETAILS

TYPE OF EXAMS: Initial ___ Replacement _X_ Requalification ___

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	10 / 2	4 / 1
Oral Exam	11 / 1	5 / 0
Simulator Exam	9 / 3	3 / 2
Overall	7 / 5	3 / 2

I. CHIEF EXAMINER AT SITE: G. S. Barber, NRC

II. OTHER EXAMINERS: R. M. Keller, NRC
N. F. Dudley, NRC
B. S. Norris, NRC
D. M. Silk, NRC
B. Gruel, PNL
L. Defferding, PNL

III. Generic observations and weaknesses noted during the operating exams:

1. Candidates became preoccupied with hanging caution tags and OOS stickers while instrument malfunctions and casualties were still in progress. Attention to these administrative requirements is commendable, however, timing in the cases noted was improper.

2. Nonpermanent marker pen was used to list diesel trips, AFW start signals and other oral examination answers on panels, components and switchgear throughout the plant. If these operator aids are needed, they should be replaced with permanent tags or labels.

3. The control room key cabinet was improperly locked. It could be opened by turning the combination lock approximately one-quarter turn. Three instances were observed where Maintenance and Radiological Controls personnel took keys without an operations supervisor's approval. The follow-up on this issue was turned over to the senior resident inspector and will be discussed in Inspection Report 86-18.

4. Some ROs could not do a manual RCS subcooling calculation.

5. An examiner observed three plant personnel in the Spent Fuel Pool Area without proper anti-contamination clothing.

6. Some ROs could not explain the functions and principles of operation of the incore instrumentation system.

7. An SRO could not verify the accuracy of a manual calculation for an unplanned release. The unplanned release was due to a steam generator tube rupture with a stuck open atmospheric dump valve.

8. Candidates frequently reported proper SIS, CIA and CIB valve and pump alignment prior to checking or verifying the actual indication.

IV. Simulator Deficiencies noted during the Operating Examinations:

1. During a scenario, the RO identified that annunciators were alarming and resetting without a horn. When he attempted to acknowledge and test the alarm, the simulator froze. In a subsequent scenario, the manual tap changers failed to operate and the Building Services Panel Alarms could not be acknowledged. The simulator instructors attributed these deficiencies to an electrical storm that occurred the previous night and to the lack of surge suppressors for the simulator's power supply.

2. There were instances during scenarios where the turbine driven AFW pump did not start even with the proper valve alignment.

3. Candidates were distracted by erroneous electrical spikes in the megawatt, steam flow and feed flow recorders.

4. Instructors stated that the BOL snapshots were not as accurate as the MOL snapshots.

5. The operators normally have the source range fuses removed when operating in Mode 1. There is no administrative or procedural basis for this action.

6. Changing the lineup of the Boron Recovery System sometimes resulted in isolating CCR to the Reactor Coolant Pumps. The normal flow (48 gpm) is very close to the trip setpoint (50 gpm).

7. AFW pump flow was 350 gpm with the normal supply tank empty and suction valves from river water closed.

V. Generic weaknesses noted from grading of written exams:

A. RO candidates were unable to adequately explain the following:

1. The effect of starting a RCP or bypassing a string of feedwater heaters on actual critical rod position during reactor startup.

2. The effect of interstitial fission gas absorption on fuel centerline temperature.

3. What determines differential pressure across the #1 seal of a RCP.

4. The purpose of opening the turbine driven AFW pumps recirculation valve.

5. The automatic actions associated with the Containment Purge Exhaust Monitor during Refueling.

6. Immediate action substeps for E-0, Reactor Trip/SI. For example, the actions required to verify AFW flow.

7. FRGs may be entered from other than red path conditions. For example, FR-H.1 is required to be entered from E-0 when flow is less than 350 gpm.

8. Conditions that cause high activity in the RCS per AOP-43, High Reactor Coolant Activity.

B. SRO candidates were unable to adequately explain the following:

1. The design features that protect the CCR system in the event of a leak in the thermal barrier.

2. The advantages and disadvantages of using alternate dilute.

3. Reasons for closing the MSIVs on a steam line rupture.

4. System parameters checked that verify that inadequate core cooling no longer exists.

5. When pressurizer venting should take priority over containment hydrogen limits.

6. Given the RCS leakage T.S., determine if leakage limits are exceeded for a given set of plant conditions.

VI. Training/Reference Material:

1. The training material was improved from the previous examination. However, there were several instances where the material was incorrect or inadequate. (See Attachment 4)

VII. Personnel Present at the Exit Interview:

NRC Personnel

G. S. Barber, Reactor Engineer (Examiner)
B. S. Norris, Reactor Engineer (Examiner)
D. M. Silk, Reactor Engineer (Examiner)
W. Troskoski, Senior Resident Inspector
T. J. Kenny, Senior Resident Inspector
A. J. Lodewyk, Reactor Engineer

Facility Personnel

T. D. Jones, General Manager - Nuclear Operations
W. S. Lacey, Plant Manager, BV-1
J. D. Sieber, Senior Manager, BV-1
L. G. Schad, Coordinator, Simulator Training
A. J. Lindgren, Simulator Supervisor
T. E. Kuhar, Nuclear Operations Instructor
A. Nowinowski, Westinghouse Training
P. A. Russell, Nuclear Operations Instructor

VIII. Summary of NRC Comments made at exit interview:

The chief examiner reviewed the number and type of examinations administered during the previous two weeks and presented generic weaknesses observed during the simulator and oral examinations.

IX. Examination Review:

An examination review was conducted. Facility comments were discussed on a line item basis. All items were considered during grading but not all items resulted in a change to the master exam. Attachment 3 details the Facility's Comments on the written exam. Attachment 4 details the significant changes to the examinations.

Attachments:

1. Written Examination and Answer Key (RO)
2. Written Examination and Answer Key (SRO)
3. Facility Comments on the Written Examination
4. NRC Response to Facility Comments

Attachment 1
MASTER

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

FACILITY: BEAVER VALLEY 1&2

REACTOR TYPE: PWR-WEC3

DATE ADMINISTERED: 86/07/22

EXAMINER: SILK, D.

APPLICANT: Answer Key

INSTRUCTIONS TO APPLICANT:

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

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00	________	________	5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00	________	________	6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00	________	________	7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00	________	________	8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00	100.00	________	________	TOTALS

FINAL GRADE ________________%

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

____
APPLICANT'S SIGNATURE

QUESTION 5.01 (3.00)

a. Would the positioning of a neutron source TOO CLOSE to the neutron detector, being used for constructing a 1/M plot, result in OVERPREDICTING (not conservative) or UNDERPREDICTING (conservative) the reactivity addition needed to reach criticality? EXPLAIN. (1.0)

b. How does the initial source range level (cps) affect critical rod position? EXPLAIN. (1.0)

c. How does the positive reactivity insertion rate affect the source range count level at which criticality is achieved? EXPLAIN. (1.0)

QUESTION 5.02 (3.50)

a. Explain both HOW AND WHY the following factors affect differential boron worth (more negative, less negative or no change).

1. Boron concentration increase (0.75)
2. Moderator temperature decrease (0.75)
3. Fission product buildup (0.75)
4. Core burnup from MOL to EOL with constant rod position (0.75)

b. Why does the critical boron concentration drop rapidly from 0 to 150 MWD/MTU of burnup as seen in Figure 1? (0.5)

QUESTION 5.03 (3.00)

a. How does DNBR change (increase, decrease, no change) as the following are increased? (Consider each separately). (1.0)

1. Tavg
2. RCS pressure
3. RCS flow
4. Reactor power (Constant Tavg)

b. What adverse fuel assembly condition could result if actual heat flux exceeds the critical heat flux in a PWR core? Explain. (1.0)

c. From Figure 2, what parameter is being limited on Section A of the figure and what is the significance of it? (1.0)

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

QUESTION 5.04 (2.00)

After operation at 100% power for several weeks near the end of cycle, power is reduced to 75% using rods only.

a. Explain HOW and WHY Xenon concentration will change over the next 40 hours. (1.5)

b. What rod motion would be required to maintain the plant at 75% power over the same 40 hours assuming no change in boron concentration? Include applicable time frames. (0.5)

QUESTION 5.05 (1.50)

a. Does Beta bar effective increase, decrease, or remain the same from BOL to EOL? Explain your answer. (1.0)

b. For two equivalent positive reactivity additions to a critical reactor, will the SUR be the same, larger, or smaller at EOL as compared to BOL? No explanation is necessary. (0.5)

QUESTION 5.06 (2.50)

a. To increase the discharge head of a variable speed centrifugal hydro-pump from 1200 to 1800 psia by what factors should the speed and power inputs be increased? Show your calculations. (1.5)

b. What pressure is needed at the suction of a feed pump to provide 215 feet of NPSH if the water is at 384 F? (1.0)

QUESTION 5.07 (2.00)

When would a rod be worth more - if it were dropped while at power or if it were stuck out while all other rods were inserted? EXPLAIN.

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

QUESTION 5.08 (2.00)

With all systems in manual and no operator action, what effect (increase, decrease, no change) will decreasing the circulating water temperature have on the following?

a. Condenser vacuum
b. Condensate temperature
c. Steam generator pressure
d. Electrical output
e. Reactor power

QUESTION 5.09 (2.50)

a. What effect does increasing moderator temperature have on control rod worth? Explain. (1.0)

b. What is the effect of a dropped rod on long term reactor power and Tave? Explain. Assume all systems in manual and no reactor trip occurs. (1.5)

QUESTION 5.10 (3.00)

The reactor is at 70% power and Tave is 568 F. A governor valve failure raises load 15%.

a. From a reactivity standpoint, explain how and why reactor power responds. Assume rods in manual. (1.5)

b. Using Figure 3, calculate the new Tave if rods are in automatic. Show all work and state all assumptions. (1.5)

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

QUESTION 6.01 (2.00)

a. Why is the loss of compensating voltage more noticeable during a startup than at 100% power? (0.5)

b. At 100% power the N44-B Power Range Detector fails high. With rods in manual, give five annunciators associated with the NIS that alarm. (1.5)

QUESTION 6.02 (2.50)

Delete 6.02a

a. What is the major advantage of drawing an RCS activity sample from the letdown line instead of directly from the RCS? (0.4)

b. Besides the Condenser Air Ejector Radiation Monitor, list four radiation monitor alarms that may be indicative of a primary to secondary leak? (1.6)

c. What automatically happens when a high-high alarm from the Condenser Air Ejector Radiation Monitor occurs? (0.5)

QUESTION 6.03 (2.20)

a. How would an operator determine the location of a 10 GPM leak from the component cooling water system by using the indications available to him in the main control room? (0.7)

b. What three design features of the component cooling water system minimize the effects of a rupture of the RCP thermal barrier? (1.5)

QUESTION 6.04 (2.00)

a. What is the reason for maintaining a minimum pressure of 15 psig in the volume control tank? (0.5)

b. Normal operations has the '1C' charging pump breakers 1E15 and 1F15 disconnected from the bus. What prevents tying both emergency busses together? (0.5)

c. When is the Alternate Dilute mode used and what disadvantage accompanies its use? (1.0)

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

Delete 6.05

QUESTION 6.05 (2.00)

The plant is operating at 30% power when the controlling first stage impulse pressure transmitter PT 446 fails HIGH. Explain the effects of this failure and the sequence of events (control and protection) that lead to a reactor trip. Assume BOL, no operator action and initial plant conditions are in a normal system line-up for 30% power. (Setpoints are not required.) (2.0)

QUESTION 6.06 (2.70)

a. What is used to control RCS pressure during cold solid plant operations? (0.4)

b. What three plant conditions provide inputs to the interlocks associated with RHR suction valve MOV-RH-701? Setpoints are required.(1.5)

c. Prior to entering a water solid operating mode, describe how overpressure protection is enabled? (0.4)

d. If the air supply system for PORV's PCV-RC-455C & D fails, describe how the overpressure protection system functions? (0.4)

QUESTION 6.07 (2.50)

a. Why is the operability of the steam generator code safety valves important during power operation? (0.5)

b. Give two reasons (NOT CONDITIONS) why the MSIV's are required to close during a steam line rupture. (1.0)

c. Which mode (HSB, HZP, HFP) and time in cycle (BOL, MOL, EOL) will have the most severe effect on a main steam line break accident. Explain each separately. (1.0)

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

QUESTION 6.08 (2.30)

a. Originating at the 4160V 1AE Bus, provide a sketch which shows how power is supplied to one 120 VAC Vital Bus and one 125 VDC Bus. The sketch should include all normal, alternate and emergency supplies. Label all electrical components, busses and transformers. (Breakers are not required.) (1.5)

b. Why do the two 480 V Emergency Motor Control Centers MCC1-E13 and E14 feeder breakers remain closed during a loss of offsite power? (0.4)

c. What signal is needed to allow sequencial loading following a loss of offsite power? (0.4)

QUESTION 6.09 (3.20)

a. What two simultaneous conditions will cause the quench spray flow cut-back valves (MOV-1QS-103A,B) to close? (0.8)

b. What is the purpose of the orifice that is parallel to quench spray flow cut-back valves? (0.8)

c. In the recirculation spray coolers, what is the reason for the recirculation water pressure being greater than the river water pressure? (0.8)

d. CIB has been reset and the spray pumps have been secured. If a CIB signal recurs, will the quench spray pumps restart automatically? EXPLAIN. (0.8)

QUESTION 6.10 (3.60)

a. The safety injection accumulators are required to be maintained within certain pressure limits. What problems exist if the pressure is significantly above and below its limits? (0.8)

b. What conditions are required before automatically transferring from the injection phase to the recirculation phase? Include logic and coincidences. (0.4)

c. What is the sequence of the automatic valve realignments that occur to transfer from the injection phase to the recirculation phase? (2.0)

d. If the low head safety injection pumps fail during recirculation, what can be done to provide suction to the high head safety injection pumps? (0.4)

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

QUESTION 7.01 (1.70)

a. A Decay Tank Discharge is in progress when Gaseous Waste Gas Monitor, RM-1GW-108B, becomes inoperable. Briefly explain what has to be done to continue the release. (1.0)

b. During a liquid release, a liquid waste effluent high-high activity alarm comes in. The problem is identified and corrected. When pumping to the cooling tower is re-established, high activity is still present. Is this to be expected? Explain. (0.7)

QUESTION 7.02 (2.50)

a. What are the two entry conditions to FR-H.1, 'Response to Loss of Secondary Heat Sink'? (0.5)

b. What two conditions, caused by a loss of secondary heat sink, calls for tripping the RCP's and initiating feed and bleed? (0.8)

c. In the response to inadequate core cooling, what three system parameters are checked to verify adequate core cooling has been recovered? (1.2)

QUESTION 7.03 (2.50)

Answer the following concerning E-0, Reactor Trip or Safety Injection:

a. The Main Turbine has not tripped and you attempt a manual trip as required, with no response. What additional action are you required to take in order to shutdown the turbine? (0.6)

b. List three plant conditions that require SI initiation? Include setpoints. (0.6)

c. What four parameters are checked to determine if SI flow should be terminated? (0.9)

d. Following an SI reset, what condition must be met before an automatic reinitiation of SI will occur? (0.4)

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

QUESTION 7.04 (2.50)

Answer the following concerning the EOPs'rules of usage.

a. How does the operator know if the sequencial performance of subtasks within a procedure is required? (0.5)

b. When does monitoring of the STATUS TREE's begin? List two circumstances. (1.0)

c. The STA reports the following:
   1. Heat Sink - Orange Path
   2. Containment - Red Path
   3. Core Cooling - Orange Path
   4. Subcriticality - Yellow Path

   List the order in which the above conditions should be addressed? (1.0)

QUESTION 7.05 (2.00)

In order to maintain the plant at 100% power, work must be performed inside the containment in a radiation field of 850 MREM/HR gamma and 300 MREM/HR thermal and fast neutron. The maintenance man selected is 28 years old and has a lifetime exposure through last quarter of 48 REM on his NRC Form 4; additionally, he has accumulated 1.0 REM so far this quarter.

a. How long may the man work in this area without exceeding his 10 CFR limit? Show all work. (1.2)

b. During a declared emergency, this individual volunteers to enter a high radiation area and perform work necessary to prevent further effluent release. In accordance with the Station Procedures, what is his maximum allowed whole body exposure and whose authorization is needed? (0.8)

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

QUESTION 7.06 (2.50)

Answer the following questions in regard to a reactor startup.

Delete 7.06a

a. An idle RCP in a non-isolated loop, with the RCS at 250 F, shall not be started unless what specification is met? (0.5)

b. What should be done if criticality is not achieved by 500 pcm past the ECP? (0.5)

c. The Reactor Coolant System lowest operating temperature (Tavg) is not allowed to go below 541 F during a reactor startup. What are the four bases for this limit? (1.5)

QUESTION 7.07 (2.00)

Answer the following questions in regards to Operating Manual 1.6.4 Q, 'Response to Voids in Reactor Vessel.'

a. What symptoms would be indicative of a void in the reactor vessel? (1.0)

b. When should venting the reactor vessel take priority over containment hydrogen limits? (0.5)

c. When should venting the pressurizer take priority over containment hydrogen limits? (0.5)

QUESTION 7.08 (3.30)

a. What are the two reasons for stopping all RCP's in the case of a small break LOCA? (0.6)

b. What are two criteria for determining if RCP's should be stopped if HHSI pumps are running? (0.8)

c. In accordance with E-3, Steam Generator Tube Rupture, list four ways that a ruptured steam generator can be identified. (1.0)

d. What is the definition of adverse containment conditions? (0.9)

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

QUESTION 7.09 (3.00)

a. While moving fuel, a high-high alarm from a containment purge exhaust monitor occurs. What automatic actions follow besides an evacuation alarm? (1.6)

b. What is the basis for the requirement that two RHR loops be operable when water level is less than 23 feet above the vessel flange? (0.6)

c. Under what conditions is it permissible to stop RHR flow during refueling? (0.8)

QUESTION 7.10 (3.00)

a. Per AOP-43, High Reactor Coolant Activity, what three plant conditions can cause high RCS activity due to the release of irradiated corrosion products? (1.0)

b. In the event of high RCS activity, what is the reason for securing the following: containment sump pumps, primary drain pumps and their containment isolation valves, containment vacuum pumps, and containment isolation valves for reactor plant sample systems? (0.5)

c. An increased concentration of what two gases sampled from the VCT gas sample space would be indicative of failed fuel? (0.5)

d. Under what conditions can power operations continue if the specific activity of the primary coolant is greater than its Technical Specification limit? (1.0)

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

QUESTION 8.01 (1.50)

The concentration of the boric acid solution in the Refueling Water Storage Tank (RWST) shall be verified once per 7 days in accordance with Technical Specification 3.5.5. The chemist sampled the RWST on the following schedule. (All samples taken at 1200 hours.)

April 1 --- April 8 --- April 16 --- April 24 --- April 31

a. EXPLAIN why or why not surveillance time interval requirements were exceeded on April 16. (0.75)

b. EXPLAIN why or why not surveillance time interval requirements were exceeded on April 24. (0.75)

QUESTION 8.02 (1.00)

What restrictions are placed on the manning and composition of the Fire Brigade? (1.0)

QUESTION 8.03 (2.50)

The RCS is heating up at 50 F per hour with the RCS presently at 325 F. Maintenance reports that Charging Pump 1B repairs will not be completed for one hour but that Charging Pump 1A is operable. Technical Specifications Action Statement allows 72 hours to repair an inoperable pump in Mode 3. What action, if any, should be taken? (2.5)

QUESTION 8.04 (2.50)

What action(s) (BOTH operational AND administrative) must be taken if the RCS-PRESSURE-Safety Limit is exceeded in accordance with Technical Specifications? Consider ALL Modes AND include applicable time limits in your answer.

QUESTION 8.05 (2.50)

Discuss the relationship between Limiting Conditions for Operations, Limiting Safety System Settings, and Safety Limits in terms of preventing release of radioactivity to the environment.

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

QUESTION 8.06 (2.00)

The plant is operating at 50% load and you are the on-shift Shift Supervisor. Explain what actions, if any, would need to be taken in regards to shift staffing for the following conditions. CONSIDER EACH CASE SEPARATELY.

a. Your on-shift BOP operator is seriously injured in the plant and you send him to the hospital for treatment. (1.25)

b. The on-coming STA calls and says he won't be in. (0.75)

QUESTION 8.07 (2.00)

The plant is operating at 75% power and the latest leak rate data shows:

13.2 GPM	- Corrected RCS leakage rate
1.5 GPM	- Leakage into the Pressurizer Relief Tank
1.2 GPM	- Leakage into the Primary Drains Transfer Tank
3.4 GPM	- Leakage through SI-23, RCS Loop 1A, cold leg isolation (Previous leakage rate was 1.6 GPM)
0.8 GPM	- Total primary to secondary leakage
4.2 GPM	- Leakage past RCP seals

What RCS leakage limits, if any, have been exceeded? Refer to attached Technical Specifications.

QUESTION 8.08 (2.50)

Per Technical Specifications, when does containment integrity exist? (2.5)

QUESTION 8.09 (2.00)

a. If an emergency condition develops, who assumes the role of the Emergency Director? (0.5)

b. When is an immediate deviation from Technical Specifications justified? (1.5)

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

QUESTION 8.10 (3.50)

a. What is the MINIMUM number of operable excore channels indicating AFD outside the target band before AFD is considered outside its target band by Technical Specifications? (0.5)

b. Assume the plant is operating at full power and the Axial Flux Difference (AFD) has been outside the target band for the last 5 minutes. What are the TWO actions specified which you may choose between to meet the Technical Specification requirements? Include time limitations. (1.0)

c. Assume that it is 0310 on 05/13/85 and the plant is presently at 45% power. Considering the AFD penalty history below, at what date and time may power be increased above 50%? EXPLAIN. (Show all work.) Assume no deviation outside the band after 0310 on 05/13/85.

DATE	TIME WENT OUT OF BAND	TIME BACK IN BAND	POWER
05/12/85	0310	0318	85%
05/12/85	1557	1637	65%
05/13/85	0148	0310	45%

(2.0)

QUESTION 8.11 (3.00)

a. What are the responsibilities of the Nuclear Station Operating Foreman (NSOF) at shift change? (1.0)

b. If clearance is needed to do maintenance on a piece of non-ESF equipment, how is permission granted to do the work and who gives the permission? (1.0)

c. Can a SRO soley authorize the installation of a jumper for non-Technical Specification related equipment? Explain. (1.0)

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

(************* END OF EXAMINATION ***************)

$f = ma$

$v = s/t$

Cycle efficiency = (Network out)/(Energy in)

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N$

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

$PE = mgh$

$V_f = V_o + at$

$w = \theta/t$

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

$W = v\ \Delta P$

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

$\Delta E = 931\ \Delta m$

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

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

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

$I = I_o e^{-ux}$

$Pwr = W_f \Delta h$

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

$TVL = 1.3/u$

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

$HVL = -0.693/u$

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

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

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

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

$\ell^* = 10^{-5}$ seconds

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

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

$I_1 d_1 = I_2 d_2$

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

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

$\Sigma = \sigma N$

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

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

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 $lbf/in.^2$

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

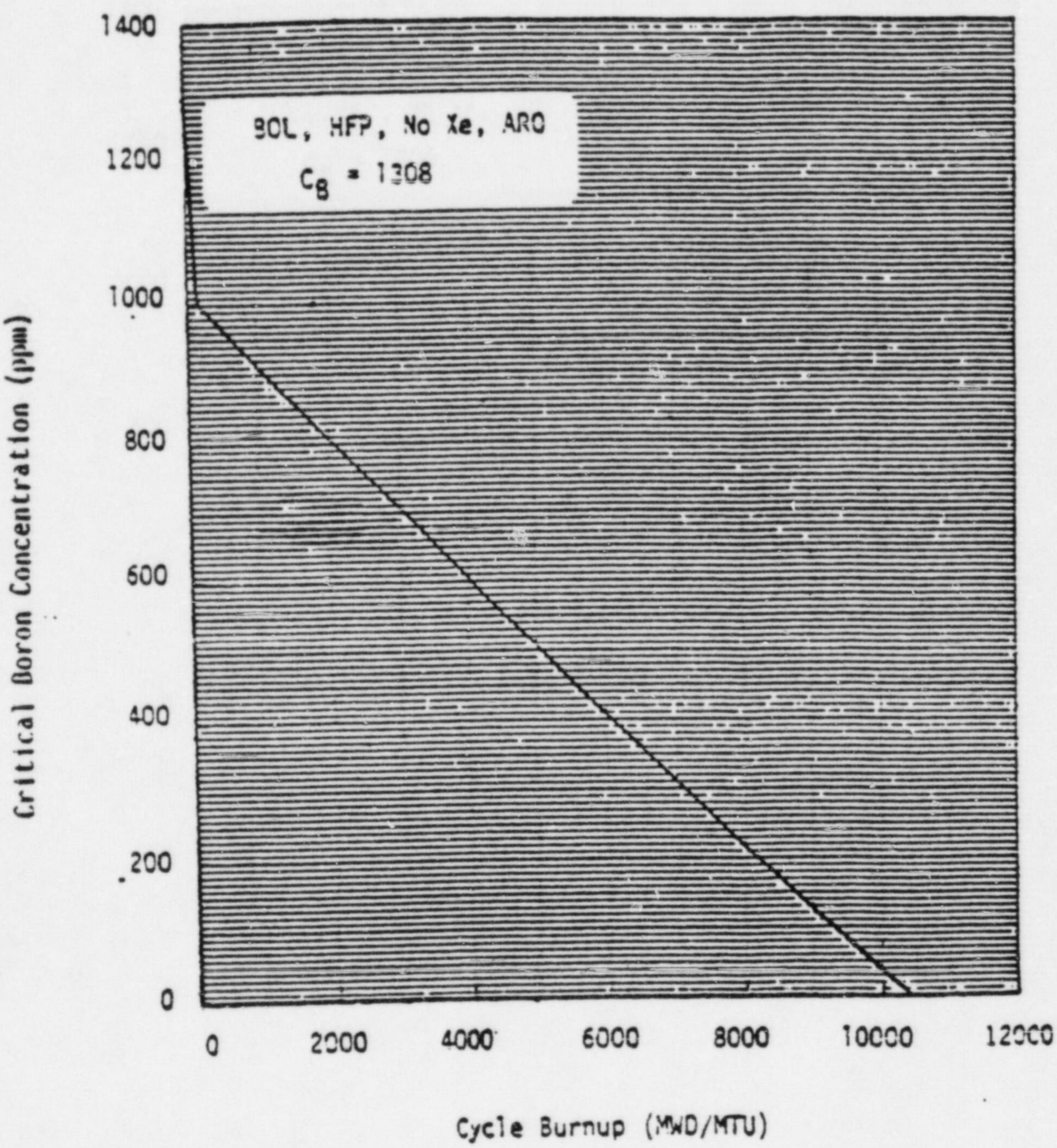
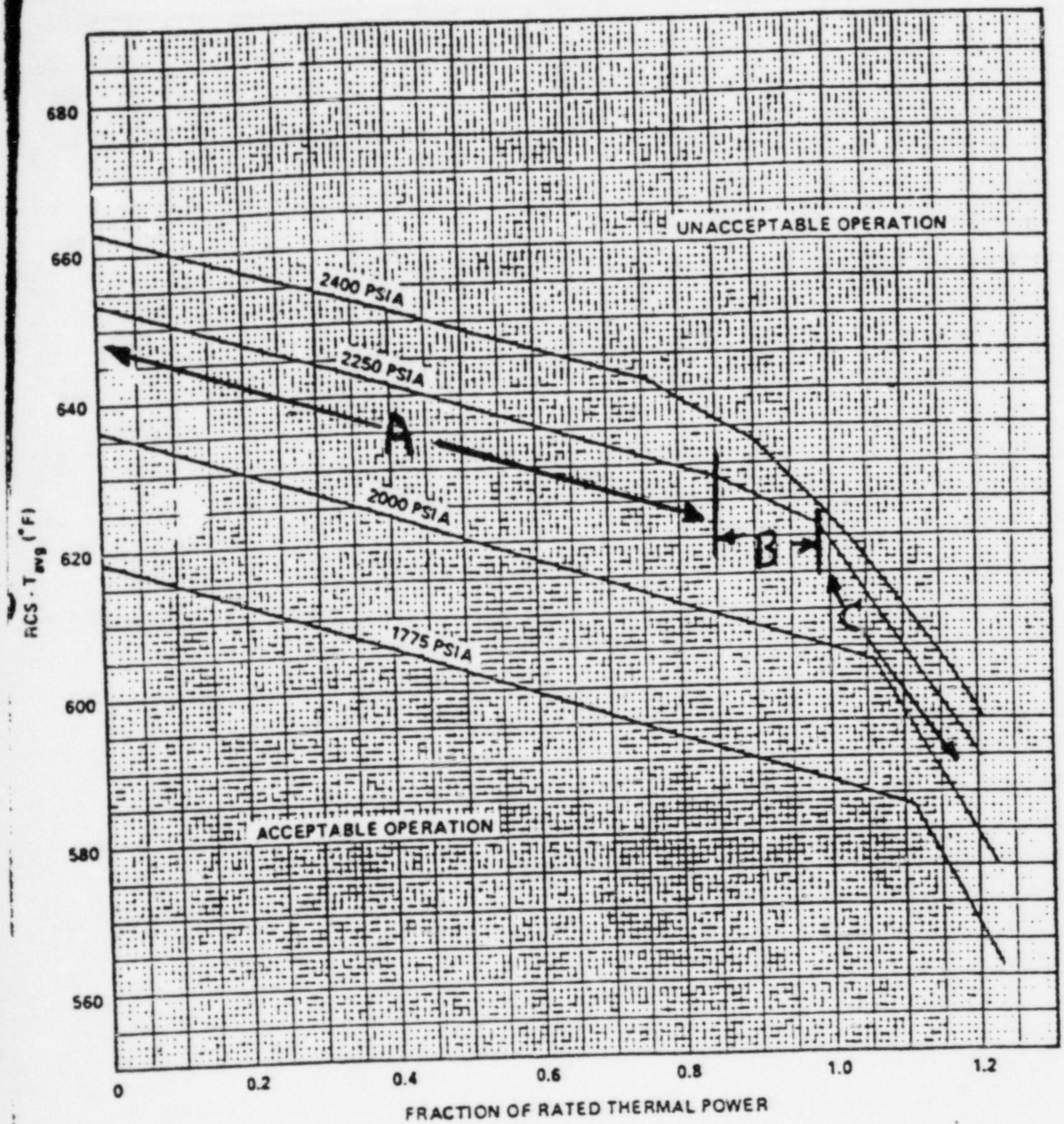


FIGURE 1

Critical Boron Concentration vs. Burnup
for HFP, ARO, Equilibrium Xenon Conditions



REACTOR CORE SAFETY LIMIT - THREE LOOPS IN OPERATION

Figure 2

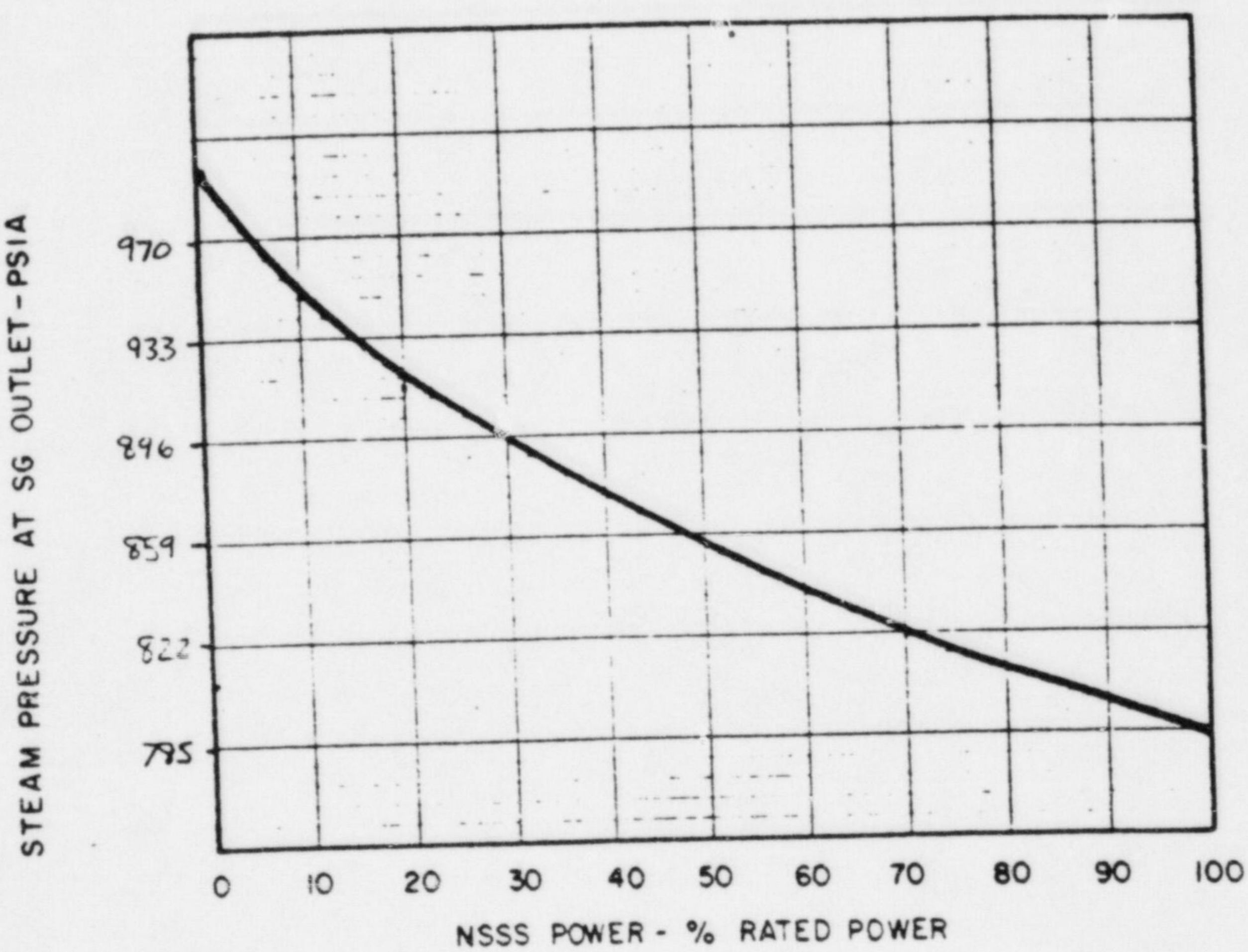

STEAM PRESSURE AT SG OUTLET - PSIA
970
933
896
859
822
795
0
10
20
30
40
50
60
70
80
90
100
NSSS POWER - % RATED POWER

Figure 3

OPERATIONAL LEAKAGE

LIMITING CONDITION FOR OPERATION

3.4.6.2 Reactor Coolant System leakage shall be limited to:

a. No PRESSURE BOUNDARY LEAKAGE,

b. 1 GPM UNIDENTIFIED LEAKAGE,

c. 1 GPM total primary-to-secondary leakage through all steam generators not isolated from the Reactor Coolant System and 500 gallons per day through any one steam generator not isolated from the Reactor Coolant System,

d. 10 GPM IDENTIFIED LEAKAGE from the Reactor Coolant System, and

e. 28 GPM CONTROLLED LEAKAGE at a Reactor Coolant System pressure of 2230 ±20 psig.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With any PRESSURE BOUNDARY LEAKAGE, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

b. With any Reactor Coolant System leakage greater than any one of the above limits, excluding PRESSURE BOUNDARY LEAKAGE, reduce the leakage rate to within limits within 4 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.2 Reactor Coolant System leakages shall be demonstrated to be within each of the above limits by:

a. Monitoring the containment atmosphere particulate and gaseous radioactivity monitor at least once per 12 hours.

REACTOR COOLANT SYSTEM

PRESSURE ISOLATION VALVES

LIMITING CONDITION FOR OPERATION

3.4.6.3 Reactor coolant system pressure isolation valves shall be operational.

APPLICABILITY Modes 1,2, 3 and 4.

Action:

1. All pressure isolation valves listed in Table 4.4-3 shall be functional as a pressure isolation device, except as specified in 2. Valve leakage shall not exceed the amounts indicated.

2. In the event that integrity of any pressure isolation valve specified in Table 4.4-3 cannot be demonstrated, reactor operation may continue, provided that at least two valves in each high pressure line having a non-functional valve are in, and remain in, the mode corresponding to the isolated condition.[a]

3. If Specification 1 and 2 cannot be met, an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours.

4. The provision of specification 4.0.4 is not applicable for entry into Mode 3 or 4.

---

[a] Motor operated valves shall be placed in the closed position and power supplies deenergized.

4.4.6.3.1 Periodic leakage testing[(a)] on each valve listed in Table 4.4-3 shall be accomplished prior to entering Mode 1 after every time the plant is placed in the cold shutdown condition for refueling, after each time the plant is placed in a cold shutdown condition for 72 hours if testing has not been accomplished in the preceeding 9 months and prior to returning the valve to service after maintenance, repair or replacement work is performed.

4.4.6.3.2 Whenever integrity of a pressure isolation valve listed in Table 4.4-3 cannot be demonstrated the integrity of the remaining valve in each high pressure line having a leaking valve shall be determined and recorded daily. In addition, the position of the other closed valve located in the high pressure piping shall be recorded daily.

(a) To satisfy ALARA requirements, leakage may be measured indirectly (as from the performance of pressure indicators) if accomplished in accordance with approved procedures and supported by computations showing that the method is capable of demonstrating valve compliance with the leakage criteria.

TABLE 4.4-3

REACTOR COOLANT SYSTEM PRESSURE ISOLATION VALVES

System	Valve No.	Maximum[(a)(b)] Allowable Leakage
Loop 1, cold leg	SI-23	$\leq$ 5.0 GPM
	SI-12	$\leq$ 5.0 GPM
Loop 2, cold leg	SI-24	$\leq$ 5.0 GPM
	SI-11	$\leq$ 5.0 GPM
Loop 3, cold leg	SI-25	$\leq$ 5.0 GPM
	SI-10	$\leq$ 5.0 GPM

(a) 1. Leakage rates less than or equal to 1.0 gpm are considered acceptable.

2. Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered acceptable if the latest measured rate has not exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.

3. Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered unacceptable if the latest measured rate exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.

4. Leakage rates greater than 5.0 gpm are considered unacceptable.

(b) Minimum test differential pressure shall not be less that 150 psid.

MASTER

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 5.01 (3.00)

a. Overpredicts (not conservative) (0.5). The source neutron flux dominates the detector reading until the flux level from core multiplication is higher than if the source was further from the detector (0.5).

b. It doesn't (0.5). The critical rod position reflects the positive reactivity necessary to bring the reactor critical and is independent of source magnitude (0.5).

c. The faster the rate, the lower the source range counts at criticality (0.5) due to the reduced time for subcritical multiplication (0.5).

REFERENCE
BVPS Reactor Theory Manual Chapter 5, pp 36,47,49

3.1 001 000 K 5.18 4.3
010 K 5.16 3.5

ANSWER 5.02 (3.50)

a. 1. Delta boron worth becomes less negative (0.25) due to increased competition for neutrons by more boron atoms (0.5).

2. Delta boron worth becomes more negative (0.25) because more neutrons are thermalized due to denser moderator and since boron is a 1/v absorber, the probability of absorption increases (0.5).

3. Delta boron worth becomes less negative (0.25) due to increased competition for neutrons by the poison atoms (0.5).

4. Delta boron worth becomes more negative (0.25) due to reduced boron concentration from MOL to EOL (0.5).

b. Negative reactivity caused by the buildup of Xe and Sm (0.5).

REFERENCE
BVPS Reactor Theory Manual Chapter 8, p 34, 45, 37

3.1 001 000 K 5.20 3.2
K 5.28 3.8
K 5.30 3.1

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 5.03 (3.00)

a. 1. Decrease (0.25)
   2. Increase (0.25)
   3. Increase (0.25)
   4. Decrease (0.25)

b. Clad failure (melting, burnout) probability is greatly increased because film boiling will reduce the heat being transferred from the fuel (1.0).

c. Coolant outlet temperature is limited (to below saturation temperature) (0.5). If coolant becomes saturated then there will be no change in RCS hotleg temperature and thus no indication of core power (0.5).

REFERENCE
BVPS Thermodynamics Manual, Chapter 7, pgs. 14-17, 19

3.4 003 000 K 5.01 3.9
3.2 002 000 K 5.09 4.2
K 5.01 3.4

ANSWER 5.04 (2.00)

a. After the power decrease, the production of xenon from fission (0.25) and from the decay of iodine (0.25) is greater than the removal by decay of xenon (0.25) and burnout by flux (0.25). After five hours, the removal rate is greater than the production (0.25) and positive reactivity is being added until equilibrium at about 40 hours (0.25).

b. Rods will need to be withdrawn for about 5 hours (0.25) and then inserted for the next 35 hours (0.25).

REFERENCE
BVPS Rx Theory Manual chapter 7 pgs. 13-16

3.1 001 000 K 5.13 4.0
K 5.32 3.5

ANSWER 5.05 (1.50)

a. Decreases (0.5) Pu 239 concentration increases and Pu 239 has a smaller beta. (0.5)

b. Larger SUR (0.5)

REFERENCE
BVPS Reactor Theory Manual, Ch 5, pg 14-17

EO 3

001/000 K5.47 2.9/3.4 pg 3.1-3

ANSWER 5.06 (2.50)

a. The speed needs to increase to 1.225 times the original speed to raise the discha ge head from 1200 to 1800 PSIA.

$H1/H2 = (N1/N2)^2 = 1200/1800, \quad N2/N1 = (1800/1200)^{1/2} = 1.225$ (0.75)

The horsepower needs to increase to 1.837 times the original horsepower to raise the discharge head from 1200 to 1800 PSIA.

$P2/P1 = (N2/N1)^3 = (1.225)^3 = 1.837$ (0.75)

b. NPSH = (Psuct - Psat)/density (0.3)
Psat = 205.29 PSIA (0.2)
1/density = 0.018416 ft**3/lbm (0.2)

215 ft lbf/lbm = (P - 205.29 lbf/in**2) (144 in**2/ft**2) (0.018416 ft**3/lbm)

P = 286.3 PSIA or 271.6 PSIG (0.3)

REFERENCE
BVPS Thermo Manual chapter 4 pgs. 14, 21d, 33

Appendix pg. A-9 2.6
3.6

ANSWER 5.07 (2.00)

The stuck rod would be worth more (0.5). Reactivity worth is proportional to the relative flux squared (0.5). For a dropped rod, the flux is depressed adjacent to it (0.5) whereas if the same rod was stuck out, while the others were inserted, it would be exposed to a much higher flux than the flux in the rest of the core (0.5).

REFERENCE
BVPS Rx Theory Manual chapter 8 pgs. 14-16

3.1 000 003 EK 1.03 3.8
005 EK 1.05 4.1

ANSWER 5.08 (2.00)

a. Increase
b. Decrease
c. Decrease
d. Increase
e. Increase (0.4 each)

REFERENCE
BVPS Thermo Manual chapter 6 pg. 20

3.5 039 000 A 1.05 3.2
3.2 002 000 K 5.11 4.2

ANSWER 5.09 (2.50)

a. As moderator temperature increases, the migration and thermalization lengths of neutrons in the core increases, therefore more neutrons will migrate to the control rods (0.5) thus increasing their worth (0.5).

b. Reactor power would remain constant (0.5). The negative reactivity inserted by the dropped rod would be countered by positive reactivity inserted by MTC (0.5) since Tave would be lower (0.5).

REFERENCE
BVPS Rx Theory Manual chapter 6 pgs. 16, 20
chapter 9 pg. 3

3.1 001 000 K 5.10 4.1

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

K 5.29 3.9
000 003 EK 1.16 3.2

ANSWER 5.10 (3.00)

a. Reactor power will increase (0.5) to match secondary power from positive reactivity inserted by MTC (0.5) which will be countered by negative reactivity from power defect as power increases (0.5).

b. Q = U A (Tave - Tstm)
70% = U A (568 - 521.3) = 70/85 U A (Tave - 518.7) (0.5)
{521.3 and 518.7 are from the steam tables for their corresponding pressures in Figure 3} (0.5)
Tave = ~~570.9 F~~ 575.4 F (0.5)

REFERENCE
BVPS Thermo Manual chapter 7 pgs. 1-4

3.5 039 000 K 5.08 3.6
A 2.05 3.3

ANSWER 6.01 (2.00)

a. The ratio of gamma to neutron flux is greater (0.5)

b. PR comparitor deviation
NIS PR high setpoint rod stop block rod w/D
NIS PR high setpoint neutron flux high
NIS PR neutron flux rate high
PR low setpoint flux deviation or auto defeat
Computer alarm rod deviation / SEQ NIS PR Tilts (5 of 6, 0.3 each)

REFERENCE
BVPS OM 2.1 pg. 16
2.2 pg. 7
NS-8 figures 8, 9

3.9 015 000 K 3.01 4.3
K 6.02 2.9

LP-SQS-2.1 3,4g

ANSWER 6.02 (2.50)

602a Deleted a. Allow for the decay of N-16 (0.4)

b. Steam generator blowdown sample monitor
AFWP turbine exhaust monitor
Main steam safety valve effluent monitor
Steam generator blowdown tank discharge monitor (0.4 each)

c. The condenser air ejector discharge will be diverted to the containment (0.5).

REFERENCE
BVPS OM 43.1 pgs. 9, 15, 21
AOP-42 pgs. 1, 2

Appendix pg. A-6 2.7
3.3 000 037 EK 2.02 2.4
3.3 000 037 EK 3.10 3.7
3.9 073 000 K 1.01 3.9

2336 RCS 6
2353 MSS 10

ANSWER 6.03 (2.20) component temperature alarms ~~(.7)~~ (.35) and sump alarms (.35)

a. ~~Flow indicators parallel to the leak will indicate a lower than normal flow and abnormally high component temperatures. OR affected component temperatures would be much lower than normal if the leak was downstream of the component or much higher than normal if the leak was upstream of the component (0.7).~~

b. High flow will cause RCP thermal barrier CCR outlet valves to close
Pressure buildup will seat check valve
Piping between valves is designed for 2485 psig (0.5 each)

REFERENCE
AOP-20 pg. 1
BVPS OM 15.1 pg. 16

3.10 008 000 K 3.01 3.5
3.3 000 009 EK 3.15 3.2

LP-SQS-6.3 1

ANSWER 6.04 (2.00)

a. To ensure required adequate back pressure in the RCP seals (0.5)

b. Key interlock will only allow one breaker to be racked in at a time (0.5)

c. For load follow and permits the dilution of water to follow the initial xenon transient (0.5) but using it adds large amounts of non-hydrogenated water to the RCS (0.5).

REFERENCE
BVPS OM 7.1 pg. 38
7.2 pgs 1, 3

3.1 004 000 K 1.06 3.1
K 2.03 3.5
K 5.01 3.3
3.2 002 000 K 1.06 4.0

LP-SQS-7.1 3,5

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER Deleted 6.05 (2.00) –

Control rods will automatically move outward (0.4) due to temperature error and power mismatch error during the transient (0.4). With a small MTC, reactor power will rise (0.4) causing a (C-2) overpower rod stop (0.4) and power overshoot results in an OTdT or OPdT trip despite Doppler feedback (0.4).

REFERENCE
BVPS NS-10 pgs 3 to 12
NS-8 pg.39

3.1 001 000 A 1.02 3.4
3.5 045 010 K 4.21 3.2
3.9 012 000 K 4.02 4.3

2352 MSS 3

ANSWER 6.06 (2.70)

a. Letdown pressure control valve (~~MOV-CH-142~~) PCV-CH-145 (0.4)

b. Will not open at RCS pressure > 430 psig
Will auto close at RCS pressure > 630 psig
Will not open if pressurizer vapor temperature > 475 F (0.5 each)

c. Manually placing two keylock switches in their automatic position (Enables the PORVs' low pressure setpoint) (0.4)

d. The backup supply are two nitrogen filled accumulators (0.4)

REFERENCE
BVPS OM 10.1 pgs. 2, 15
10.2 pgs. 6, 7
6.1 pgs. 52, 53

3.2 006 000 K 4.08 3.5
3.4 005 000 K 4.01 3.2 ; K 4.07 3.5
3.3 010 000 K 4.03 4.1
3.8 078 000 K 3.02 3.6

LP-SQS-10.1 4 RCS PZR Pressure relief system 7

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 6.07 (2.50)

a. Ensures that secondary system pressure will be limited to within its design pressure during the most severe transient (0.5).

b. 1. Minimize positive reactivity effects of RCS cooldown associated with the blowdown (0.5)
2. Limit pressure rise within containment during a steam break in containment (0.5)

c. Hot Zero Power (.25) because of the greatest mass in the SG results in the largest RCS cooldown (.25)
EOL (.25) because MTC is at its maximum negative value (.25)

REFERENCE
T/S B 3/4 7-1
T/S B 3/4 7-3
FSAR 14.1-35 to 38

3.5 000 040 EK 3.01 4.5
EK 2.01 2.5
EK 1.05 4.4
3.5 039 000 K 4.05 3.7

Objectives PGS-10-17

ANSWER 6.08 (2.30)

a. See sketch (1.5)

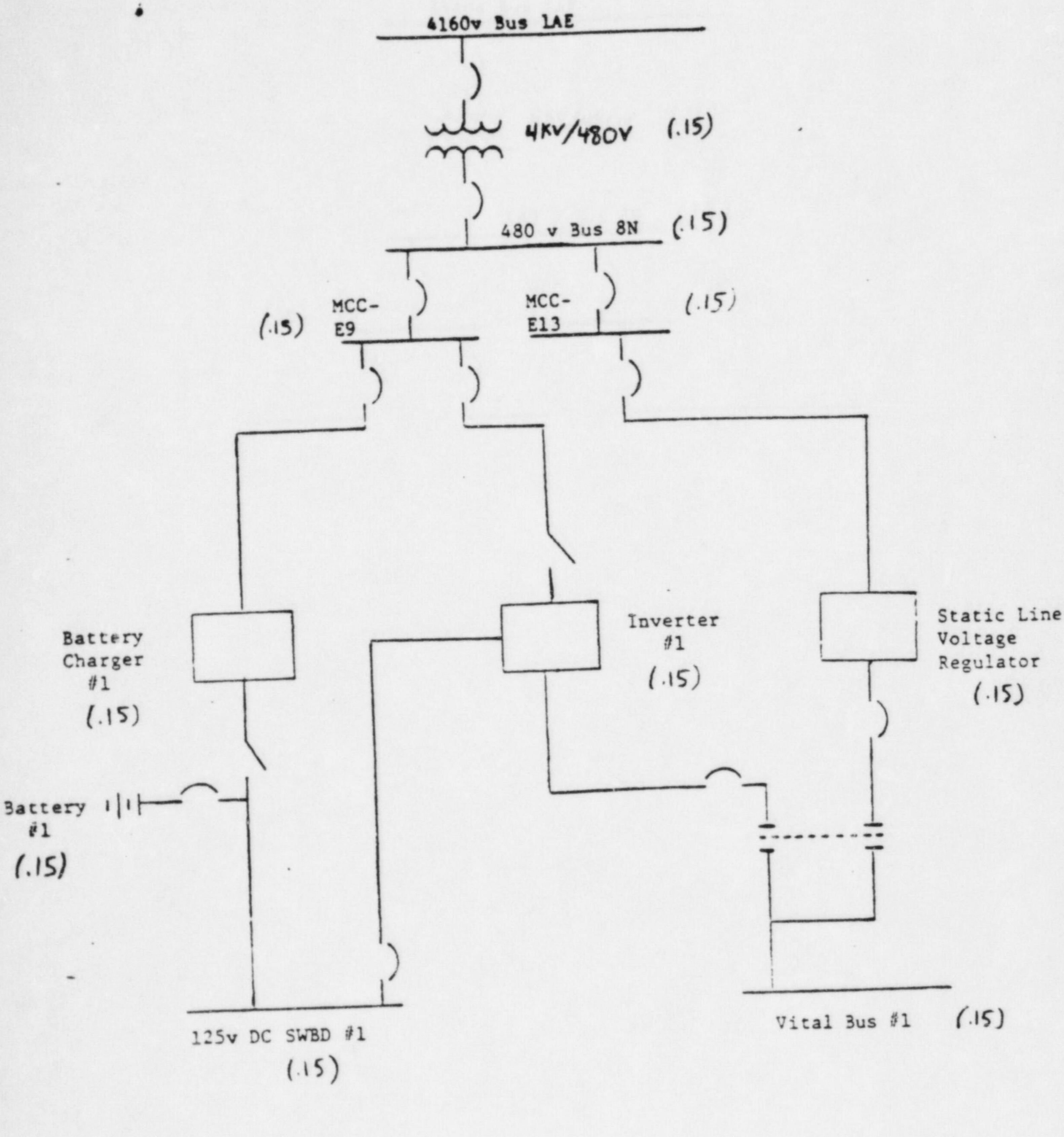
b. To preserve power to the Diesel Generator Auto Loading Sequence Circuits (0.4)

c. Permissive signal from associated undervoltage devices (0.4)

REFERENCE
BVPS OM 37.1 pgs 78, 79
BV exam Bank Question 6-4 a

3.7 062 000 K 4.09 2.9
K 4.03 3.1

LP-SQS-36.1 2,7


4160v Bus 1AE
4KV/480V (.15)
480 v Bus 8N (.15)
MCC-
E9
(.15)
MCC-
E13
(.15)
Battery
Charger
#1
(.15)
Inverter
#1
(.15)
Static Line
Voltage
Regulator
(.15)
Battery
#1
(.15)
125v DC SWBD #1
(.15)
Vital Bus #1 (.15)

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 6.09 (3.20)

a. Associated quench spray pump running (0.4)
RWST low low level (0.4)

b. Reduces quench spray flow to minimize negative pressure when containment returns to subatmospheric pressure following a LOCA (0.8)

c. Only out leakage can occur and dilution of borated water by river water in containment is not possible which ensures necessary shutdown margin (0.8)

d. ~~No (0.3). CIB initiate pushbuttons must be depressed before the pumps will automatically restart (0.5).~~
Yes (0.3) CIB signal will automatic start quench spray pumps.

REFERENCE
BVPS OM 13.1 pgs. 2, 8, 12, 19

3.6	103	000	K	1.08	3.8
	026	000	K	4.04	4.1
	026	000	K	1.02	4.1
	026	020	K	4.03	4.3

LP-SQS-13.1 3,4,5

ANSWER 6.10 (3.60)

a. Higher pressure would tend to increase the amount of accumulator water carried out the break (0.4). Lower pressure results in less rapid delivery of accumulator water to the reactor tending to delay core recovery (0.4).

b. SI signal (0.2) and 2/4 low level on RWST (0.2)

c. 1. Containment sump to LHSIP's suction valves (SI-860A,B) open
2. LHSIP's miniflow isolation valves (SI-855A,B,C,D,) close
3. LHSIP's discharge valves to HHSIP's suction (SI-863A,B) open
4. HHSIP's suction from RWST (CH-115B,D) closed (0.3 for valves
5. LHSIP's suction from RWST (SI-862A,B) closed 0.5 for order)

d. Manually align an outside recirculation spray pump (0.4)

REFERENCE
BVPS OM 11.1 pgs. 3, 7; Fig 11-12 ; BV Exam Bank Question 6-11 a,b
BVPS NS-13 pgs. 9-13

3.2	006	000	K	6.02	3.9
			K	4.06	4.2
3.4	005	000	K	3.05	3.8

LP-SQS-11.1 3,6

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 7.01 (1.70)

a. Decay Tanks sampled and analyzed (0.5)
Independent verification of release rate calculation and valve line-up (0.5)

b. Activity should decrease as soon as water in the pipes from the discharge of the pumps is purged ~~(0.4)~~. ~~If not, then the release should be stopped (0.3).~~ (0.7)

REFERENCE
TS pg. 3/4 3-63
BVPS OM 19.4 pg. 9
17.4 pg. 67

3.11 068 000 Sys gen 4 3.3
071 000 Sys gen 5 4.0

ANSWER 7.02 (2.50)

a. While performing E-0 if total AFW flow < 350 gpm (0.2)
Heat Sink Red Path - SG narrow range level in ~~least one~~ all SG < 5% (.15)
- Total feedflow to SG's < 350 GPM (.15)

b. Wide range level in two SG's < 10% (0.4)
Pressurizer pressure greater than 2335 psig (0.4)

c. RVLIS full range indication (> 61%) (0.4)
At least two RCS hot leg temperatures (< 350 F) (0.4)
Five hottest exit TC's (< 1200 F) (0.4)

REFERENCE
BVPS EOP FR-C.1 pg. 11
FR-H.1 pgs. 1, 2

3.4 000 074 EK 3.11 4.4
3.5 000 054 EK 3.04 4.6

LP-SQS-53A-FR-H EO 2
LP-SQS-53A-FR-S EO 2

ANSWER 7.03 (2.50)

a. (1) Close main steam trip valves ~~(0.3)~~ Runback the turbine
   (2) Close non-return valves ~~(0.3)~~ Close the mainsteam bypass valves (0.15 each)

b. (1) Pressurizer pressure < 1845 PSIG
   (2) Containment pressure > 1.5 PSIG.
   (3) Steamline pressure < 510 PSIG (0.2 each)

c. (1) RCS subcooling criteria met (0.23)
   (2) Feed flow to intact SG's (> 350 GPM) or Narrow Range level in at least one intact SG (0.23)
   (3) RCS pressure - (stable or increasing) (0.22)
   (4) PZR level (> 5%) (0.22)

d. Reactor trip breakers must be closed (0.4)

REFERENCE
BVPS EOP E-0 pgs. 3, 5, 14, 17

3.1 000 007 EK 3.01 4.6

LP-SQS-53A-E-0 EO 1,3

ANSWER 7.04 (2.50)

a. Letters denote sequencial importance, bullets do not (0.5)

b. As directed in E-0 (0.5)
   When transferring out of E-0 (0.5)

c. 2,3,1,4 (1.0)

REFERENCE
EOP Ex Vol pgs. 3,6,8

SWPWGKA 22 4.3

LP-SQS-53A-Intro EO 1b, 2a

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

ANSWER 7.05 (2.00)

a. 5(N-18) = 50 REM (0.2)
Total lifetime to date = 48 + 1 = 49 REM (0.2)
Total lifetime available = 50 - 49 = 1 REM (0.2)
Total this quarter available = 3 - 1 = 2 REM (0.2)
Lifetime is more restrictive than quarterly limit

0.85 REM/HR gamma + 0.30 REM/HR neutron =1.15 REM/HR dose rate
1.0 REM/1.15 REM/HR = 0.87 HRS = 52 MIN (0.4)

b. 25 REM whole body one time exposure (0.4)
Emergency Director (0.4)

REFERENCE
10 CFR 20.4; 101
BVPS RCM pg. 9

System wide and plant wide generic K&A (SWPGK&A) 10 3.9

ANSWER 7.06 (2.50)

Delete (a.) The actual pressurizer water level is less than 60% or
The secondary water temperature of each SG is less than 25 F above each of the in-service RCS cold legs temperature (0.5 for either)

b. Return bank to 500 pcm below ECP and recalculate ECP (0.5)

c. Ensures that:
1. The moderator temperature coefficient is within its analyzed temperature range
2. The protective instrumentation is within its normal operating range
3. The pressurizer is capable of being in an operable status with a steam bubble
4. The reactor vessel is above its minimum NDTT temperature (0.3 each)

REFERENCE
BVPS OM 50.4 pg. 30& 10
TS pg. B 3/4 1-2
TS 3.4.1.6, BVPS OM 6.4 pg. 3

3.4 000 000 Sys Gen 5 3.9
3.1 001 010 A 2.07 4.2

LP-SQS-6.3 5

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

2336 RCS 8

ANSWER 7.07 (2.00)

a. Abnormal pressurizer pressure and level responses to charging and spraying (0.5)
   Indication of departure from subcooled conditions (0.5)

b. If the potential for interruption of core cooling with hydrogen in the vessel exists (0.5)

c. If the pressurizer bubble is interferring with the ability to maintain pressure control (0.5)

REFERENCE
BVPS OM 6.4 pgs. 121, 126

3.6 028 000 K 5.01 3.9
3.3 000 009 EA 2.01 4.8
EA 2.38 4.3

LP-SQS-6.9 5

ANSWER 7.08 (3.30)

a. 1. Prevent excessive inventory loss (0.3)
   2. Preclude core uncovery from RCP's tripping at a later time (0.3)

b. 1. Highest RCS SG D/P < 145 PSI (0.4)
   2. No CCR Flow to RCP's (0.4)

c. 1. Unexpected increase in S/G narrow range level.
   2. High S/G sample radiation.
   3. High S/G steamline radiation.
   4. High S/G blowdown line radiation. (0.25 each)

d. Containment pressure > 5 psig or containment radiation > 100000 R/hr or integrated containment radiation > 1000000 R (0.9)

REFERENCE
BVPS Exec Vol E-0 step 23 pg. 33
BVPS EOP E-3 pgs. 2, 3
E-0 Attachment 6

3.3 000 038 EK 3.06 4.5

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-SILK, D.

LP-SQS-53A-E-1 EO 3
LP-SQS-53A-E-3 EO 1

ANSWER 7.09 (3.00)

a. Containment purge exhaust and supply dampers close
Containment purge to exhaust fan damper closes
Main filter bank bypass dampers close
Main filter bank inlet dampers open (0.4 each)

b. Ensure that a single failure will not result in a loss of heat removal capability (0.6)

c. May be stopped (for one hour per eight hour period) for core alterations in the vicinity of the hot legs (0.8)

REFERENCE
AOP-22 pg. 1
TS pgs. B 3/4 9-2, 3/4 9-8

3.4 000 025 Sys gen 5 3.9
3.11 034 000 K 3.01 2.9

LP-SQS-10.1 9

ANSWER 7.10 (3.00)

a. Plant heatup, plant cooldown, abnormal pressure/temperature transients
Chemical shock (0.33 each)

b. Preclude potential high airborne and increased radiation levels in the auxiliary building (0.5)

c. Xenon and iodine (0.25 each) or Krypton

d. ~~Operations may continue (up to 48 hours) provided that operation under these circumstances shall not exceed 10% of the unit's total yearly operating time (1.0)~~ Operation may continue provided the activity does not exceed the limit on the Tech Spec curve (TS Figure 3.4-1) or be within specific activity limits within required time.

REFERENCE
AOP-43 pgs. 1, 2
TS pg. 3/4 4-18

3.11 000 076 EK 3.01 3.1
EK 3.05 3.6
Sys gen 5 3.6

2336 RCS 5,8

ANSWER 8.01 (1.50)

a. Interval requirement not exceeded [0.25]. Eight days does not exceed 1.25 times the specified interval [0.5].

b. Interval requirement exceeded [0.25]. The last 3 consecutive intervals exceed 3.25 times the specified interval [0.5].

REFERENCE
TS pg. 3/4 0-2

SWPWGK&A 5 3.9

LP-SQS-11.1 7

ANSWER 8.02 (1.00)

The Fire Brigade shall not include three members of the minimum shift crew necessary for the safe shutdown of the unit or any personnel required for other essential functions during a fire emergency (1.0).

REFERENCE
SAP pg. 8
TS pg. 6-1

SWPWGKA 19 4.2

ANSWER 8.03 (2.50)

(The Technical Specifications require that all LCO's be satisfied prior to entry into an operational mode.) ~~(0.75)~~ 1.0 Since you are about to enter Mode 3 (~~0.75~~) the heatup must be discontinued (~~0.5~~ .75) and Tave held at less than 350 F until Charging Pump 1B is proven operable (~~0.5~~ .75).

REFERENCE
TS pg. 3/4 0-1; TS pg. 3/4 5-3

3.4 005 000 Sys gen 5 4.0

LP-SQS-7.1 9

ANSWER 8.04 (2.50)

(.m) (.2) (.2) (.2)
Modes 1&2-- Be in HSB with pressure within limits in one hour. (.75)
(.25) (.25) (.25)
Modes 3,4,5-- Reduce pressure to within limit in 5 minutes. (.75)
(.4) (.3) (.3)
All Modes-- Notify the NRC, Manager of Nuclear Operation, and ORC (within 24 hours). (1.0)

REFERENCE
TS pgs. 2-1, 6-12

SWPWGK&A 5 3.9

2336 RCS 8

ANSWER 8.05 (2.50)

LCO's indicate lowest performance level of equipment required for safe operation of the facility (0.5). If proper automatic action occurs prior to reaching Limiting Safety System Settings, then Safety Limits will not be exceeded (1.0). If Safety Limits are not exceeded then fuel and RCS integrity will be maintained (1.0).

REFERENCE
TS pgs. B 2-2,3
10 CFR 50.36 c

SWPWGK&A 5 3.9

ANSWER 8.06 (2.00)

a. You may operate for up to two hours with one less than minimum complement (0.75) provided that immediate action is taken to bring the complement up to minimum (0.5).

b. The on-shift STA will have to wait for a relief to come in (0.75).

REFERENCE
TS pg. 6-4

SWPWGKA 23 3.5

ANSWER 8.07 (2.00)

RCS Pressure Isolation Valve Limits exceeded. (1.0)

UNIDENTIFIED Leakage limits exceeded. (1.0)

REFERENCE
TS 3.4.6.2; TS 3.4.6.3

3.2 002 020 Sys gen 5 4.1

2336 RCS 8

ANSWER 8.08 (2.50)

All penetrations required to be closed during accident conditions are either:
Capable of being closed by an operable containment auto-isolation valve system (0.5), or
Closed by manual valves, or blind flanges (0.5)
All equipment hatches are closed and sealed (0.5)
Both doors in each personnel air lock are properly closed unless being used at which time at least one air lock door shall be closed (0.5) and air lock leakage is within limits (0.5)
The containment leakage rates are within limit (0.5)

REFERENCE
TS 1-2

SWPWG K&A 5 3.9

LP-SQS-12.1 5

ANSWER 8.09 (2.00)

a. Shift Supervisor (0.5)

b. In an emergency when this action is immediately needed to protect the public health and safety and no action consistent with the license conditions and Tech Specs that can provide adequate or equivalent protection is immediately apparent. (1.5)

REFERENCE
SAP pg. 49
EPP pg. 5-3

SWPWGK&A 36 4.7

ANSWER 8.10 (3.50)

a. 2 (0.5)

b. Within 15 minutes (0.2)
   1. Restore the indicated AFD to within the target band (0.4), or
   2. Reduce the thermal power to <90% of rated thermal power. (0.4)

c. Accumulated penalty over the past 24 hours is 89 minutes. (1.0) The penalty will be reduced to 60 minutes at 1618 minutes on 05/13/85 and then power may be increased. (1.0)

85%	0318-0310	=	8			(0.25)
65%	1637-1557	=	40			(0.25)
45%	0310-0148	-	82/2	=	41	(0.5)
					--	
					89 min. total penalty	

05/13/85, from 1557; 81 min left -60 - 21 min -> 1618 05/13/85 (1.0)

REFERENCE
TS 3.2.1; TS pg. B 3/4 2-2

3.9 015 020 Sys gen 5 3.9

LP-SQS-2.1 3,7

ANSWER 8.11 (3.00)

a. Review plant status by inspection of control room instrumentation
Review entries in logs
Conduct a briefing with the off-going NSOF using Shift Relief Turn-over Checklist (0.33 each)

b. The Nuclear Shift Supervisor (0.33) expresses permission via the Equipment Clearance Permit (0.33) and Maintenance Work Request (0.33)

c. No (0.5). Technical evaluation has to be done with OSC concurrence prior to installation (0.5).

REFERENCE
SAP pgs. 12, 27, 23

SWPWGK&A 14 4.0

Attachment 2

SENSITIVE INFORMATION MASTER

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: BEAVER VALLEY 1&2

REACTOR TYPE: PWR-WEC3

DATE ADMINISTERED: 86/07/22

EXAMINER: BARBER, S.

APPLICANT: KEY

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~~ 24.00	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~~ 23.00	25.00	________	________	4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
~~100.00~~ 97.00	100.00	________	________	TOTALS

FINAL GRADE ________________%

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

____
APPLICANT'S SIGNATURE

Marked up 8/19/86
S Barber

QUESTION 1.01 (2.50)

a. For an operator taking data for a 1/M plot, how will the Shutdown margin (SDM) affect the time elapsed before a stable count rate can be obtained after withdrawing rods ? (0.75)

b. How will the initial count rate affect the count rate at criticality ? (0.75)

c. If the speed of the control rods were to somehow increase. What would be the effect be on:

1. Rod height at criticality ? (0.5)

2. Count rate at criticality ? (0.5)

QUESTION 1.02 (2.00)

a. Does Beta bar effective increase, decrease, or remain the same from BOL to EOL? Explain your answer. (1.5)

b. For two equivalent positive reactivity additions to a critical reactor, will the SUR be the same, larger, or smaller at EOL as compared to BOL? No explanation is necessary. (0.5)

QUESTION 1.03 (2.00)

The reactor is at 100% power at EOL. Rods are at 220 steps on Bank D. Boron concentration is 300 ppm. Power must be reduced to 75%. If rods will be inserted to 129 steps on Bank D, what will be the final boron concentration at equilibrium conditions at 75% power? Use the Figures 50-6, 50-7, 50-8, 50-10 attached. Show all work and state all assumptions.

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

QUESTION 1.04 (3.00)

Compare the Actual Critical Position (ACP) for a startup to be performed 4 hours after a trip from 100% power, to the Estimated Critical Position (ECP) if the following events/conditions exist. Consider each separately and independently. Indicate whether the ACP is HIGHER than, LOWER than or the SAME as the estimated critical control rod position. Briefly explain the reason for each of your answers.

a. The THIRD coolant pump is started two minutes prior to criticality.

b. The startup is delayed until 8 hours after the trip.

c. The steam dump pressure setpoint is increased to a value just below the Steam Generator Atmospheric Dump (PORV) setpoint.

d. An entire string of feedwater heaters is taken out of service just prior to criticality.

QUESTION 1.05 (2.50)

A clean core is started up and taken to 50 % power, where it remains for 30 days:

a. Describe the reactivity changes the operator must compensate for due to fission product poisons. (1.5)

b. After 30 days power is increased to 100%. Explain any further reactivity changes required. (Specific reactivity values are NOT required) (1.0)

NOTE! Indicate approximate time and duration of reactivity changes.

QUESTION 1.06 (3.00)

How will the following paramater changes affect control rod worth? Explain.

A.Tave increases 5 degrees F (1.0)

B.Boron Concentration increases 50 PPM (1.0)

~~C.Fuel Burnup over core life (1.0)~~ DELETED

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

QUESTION 1.07 (2.00)

a. Why is the limit for the overtemperature Delta T trip based on not reaching saturation conditions in the hot legs?

b. Refer to figure 2.1-1 attached.

Operation within the limits of the 2250 psia curve from ~98% power- ~622-F Tave to ~120% power- 590-F Tave will prevent exceeding what specific minimum plant thermal criteria? Include any applicable setpoints.

QUESTION 1.08 (2.50)

Assume one RCP trips at 30% power without a reactor protection system actuation or a change in turbine load. Briefly discuss HOW and WHY each of the following parameters will change.

a. Flow in the operating Reactor Coolant Systems loops. (0.5)

b. The ratio of core flow compared to the total loop flow. (Core flow/Total loop flow) (0.5)

c. Reactor vessel delta-P. (0.5)

d. Actual Core delta-T. (0.5)

e. Steam temperature in a steam generator in an operating loop. (0.5)

QUESTION 1.09 (2.50)

Briefly explain how and why fuel centerline temperature is affected by the following:

a. Fuel densification. (1.0)

b. Interstitial absorbtion of fission gasses in the fuel pellets. (0.75)

c. Clad creep. (0.75)

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

QUESTION 1.10 (3.00)

a. A variable speed centrifugal pump is operating at 1/4 rated speed in a CLOSED system with the following parameters:

Power = 300 KW
Pump delta P = 50 psid
Flow = 880 gpm

What are the new values for these parameters when the pump speed is increased to full rated speed? (1.5)

b. Choose the answer that most correctly completes the sentence. (0.5)

"In a CLOSED system, two single stage centrifugal pumps operating in parallel will have--(choose-from-below)--, as compared to the same system with one single stage centrifugal pump operating with one pump isolated."

1. double the head and double the flow rate.

2. the same head and the same flow rate.

3. the same head and double the flow rate.

4. double the head and the same flow rate.

c. How does the available NPSH change when system flowrate is increased ? (0.5)

d. Why is cavitation undesirable? (0.5)

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

QUESTION 2.01 (2.00)

Match each RCS system penetration in Column A to its correct location in Column B.

COLUMN A	COLUMN B
a. Excess Letdown	1. Loop A Hot Leg
b. Normal Letdown	2. Loop C Hot Leg
c. RHR Cooldown Suction	3. Loop A Cold Leg
d. Pzr Surge Line	4. Loop B Cold Leg
e. Normal Charging	5. Loop C Cold Leg
	6. Loop B Hot Leg

QUESTION 2.02 (2.50)

a. Explain why the flowrate through the RCP #1 seal is not constant for all plant conditions. (1.0)

b. How is the #1 seal return flowpath affected by a Containment (cntmt) phase " A " isolation ? (1.0)

c. What determines the differential pressure across the RCP #1 seal? (0.5)

QUESTION 2.03 (2.50)

a. How is the interlock associated with 4160 Bus 1A supply breakers ACB 41A&C bypassed so that a live bus transfer can be conducted? (0.5)

b. What plant condition will cause automatic closure of the Emergency Diesel Generator output breaker ? (0.5)

c. What are the three 4160 volt loads (motors) capable of being supplied by either safeguards bus 1AE or 1DF? (1.5)

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

QUESTION 2.04 (2.50)

a. Describe the opening interlocks associated with the RHR inlet isolation valve (MOV-1RH-701).Include setpoints where applicable. (1.0)

b. State the TWO conditions that must be satisfied for Automatic Recirculation Sump valve, opening for Cold Leg Recirculation. (1.0)
ASSUME VALVE NUMBERS 860A & 860B

c. How does RCS pressure change if a RCP is started when RHR is controlling plant pressure and temperature under solid conditions ? Assume a plant cooldown has just been completed using RHR from 250 F to 150 F. (0.5)

QUESTION 2.05 (1.50)

Indicate whether the following statements concerning the Feedwater and Condensate system are TRUE or FALSE.

a. At 300 psig feed pump suction pressure (decreasing), a condensate ~~booster~~ Deleted pump will auto start, if available.

b. 70 % SG level will trip a feedwater pump/turbine.

c. If a Main Feedwater Pump's recirculation valve doesn't open shutdown the pump.

QUESTION 2.06 (2.50)

a. State the rated flow of each type of auxiliary feedwater pump below:
- motor driven.
- turbine driven. (1.0)

b. State FOUR conditions/signals that will automatically start the MOTOR driven auxiliary feedwater pump. (Include coincidences) (1.0)

c. Why does the turbine driven auxiliary feedwater pump's recirculation valve open at 255 gpm ? (0.5)

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

QUESTION 2.07 (3.00)

a. List 3 sources of hydrogen found in containment post-LOCA (1.5)

b. The containment air hydrogen concentration must be kept below ____ percent by volume to prevent the possibility of an explosion in containment. (Provide value) (0.5)

c. What two systems provide for hydrogen removal post-LOCA ? (1.0)

QUESTION 2.08 (3.00)

For the following components, indicate whether they will receive an OPEN CLOSE, or NO signal upon safety injection initiation due to low RCS pressure.

a. Control room supply and exhaust ducts
b. Main feed bypass valves
c. SI accumulator discharge isolation valves
d. Normal charging containment isolation valve
e. Main steam isolation valves
f. RWST to charging pump suction valves
g. Boron recirc to BIT isolation valves
h. VCT outlet isolation valves
i. Component cooling isolation from letdown heat exchanger
j. Steam supply valves to turbine-driven feed pump

QUESTION 2.09 (3.00)

a. Provide THREE Component Cooling (CCW) system alarms that could indicate a RCS to CCW leak.

b. Describe, in detail, how the CCW system is protected against an overpressure condition if a RCS to CCW rupture occurred in the RCS Thermal Barrier.

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

QUESTION 2.10 (2.50)

If a Recirculation Spray Heat Exchanger tube rupture were to occur during operation with a large break LOCA in progress, what would be:

a. The indication to alert the operator of this occurence? (0.5)

b. The consequences of no operator action? (1.0)

c. How would the operator recover from this event? (Give the basic steps that are necessary - valve and instrument numbers, etc. not required.) (1.0)

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

QUESTION 3.01 (3.00) Assume RTD is Control channel

The plant is operating at 80% power when a Thot RTD fails high. Briefly EXPLAIN how this failure will affect the following. Consider each item independently. Assume no operator action and all control systems are in automatic.

a. Rod insertion limit setpoint (0.75)

b. Charging flow (initially) (0.75)

c. Control rod bank position (0.75)

d. Steam dump control system (0.75)

QUESTION 3.02 (3.00)

Briefly describe any AUTOMATIC actions and alarms associated with the following Process Radiation Monitoring System channels.

a. Condenser Air Ejector Vent Monitor (RM-1SV-100) (0.8)

b. Gaseous Waste Particulate Monitor (RM-1GW-108A) (0.8)

c. Containment Purge Exhaust Monitor (RM-1VS-104A,B) during REFUELING operations. (1.4)

QUESTION 3.03 (3.50)

a. How might overcompensation of one intermediate range excore detector be recognized on the startup RATE meters after a reactor trip ? Consider response immediately after the trip and 5-10 minutes after the trip. (0.75)

b. Intermediate range channel N35 is reading 10^{-11} amps while channel N36 is reading 10^{-10} amps. Using the Source Range, how would you verify which channel is reading correctly? (0.75)

c. 1. Explain the effect of an adjustment of the 'summing and level amp gain adjust pot' on the N50 current comparator and the power range (PR) level indication. (0.75)

2. Why should caution be used when adjusting this pot while at power? (0.75)

3. When is this pot adjusted while at power? (0.5)

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

QUESTION 3.04 (2.00)

Indicate whether the following situations will ARM ONLY, ARM AND ACTUATE or HAVE NO EFFECT on the steam dump system.

a) 50% power, 18% step load increase, Tavg is 6 F less than Tref, steam dumps are in the Tavg mode of operation

b) 80% power, 7.5%/min ramp decrease in turbine load for 3 minutes, Tavg is 7 greater than Tref, steam dumps are in the Tavg mode of operation

c) Hot Zero Power, Tavg=549 F, steam dumps are in the STM PRESS mode with 985 psig set into the steam pressure controller

d) Reactor trip, Tavg=549 degrees, steam dumps in Tavg mode

QUESTION 3.05 (2.50)

a. List two control rod interlocks that will prohibit rod withdrawal in automatic only AND explain the necessity for these interlocks. (1.0)

b. List and explain the 5 functions of (or automatic actions resulting from) an urgent failure in the Rod Control System. (1.5)

QUESTION 3.06 (1.50)

TRUE or FALSE

a. The interceptor and govenor valves are the ONLY valves closed by the Overspeed Protection Controller.

b. The throttle and reheat stop valves are th ONLY valves closed by the Overspeed Trip Mechanism.

c. The reheat stop and interceptor valves are opened when the turbine is latched.

QUESTION 3.07 (3.00)

List all the automatic signals that will cause a safety injection. Include setpoints and coincidence/logic. Do not include manual SI.

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

QUESTION 3.08 (2.00)

Indicate whether the Over Temperature Delta Temperature (OT-DeltaT) trip setpoint will INCREASE, DECREASE, or REMAIN THE SAME for the following parameter changes. Consider each separately.

a. Increasing Tavg.

b. Tavg decreasing to less the than rated full power Tavg.

c. Delta I becoming more negative.

d. Pressurizer Pressure increasing.

QUESTION 3.09 (2.50)

a. Provide TWO additional (different/separate) AUTOMATIC signals other than High-High S/G water level, which will generate a a feedwater isloation signal. (Setpoints are not required) (1.0)

b. List ALL the additional automatic actions associated with High-High SG water level, other than feedwater isolation valve closure. (MOV-FW-156 A,B,C) (1.5)

QUESTION 3.10 (2.00)

Plant load is 50% and the Chemical and Volume Control System (CVCS) in a normal lineup and controlling pressurizer level fails high. Assuming no operator action, state the sequence of events that would occur until stable plant conditions are reached or until the reactor trips. Include applicable setpoints.

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

QUESTION 4.01 (3.25)

a. List five conditions that require Emergency Boration of the RCS. (2.25)

b. How is Emergency Boration initiated ? (1.0)

QUESTION 4.02 (3.00)

Answer the following concerning Adherence to Operating Procedures.

a. What two conditions do not require a procedure to be present (at the location) and open (readable)? (1.0)

b. There are two specific instances that allow deviation from procedures, license conditions and/or Tech Specs. In one circumstance prior SRO approval is needed. In the other, no prior approval is required. What are these two circumstances? (2.0)

QUESTION 4.03 (3.00)

List the immediate action sub-steps from E-0, 'Reactor Trip or Safety Injection' that allow you to accomplish the following immediate actions:

a. Check if SI is actuated (1.0)

b. Verify Generator Trip (1.0)

c. Verify AFW pumps running (1.0)

QUESTION 4.04 (3.00)

Answer the following questions regarding EOP 35 FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK:

a. List the two separate circumstances which warrant entry into this procedure. Include any applicable setpoints. (1.5)

b. What action is required if, during this procedure, the RWST level decreases to less than 20 feet ? (0.5)

c. What symptoms must be present before a SG is considered " hot/dry ". (1.0)

QUESTION 4.05 (2.50)

During a serious emergency, operators may be called upon to assist in search and rescue or recovery operations in the plant.

a. In such cases, what dose could you receive:

1) To bring an injured worker to safety? (0.5)
2) To eliminate the further escape of radioactive effluents ? (0.5)

b. What are the possible effects of receiving radiation exposures of the levels of 50 rem ? Include short and long term effects. (1.0)

c. Who must authorize this voluntary radiation exposure up to the emergency limits ? (0.5)

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

QUESTION 4.06 (3.00)

The following questions pertain to Procedure E-1, Loss of Reactor or Secondary Coolant.

a. If SI is terminated and RCS pressure decreases to less than 250 psig, then what action is required ? (0.5)

b. What are TWO circumstances per E-0 which require shutdown of the Reactor Coolant Pumps? One circumstance relates to the steam generators, the other relates to a RCP support system. (1.5)

c. The minimum pressurizer level required to terminate Safety Injection is not the same if containment conditions are adverse compared to normal. Which condition requires the higher level (adverse or normal) ? WHY ? (1.0)

QUESTION 4.07 (2.00)

a. Per AOP-43, High Reactor Coolant Activity, what three plant conditions may cause high RCS activity due to the release of irradiated corrosion products? (1.0)

b. In the event of high RCS activity, what is the reason for securing the following: containment sump pumps, primary drain pumps and their containment isolation valves, containment vacuum pumps, and containment isolation valves for reactor plant sample systems? (0.5)

c. An increased concentration of what two gases sampled from the VCT gas sample space would be indicative of failed fuel? (0.5)

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

QUESTION 4.08 (3.00)

Answer the following questions concerning reactor startup.

a. What are the MINIMUM requirements for Source and Intermediate range operability (# required) prior to startup?

b. What is the MINIMUM temperature for criticality?

c. What is the MAXIMUM startup rate permitted under normal conditions?

d. What is the MINIMUM number of RCPs required to be running prior to startup utilizing control rods?

e. When is it permissible to block the Source Range (SR) high flux trip?

QUESTION 4.09 (2.25)

a. State the Safety Injection termination criteria as presented in E-0. List setpoints, if applicable. (1.25)

b. State the Safety Injection reinitiation criteria as presented in E-0. List setpoints, if applicable. (1.0)

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

COPY No. 1

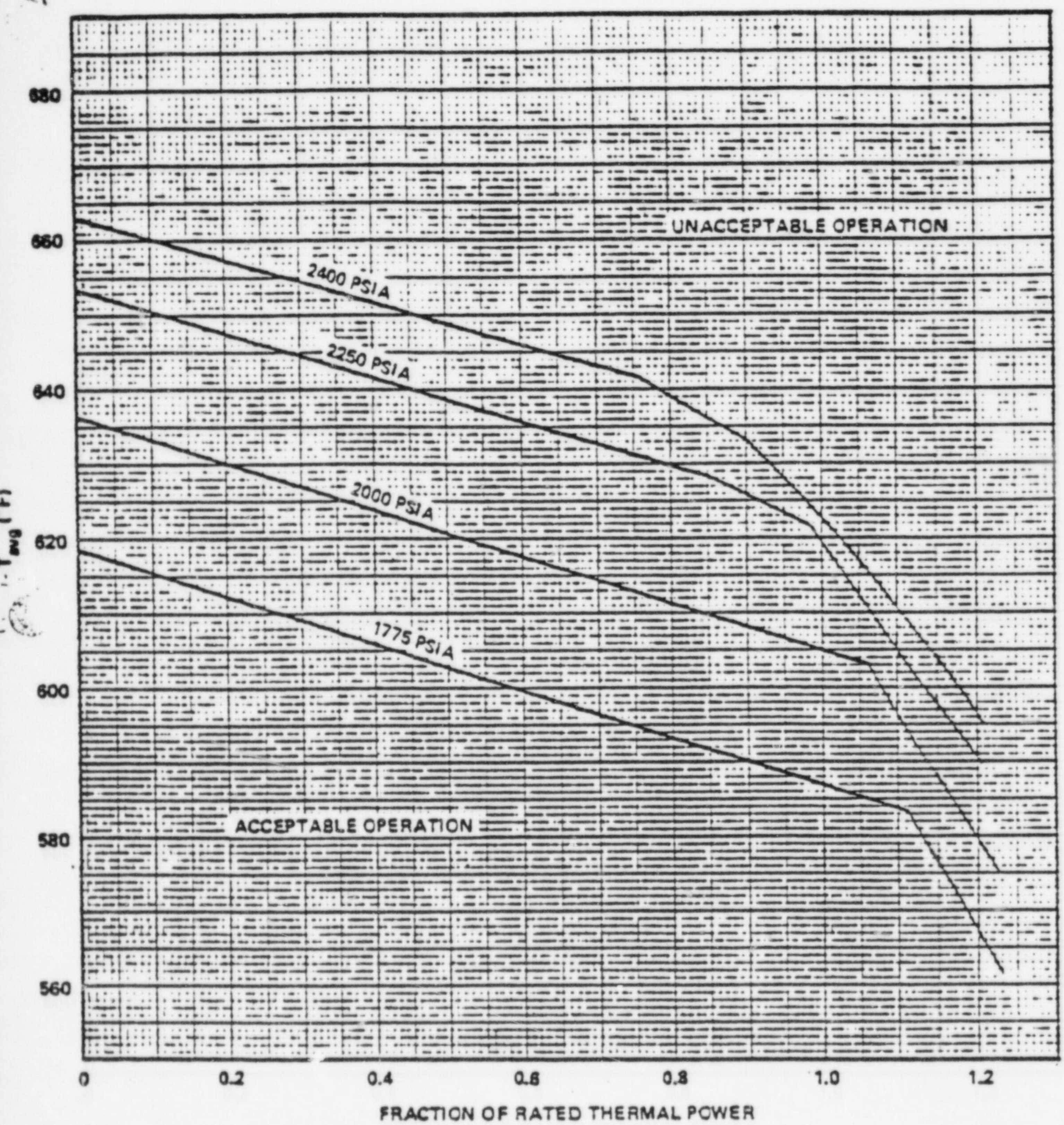
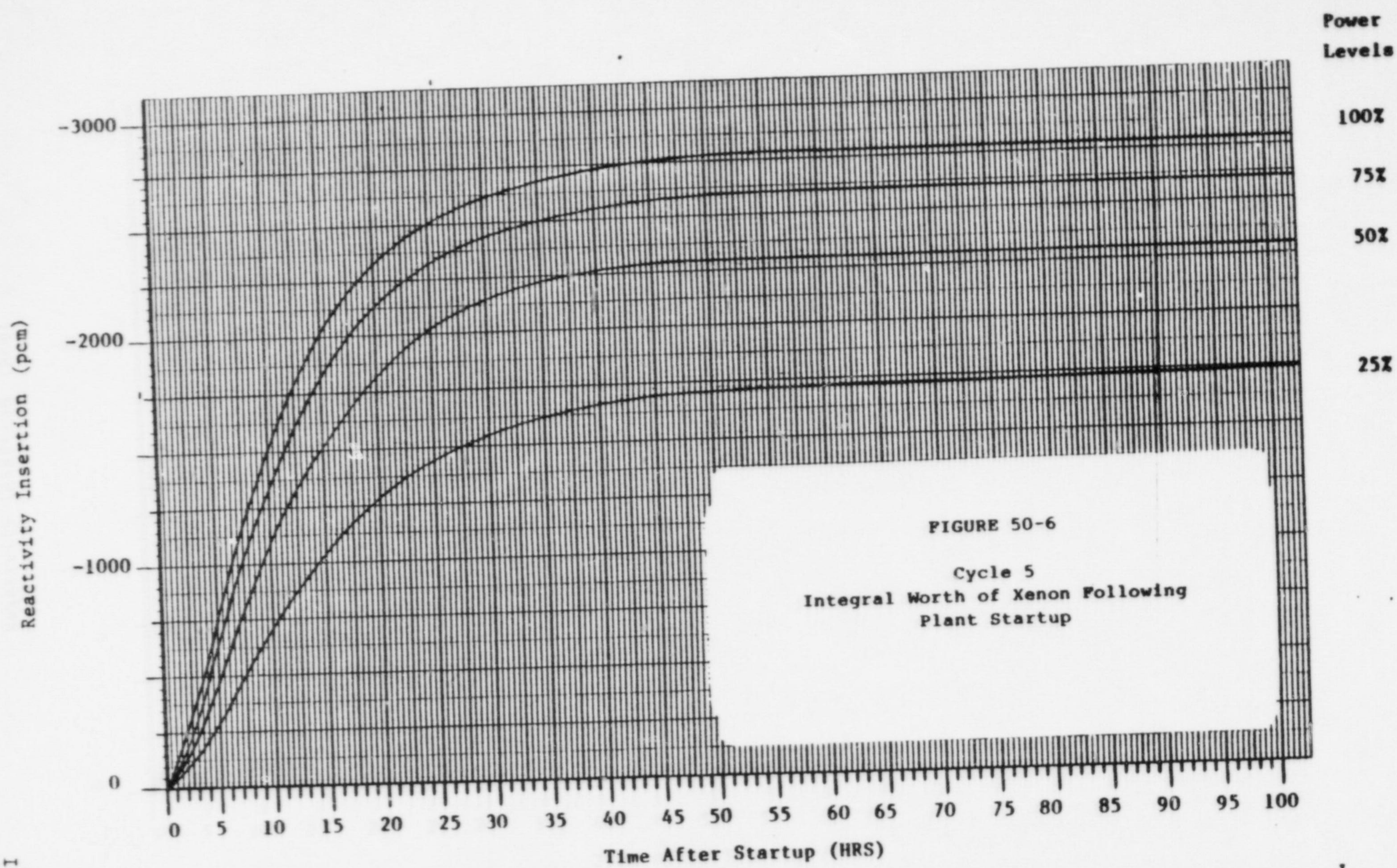


FIGURE 2.1-1 REACTOR CORE SAFETY LIMIT - THREE LOOPS IN OPERATION



Integral Worth of Xenon Following Plant Startup

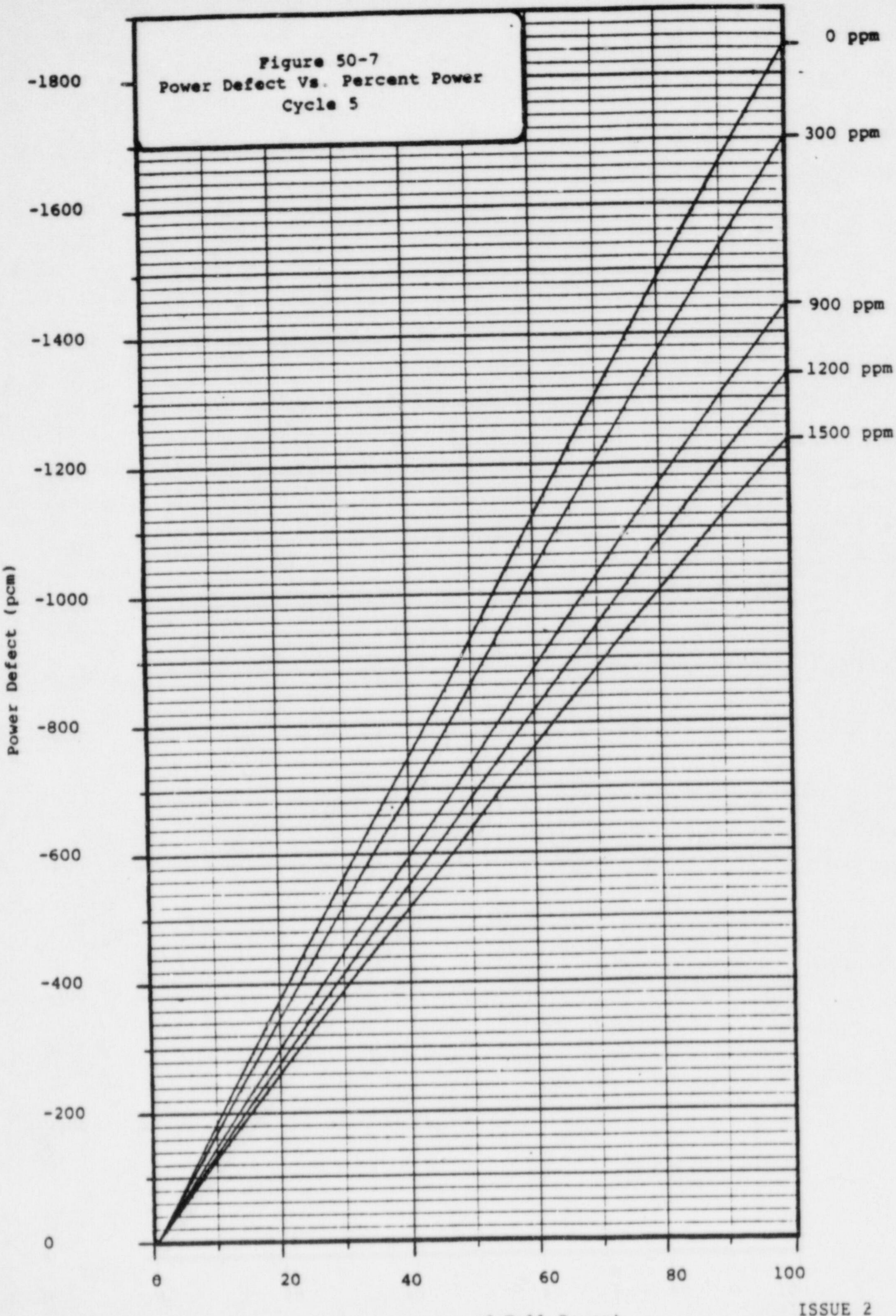


Figure 50-7
Power Defect Vs. Percent Power
Cycle 5
-1800
-1600
-1400
-1200
-1000
-800
-600
-400
-200
0
Power Defect (pcm)
0 ppm
300 ppm
900 ppm
1200 ppm
1500 ppm
0
20
40
60
80
100
Power Level (Percent of Full Power)

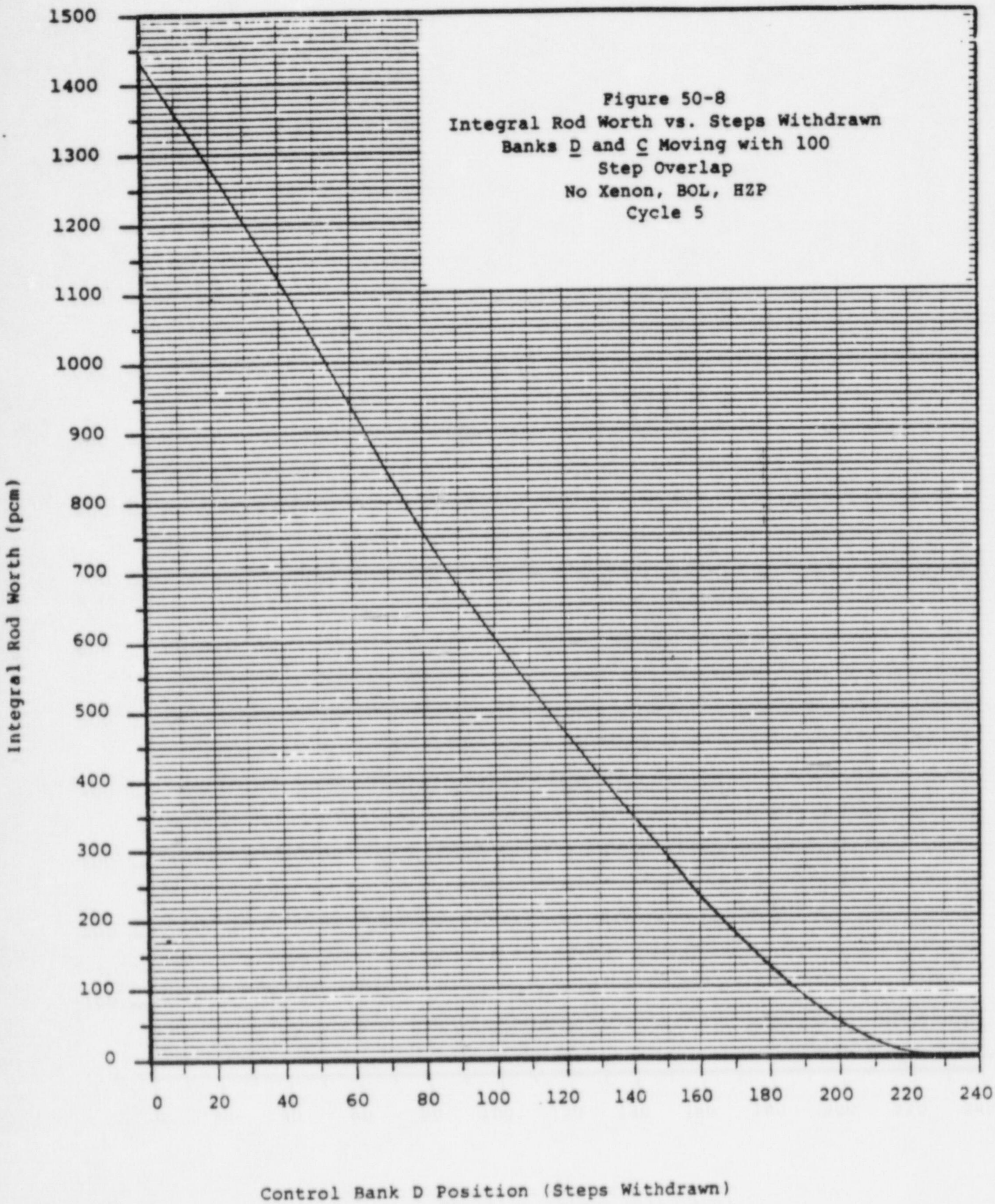


Figure 50-8
Integral Rod Worth vs. Steps Withdrawn
Banks D and C Moving with 100
Step Overlap
No Xenon, BOL, HZP
Cycle 5
Integral Rod Worth (pcm)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
200
220
240
Control Bank D Position (Steps Withdrawn)

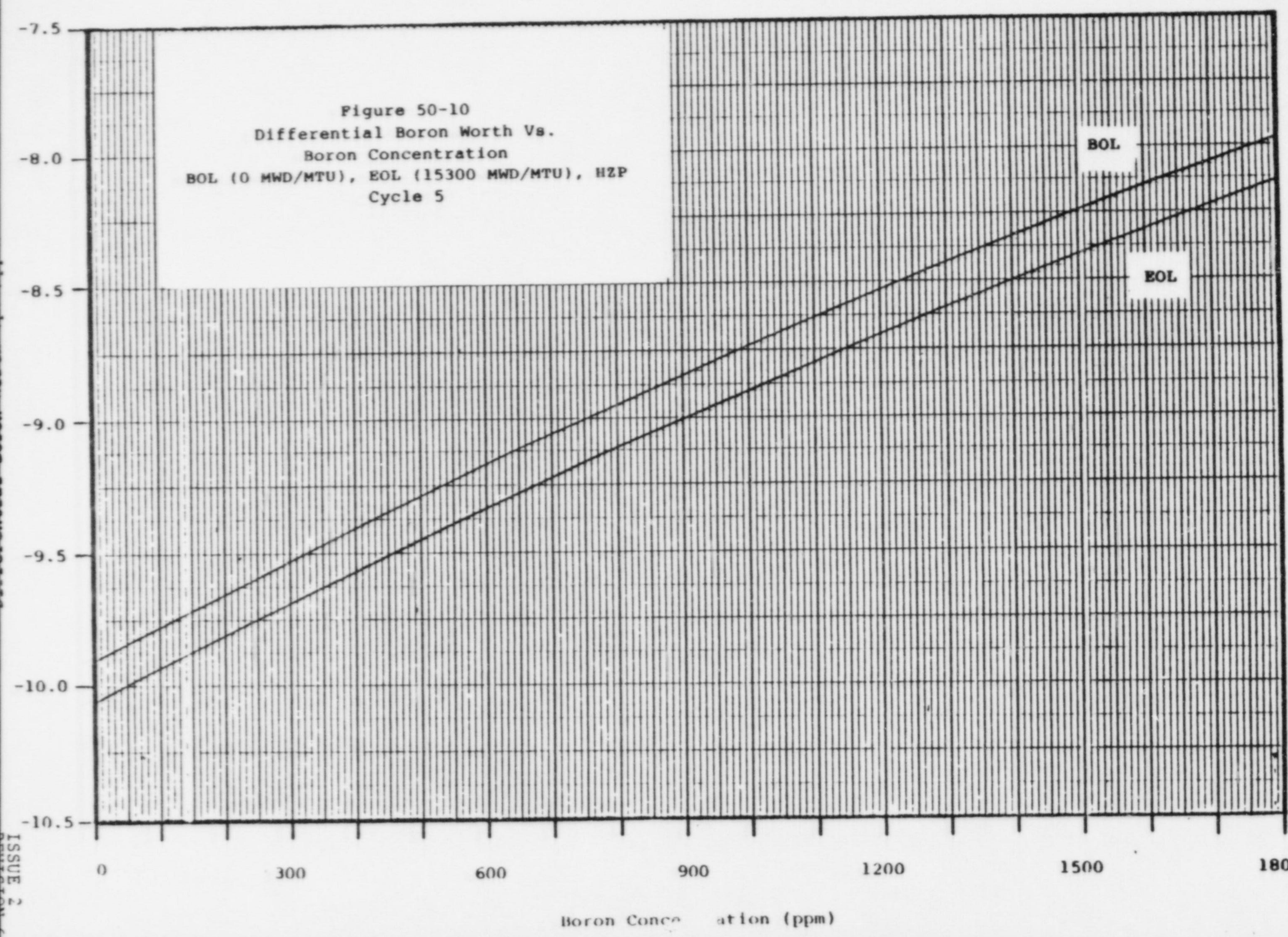


Figure 50-10
Differential Boron Worth Vs.
Boron Concentration
BOL (0 MWD/MTU), EOL (15300 MWD/MTU), HZP
Cycle 5
BOL
EOL
-7.5
-8.0
-8.5
-9.0
-9.5
-10.0
-10.5
0
300
600
900
1200
1500
1800
Boron Conce ation (ppm)

EQUATION SHEET

$f = ma$

$v = s/t$

Cycle efficiency = (Network out)/(Energy in)

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N$

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

$PE = mgh$

$V_f = V_o + at$

$w = e/t$

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

$W = v\ \Delta P$

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

$\Delta E = 931\ \Delta m$

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

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

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

$Pwr = W_f \Delta h$

$I = I_o e^{-ux}$

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

$TVL = 1.3/u$

$HVL = -0.693/u$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = (1 - K_{eff0})/(1 - K_{eff1})$

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

$\ell^* = 10^{-5}$ seconds

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

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

$I_1 d_1 = I_2 d_2$

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

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

$\Sigma = \sigma N$

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

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

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

    a. Assemble your examination as follows:

        (1) Exam questions on top.

        (2) Exam aids - figures, tables, etc.

        (3) Answer pages including figures which are a part of the answer.

    b. Turn in your copy of the examination and all pages used to answer the examination questions.

    c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

    d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

ANSWER 1.01 (2.50)

a. The closer to criticality, (less SDM) the longer time required to reach a stable count rate. (0.75)

b. A higher initial count rate will result in a higher count rate at criticality. (0.75)

c. 1. Critical rod height is not affected. (0.5)

2. Critical count rate will be lower. (0.5)

REFERENCE
BVPS Reactor Theory Manual, Ch 5, pg 39-41

EO 11

001/010 K5.08 2.9/3.2 pg 3.1-7

ANSWER 1.02 (2.00)

a. Decreases (0.5) Pu 239 concentration increases and Pu 239 has a smaller beta. (1.0)

b. Larger SUR (0.5)

REFERENCE
BVPS Reactor Theory Manual, Ch 5, pg 14-17

EO 3

001/000 K5.47 2.9/3.4 pg 3.1-3

ANSWER 1.03 (2.00)

Power Defect:	1700 pcm - 1290 pcm =	+ 410 pcm	(0.5)
Xe:	2800 pcm - 2600 pcm =	+ 200 pcm	(0.5)
Rods:	5 pcm - 405 pcm =	- 400 pcm	(0.5)
		+ 210 pcm	

Boron must supply ~~410~~ 210 pcm of negative reactivity

210 pcm X (ppm/9.7 pcm) = 22 ppm (0.25)
300 ppm + 22 ppm = 322 ppm (0.25)

REFERENCE
BVPS Reactor Theory Manual, Ch 9, pg 3-8

EO 5

001/010 K5.21 3.4

ANSWER 1.04 (3.00)

a. SAME (0.25) Steam dumps will compensate for any additional heat added by the ~~fourth~~ third RCP. RCS temperature/reactivity unchanged. (0.75)

b. ACP HIGHER than ECP (0.25) Xenon will increase to near peak at 8 hours after trip. Rods must be higher to compensate. (0.75)

c. ACP HIGHER than ECP (0.25) The corresponding temperature increase must be compensated by a higher critical rod position. (0.75)

d. ACP ~~LOWER than~~ Same as ECP (0.25) ~~The reduction in FW temperature (and hence Tc) must be compensated by a lower rod position.~~ There is no steam flow through the turbine, and therefore, no extraction steam flow. Hence, the feedwater is not preheated during a startup and there is no reactivity effect. (0.75)

REFERENCE
BVPS Reactor Theory Manual, Ch 9, pg 7-9

EO 4,6

004/000 A4.02 3.2/3.9 pg 3.1-18

ANSWER 1.05 (2.50)

a. The operator must ~~withdraw rods or dilute the RCS (0.6) to~~ compensate for the build up of Xenon to equilibrium in 40-50 hours ~~(0.6)~~ 0.4 and Samarium in ~~400-500 hours.~~ 13-14 days or 335hrs ~~(0.3)~~ (0.6)

b. Again Xenon will increase to a new higher equilibrium value in 40-50 hours. (0.6) Samarium reactivity will not change. (0.4) (Both may undergo a slight dip before increasing to or returning to equilibrium)

REFERENCE
BVPS Reactor Theory Manual, Ch 7, pg 13,22,23

EO 2,3,4,8,10

001/000 K5.33 3.2/3.5 pg 3.1-3
K5.35 2.1/2.5

ANSWER 1.06 ~~(3.00)~~ 2.00

a. Increases (0.25) moderator becomes less dense, neutrons can travel further higher probability of reaching a control rod, therefore rod worth increses. (0.75)

b. ~~Increases~~ (0.25) increased concentration ~~shifts flux spectrum more to the epithermal and thermal energy range. Control rods are black to neutrons in these ranges.~~ causes more competition for neutrons in the thermal energy range (0.75)

~~c. Increases (0.25) Explanation same as above (0.75)~~ Deleted

REFERENCE
BVPS Reactor Theory Manual, Ch 8, pg 14-16

EO 8

001/010 K5.04 2.2/2.8 pg 3.1-2

ANSWER 1.07 (2.00)

a. If core exit conditions reach saturation the enthalpy rise will no longer be proportional to the delta T across the core. Therefore the OT Delta T trip no longer provides adequate protection. (1.0)

b. Prevents exceeding the DNBR limit (0.75) of 1.3 (0.25).

REFERENCE
BVPS Thermo. Manual, Ch 7, pg 19-20

LP-SOS-1.1 EO 4

PWG 5 2.9/3.9 pg 2-1

ANSWER 1.08 (2.50)

a. Increase - due to reduction in back pressure from other loops.
b. Decrease - due the backflow in the idle loop.
c. Decrease - due to less flow resistance across the core.
d. Increase - less flow ~~- less~~ at the same heat removal ~~and~~ causes higher ~~exit~~ delta temperature.
e. Decrease - increased delta T means lower Tc and since S/G temp. is always slightly < Tc, S/G temperature is less.

(0.2) direction
(0.3) explanation

REFERENCE
BVPS Thermo. Manual, Sect 4.8

Comp Pump-Centrifugal No. 7 2.3/2.3 pg A-10

ANSWER 1.09 (2.50)

a. Fuel centerline temperature (FCT) increases (0.5) due to densification resulting in increased gap between fuel and clad. Therefore a larger delta T will be necessary to transfer the heat. (0.5)

b. FCT decreases (0.25) due to gradual swelling of fuel which reduces the gap between fuel and clad. So, a smaller delta T will transfer the heat. (0.5)

c. FCT will decrease (0.25) clad creep causes the gap to decrease. So, a smaller delta T will transfer the heat. (0.5)

REFERENCE
BVPS Thermo. Manual, Ch 2, Sect 2.6

Comp HX and Cond. No. 9 2.4/2.5 pg A-17

ANSWER 1.10 (3.00)

a. $\text{Power}(2) = \text{Power}(1) * (N2/N1)^3 = 300 * (4)^3 = 19.2$ MW (0.5)

$\text{Delta P}(2) = \text{delta P}(1) * (N2/N1)^2 = 50 * (4)^2 = 800$ psid (0.5)

$\text{Flow}(2) = \text{Flow}(1) * (N2/N1) = 880 * 4 = 3520$ gpm (0.5)

b. 3 (0.5)

c. DECREASES (0.5)

d. It causes pump damage (erosion, pitting and vibtration). (0.5)

REFERENCE
BVPS Thermo. Manual, Ch 4, pg 31-35

Comp Pump-Centrifugal No.9 2.1/2.2 pg A-10
No.23 2.1/2.3
No.10 3.4/3.6
No.29 3.0/3.1

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 2.01 (2.00)

a. 5
b. 3
c. 1
d. 2
e. 4 5 items (0.4) ea.

REFERENCE
BVPS Flow Diagrams, Fig. NS-3-1

LP 2336 EO 3

002/000-K1.06 (3.7/4.0)
-K1.08 (4.5/4.6)
-K1.09 (4.1/4.1)

ANSWER 2.02 (2.50)

a. As the plant pressure changes so will the delta-P across the #1 seal thus changing the seal flowrate. (1.0) ~~[.5] Flow is high at high pressures and low at low pressures. [.5]~~ (1.0)

b. Seal return cntmt isolation valves close. (MOV-CH-378&381) (1.0)

c. RCS pressure compared to the backpressure created by the VCT. (0.5)

REFERENCE
BVPS OM 6, Sect 1.6.1, pg 24
OM 1, Sect 1.1.5, pg 9
OM 7, Sect 1.7.4, pg 62

LP 2336 EO 2

003/000 K6.04 2.8/3.1 pg 3.4-2
A1.09 2.8/2.8 pg 3.4-3
A2.01 3.5/3.9

ANSWER 2.03 (2.50)

a. The live bus transfer switch must be in the 'on' position. (0.5)

b. Emergency bus (1AE or 1DF) undervoltage signal. (0.5)

c. Reactor plant CCW pump (CC-P-1C)
Reactor plant river water pump (WR-P-1C)
Charging/HHSI pump (CH-P-1C) [0.5 ea.] (1.5)

REFERENCE
BVPS OM 36, Sect 1.36.1, pg 7,8,26
Sect 1.36.4, pg 7

LP-SQS-36.1 EO 2,4,7

062/000 K2.01 3.3/3.4 pg 3.7-1
K3.02 4.1/4.4 pg 3.7-2
K4.03 2.8/3.1

ANSWER 2.04 (2.50)

a. 1. - RCS pressure < 430 psig. (auto close at 630 psig).
- Pzr. temp < 475 F (1.0)

b. 1. RWST Low-Low level (19'2.5" or 20' or 2/4 RWST low lvl alarm)
2. SI signal present. (1.0)

c. RCS pressure will increase (due to cold water from the RCP volute being rapidly heated in the steam generator [SG]) (0.5)

REFERENCE
BVPS OM 10, Sect 1.10.2, pg 3,7
ES-1.3, Attach. 2, pg 1

LP-SQS-10.1 EO 4,7

005/000 K4.07 3.2/3.5 pg 3.4-8
K5.05 2.7/3.1

ANSWER 2.05 (1.50)

a. TRUE
b. FALSE
c. TRUE

REFERENCE
BVPS OM 22, Sect 1.22.2, pg 5,6

LP-SQS-22.1 EO 3

059/000-K4.03 (2.1/2.3)
-K4.16 (3.1/3.2)
-K4.14 (2.1/2.3)

ANSWER 2.06 (2.50)

a. Motor Driven- 350 GPM (at 2696 ft of head).
Turbine Driven- 700 GPM (at 2696 ft of head). (1.0)

b. low-low levels in 2/~~4~~ 3 S/G's.
Running ~~Both~~ Main Feed pumps trip
Any safety injection signal.
Start signal to FW-P-2 without it developing the required discharge within a time period. 4 items (0.25) ea. (1.0)

c. To prevent pump overheating (0.5)

REFERENCE
BVPS OM 24, Sect 1.24.1, pg 6
Sect 1.24.4, pg 14,15

LP-SQS-24.1 EO 3,7,9,10

061/000 K6.02 2.6/2.7 pg 3.5-42
K4.02 4.5/4.6
K4.08 2.7/2.9

ANSWER 2.07 (3.00)

a. Zirc-water reaction
Radiolytic decomposition of ECCS fluids
Corrosion of metals by solutions used for cntmt spray (1.5)
Dissolution of Hydrogen
Any — 3 items (0.5) ea.

b. 4 (0.5)

c. Containment Atmosphere Purge Blower (1.0)
Hydrogen Recombiner

REFERENCE
BVPS OM 46, Sect 1.46.1, pg 2,8

LP-SQS-46.1 EO 3,4,5

028/000	K5.03	2.9/3.6	pg 3.6-23
	K5.01	3.4/3.9	
	K1.01	2.5/2.5	

ANSWER 2.08 (3.00)

a. NO
b. ~~NO~~ CLOSE
c. OPEN
d. CLOSE
e. NO
f. OPEN
g. CLOSE
h. CLOSE
i. NO
j. NO 10 items (0.3) ea.

REFERENCE
BVPS E-0, Attachment 2

LP-SQS-11.1 EO 4,6

006/000 A3.03 4.1/4.1 pg 3.2-12

ANSWER 2.09 (3.00)

a. RCP Therm Bar Cool Wtr Disch Flow High
RCP Therm Bar High Disch Temp
High CCW Radiation level alarms
Component Cooling Surge Tank Level alarms 3 items (0.5) ea.

b. High flow closes the respective trip valve (TV-1CC-107 A,B,C)
Check valve isolates on reverse flow
Relief valve protects isolated piping Any 3 items (0.5) ea.
Piping is rated for RCS pressure

REFERENCE
BVPS OM 6, Sect 1.6.1, pg 23
Sect 1.6.4, pg 36,43,44

008/000 K3.01 3.4/3.5 pg 3.10-1
A3.01 3.2/3.0 pg 3.10-2

ANSWER 2.10 (2.50)

a. Hi or Hi-Hi activity alarm from radiation monitor on discharge from the HX. (0.5)

b. Introduction of contaminated recirc spray water into river water return OR loss of recirc water inventory from containment (either answer acceptable). (1.0)

c. (Verify alarm)
-Determine adequate recirc spray flow through non-faulted HX's
-Isolate faulted HX [0.5 each] (1.0)

REFERENCE
BVPS OM 30, Sect 1.30.4, pg 61-72

LP-SQS-1.3.1 EO 2,5,6

026/000 K1.02 4.1/4.1 pg 3.6-13

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 3.01 (3.00)

a. Raises the limit, because high dT indicates a higher power. (0.75)

b. Increases to raise pressurizer level to 100% program, because of the higher Tave (0.75)

c. Rods move in, because of the Auct. Tave/Tref mismatch (0.75)

d. No effect, the demand signal is present (Tave/Tref) but there is no arming signal. (0.75)

REFERENCE
BVPS OM 1, Sect 1.1.1, pg 12,20
Sect 1.1.5, Fig 1-14

LP-SQS-1.3 EO 10
LP-SQS-1.4 EO 12
Pressurizer LP EO 3

016/000 K3.02 3.4/3.5 pg 3.9-11
K3.03 3.0/3.1
K3.01 3.4/3.6

ANSWER 3.02 (3.00)

a. High-High alarm (0.2) diverts air ejector discharge to cntmt (0.6)

b. High-High alarm (0.2) closes valves downstream of decay tanks (0.6)

c. High-high alarm (0.2) during refueling will automatically close the purge supply and exhaust dampers,(0.4) activate the local fuel building and local cntmt evacuation alarms (0.4) and opens the main filter bank ~~bank~~ dampers and closes the bypass dampers (0.4)

REFERENCE
BVPS OM 43, Sect 1.43.1, pg 11,15,18

073/000 K4.01 4.0/4.3 pg 3.9-23

ANSWER 3.03 (3.50)

a. Its associated SUR indication would be more negative than the other channel when power is decreasing (0.5) and approximately 5-10 minutes after a trip it will indicate more negative than -1/3 dpm (0.25). (0.75)

b. Compare SR level indication with IR level indication (IR 10 -10 amps = ~ 10 4 CPS on the SR) (0.75)

c. 1. No effect on the current comparator, but it will cause the power range meter to move accordingly. (0.75)

2. Actual protective functions (i.e. Rx trip) may be initiated. (0.75)

3. After a calorimetric (if required). (0.5)

REFERENCE
BVPS OM 2, Sect 1.2.1, pg 16:17
Sect 1.2.4, pg 4
Sect 1.2.5, Fig 2-4

LP-SQS-2.1 EO 3,4,8

015/000 K1.01 4.1/4.2 pg 3.9-5
K3.01 3.9/4.3
K5.02 2.7/2.9

ANSWER 3.04 (2.00)

a) No effect
~~b) Arm and actuate~~ Deleted
c) Arm and actuate
d) Arm ~~only~~ and actuate (0.66 ea.)

REFERENCE
BVPS OM 21, Sect 1.21.1, pg 13-17
System Flow Diagrams, Fig PGS-1-5
PGS-1-6

LP 2352 EO 3,7,8

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

041/020 K4.11 2.8/3.1
K4.14 2.5/2.8

ANSWER 3.05 (2.50)

a. Low power (C-5) interlock (0.2) prevents auto rod motion when impulse power < 15% to preclude unstable operation. (0.3)

High bank 'D' rod stop (C-11) (0.2) prevents outward motion when the bank is near the top to prevent system counter misalignment. (0.3)

b. Deenergizes the lift coils (0.2)

Energizes the stationary and moving gripper coils (0.4)

Stops all automatic rod motion (0.5)

Energizes the urgent failure alarm on the power cabinet (0.2)

Lights annuciator ' ROD CONTROL URGENT FAILURE ' (0.2)

REFERENCE
BVPS OM 1, Sect 1.1.1, pg 18,50
Sect 1.1.5, pg 1,2
Sect 1.1.2, pg 3

LP-SQS-1.3 EO 12,14

001/010 K4.10 3.2/3.4 pg 3.1-7
001/050 A2.01 3.7/3.9 pg 3.1-12

ANSWER 3.06 (1.50)

a. TRUE

b. FALSE

c. TRUE (0.5 ea.)

REFERENCE
BVPS OM 26, Sect 1.26.1, pg 14,26
Sect 1.26.4, pg 5

LP-SQS-26.6 EO 3

045/000 K4.13 2.6/2.8 pg 3.5-10
A4.02 2.7/2.6 pg 3.5-11

ANSWER 3.07 (3.00)

Low Pressurizer Pressure (0.5), <1845 psig (0.3), 2/3 (0.2)

High Containment Pressure (0.5), 1.5 psig (0.3), 2/3 (0.2)

Low Steam Pressure (0.5), <510 psig (0.3), 2/3 detectors on 1/3 S/G (0.2)

REFERENCE
BVPS OM-11, Sect 1.11.2, pg 5

LP-SQS-1.1 EO9

013/000 A4.03 4.5/4.7 pg 3.2-27

ANSWER 3.08 (2.00)

a. DECREASE
b. INCREASE
c. DECREASE (Initially will remain the same)
d. INCREASE [0.5 each]

REFERENCE
BVPS OM 1, Sect 1.1.2, pg 9

LP-SQS-1.1 EO 8

012/000 K6.11 2.9/2.9 PG 3.9-2
A1.01 2.9/3.4

ANSWER 3.09 (2.50)

a. 1. SI
2. Rx trip coincident with Low Tavg (1.0)

b. 1. Both Feedwater pumps trip (FW-P-1A,1B) (0.3)
2. All FW reg valves shut (FCV-FW-478,488,498) (0.4)
3. All FW bypass valves shut (FCV-FW-479,489,499 (0.4) ~~3 items (0.5) ea.~~
4. Turbine Trip (0.4)

REFERENCE
BVPS OM 1, Sect 1.1.5, pg 23

LP-SQS-1.1 EO 5

```
059/000   K4.19   3.2/3.4   pg 3.5-38
          A3.06   3.2/3.3
```

ANSWER 3.10 (2.00)

- Pzr. level will decrease due to charging < letdown.
- 14% Pzr. level isolates letdown.
- Pzr. level increases due to charging > letdown.
- At 92% reactor trip occurs. (No credit for trip on high press due to spray valves' ability to control pressure increase)

4 items 0.5 ea.

REFERENCE
BVPS OM 6, Sect 1.6.1, pg 58
BVPS FSAR, Sect 7, pg 7.7-11 & Fig 7.7-5

Pressurizer LP EO 3

```
011/000   K3.02   3.5/3.7   pg 3.2-21
          K3.03   3.2/3.7

016/000   K3.02   3.4/3.5   pg 3.2-21
```

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 4.01 (3.25)

a. 1. Control rod height below the low-low insertion limit.
   2. Failure of any control rod to drop following a reactor trip.
   3. Uncontrolled reactor cooldown following a reactor trip.
   4. SDM less than requirements of Technical Specifications.
   5. Unexplained or uncontrolled reactivity increase.
   6. Plant shutdown required from emergency shutdown panel
   7. ATWS
   Any 5 items (0.45) ea.

b. 1. Open emergency boration valve (MOV-1CH-350)
   2. Start a boric acid transfer pump in fast
   3 Take manual control of the charging flow control valve and establish maximum flow.
   3 items ~~(0.5)~~ (0.33) ea.

REFERENCE
BVPS OM 7, Sect 1.7.4, pg 47

LP 2337 EO 9,10

004/010 A2.07 3.8/3.9 pg 3.1-21

000/024 EA1.17 3.9/3.9 pg 3.1-45
SWG11 4.0/4.0 pg 3.1-47

ANSWER 4.02 ~~(3.00)~~ (1.00)

a. Emergency procedure immediate action steps (0.5)
   Routine procedures that are frequently repeated (0.5)

b. ~~Prior SRO approval is needed to deviate from TS or license conditions when no action consistent with the TS provides equivalent protection and is immediately apparent (1.0). No approval is needed to take whatever action is necessary to prevent personnel injury or equipment damage (1.0).~~ Deleted

REFERENCE
BVPS Station Admin Proc, Ch. 4, pg 40, 41

PWG 23 2.8/3.5 pg 2-2

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 4.03 (3.00)

a. Any SI annunciator-LIT (0.5)
SI actuation status light -LIT (0.5)

b. Main generator ~~exciter~~ breaker-OPEN (0.5)
Exciter circuit breaker-OPEN (0.5)

c. Motor driven pumps-RUNNING (0.3)
Turbine driven pump-RUNNING (if necessary) (0.3)
Verify AFW discharge valves-FULL OPEN (0.4)

REFERENCE
BVPS E-0, pg 4-6

000/007 SWG-11 4.4/4.5

ANSWER 4.04 (3.00)

a. From E-0 REACTOR TRIP OR SI when minimum AFW flow is not verified. (0.5)

All S/Gs' NR level < 5% with total FW flow to S/G's < 350 gpm (red path condition). (1.0)

b. ECCS should be aligned for cold leg recirc. (0.5)

c. ~~Tave~~ Primary temperature greater than 550 F (0.5)
SG WR level < 10% (0.5)

REFERENCE
BVPS FR-H.1, pg. 2,15

000/054 SWG7 3.6/3.7 pg 3.5-57
SWG10 4.1/4.2

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 4.05 (2.50)

a. 1) 75 REM
2) 25 REM (0.5) each

b. Increased liklihood of cancer, particularly leukemia. Short term somatic effects include blood changes. (1.0)

c. Emergency Director(or authority as delegated by the ED) (0.5)

REFERENCE
BVPS RCM, Chapter 1, p.9

PWG15 3.4/3.9 pg 2-2
PWG16 3.4/3.7

ANSWER 4.06 (3.00)

a. Manually restart LHSI pumps (0.5)

b. High head SI pumps in operation (0.5) and RCS/Highest SG DP less than 145 psid (0.5) or CCW to RCP-NO FLOW INDICATED (0.5)

c. The level must be higher (50% vs 5%) if adverse containment conditions exist (0.5) due to potential reference leg heating which causes indicated level to be higher than actual. (0.5)

REFERENCE
BVPS E-1, pg 8,11

000/011 Gen K/A 7 3.7/4.2 pg 3.3-13
EK3.12 4.4/4.6 pg 3.3-12

ANSWER 4.07 (2.00)

a. Plant heatup, plant cooldown, abnormal pressure/temperature transients (0.33 each)

b. Preclude potential high airborne and increased radiation levels in the auxiliary building (0.5)

c. Krypton Xenon and iodine Any 2 (0.25 each)

REFERENCE
BVPS AOP-43, pg 1, 2

000/076 EK 3.01 3.1
EK 3.05 3.6
Sys gen 5 3.6

LP-2336 EO 5.8

ANSWER 4.08 (3.00)

a. 2 SR 2 IR

b. 541 F

c. ~~2~~ 1 dpm

d. 2 RCPs operating

e. When power is above the P-~~10~~ 6 permissive (1 E-10 amps)

5 items (0.6) ea.

REFERENCE
BVPS OM 50, Sect 1.50.4, pg 26-28
OM 1, Sect 1.1.2, pg 3

PWG 12c 3.5/3.4 pg 2-1

ANSWERS -- BEAVER VALLEY 1&2 -86/07/22-BARBER, S.

ANSWER 4.09 (2.25)

a. RCS subcooling adequate, greater than SCM (in Attachment 5)
Pressurizer level > 5%
Auxiliary feed flow of at least 350 gpm or
Level in at least one S/G > 5%
RCS pressure stable or increasing 5 items 0.25 ea.

b. RCS SCM less than that required (by Attachment 6)
Pressurizer level cannot be maintained > 5% (1.0)

REFERENCE
BVPS OM 53, Sect 1.53.A.1, pg 14,15
013/000 A4.03 4.5/4.7 pg 3.2-27