

Examination Report  
No. 50-445/OL-85-02

Docket No. 50-445

Construction Permit No. CPPR-126

Licensee: Texas Utilities Electric Company  
400 North Oliver Street  
Lock Box 81  
Dallas, Texas 75201

Examinations administered to Comanche Peak Station (CPSES)

Chief Examiner:

J. E. Whittemore  
J. E. Whittemore, Examiner

7/10/85  
Date

Approved by:

R. A. Cooley  
R. A. Cooley, Section Chief

7/11/85  
Date

Summary

Examinations Conducted on April 1-3, 1985.

Written and/or oral examinations were administered to two Senior Reactor Operators, and five Reactor Operators. One Reactor Operator failed the examination and all others passed.

## CPSES EXAMINATION REPORT DETAILS

### 1. Examination Results

Written examinations were administered to five Reactor Operator candidates and oral examinations were administered to two of the five candidates taking the written examinations. Four candidates passed the written and both candidates passed the oral examinations. One candidate failed the written examination.

Written examinations were administered to two Senior Reactor Operator candidates. One of the two Senior Reactor Operators was administered an oral examination. All Senior Operator examinations administered were passed by the candidates.

### 2. Examiners

J. E. Whittemore (Chief Examiner)  
R. A. Cooley  
D. N. Graves  
S. C. McCrory

### 3. This Examination Report is composed of the sections listed below:

#### A. Examination Review and Comment Resolutions

This section reflects comments made by the facility during the examinations review meeting held after completion of the written examinations. In general, editorial comments or changes made during the exam and subsequent review are not addressed. The modifications have been included in the master examination keys which are included elsewhere in this report. The following personnel were present for the exam review:

#### NRC

D. N. Graves  
J. E. Whittemore

#### Utility

R. Hawkins  
D. Hubbard  
T. Lichty  
M. Niemeyer  
C. Turner

Comments and resolutions are listed by section question number.

Comments

1.10 Part c. asks how increasing circ-water flow can increase or decrease overall plant efficiency while the answer key requires the candidate to answer for both conditions. The wording of the question may induce the candidate to answer only half the question.

Resolutions: Accepted the correct reason for increasing or decreasing plant efficiency and allowed full credit for either answer.

3.03 Part c. asks for inputs used to calculate Rod Insertions Limits. The answer key includes Tav<sub>g</sub>. At CPSES, the Tav<sub>g</sub> input is set to zero which may cause examiners to ignore this input.

Resolution: Agree. Tav<sub>g</sub> is not required for full credit answer.

3.05 Part b. asks for plant response to pressurizer level control channel failure low, with no operator action. The key indicates that charging pump suction will shift to RWST on decreasing VCT level. At CPSES, make up rate is sufficient to maintain VCT level and shiftover will not occur.

Resolution: Agree. Key modified.

4.01/7.04 Part a. asks for requirements to increase allowable dose to 3 Rem/Qtr. The question did not stipulate 10 CFR 20 or administrative requirements. The key list managerial approval as a requirement. While proper managerial approval is a CPSES requirement, it is not a 10 CFR 20 requirement and may not be included as a full answer.

Resolution: Disagree. Facility personnel are expected to conform with approved facility procedures.

4.02 Part a. asks for actions required for a dropped fuel assembly striking another assembly. The key assumes fuel assemblies involved were spent fuel. Actions required by referenced procedure differ significantly concerning new fuel versus spent fuel. Since CPSES has no spent or reprocessed fuel on site, the examinee may assume new fuel and answer accordingly. There are no "Immediate Actions" in the sense of memorized operating procedures immediate actions.

Resolutions: Key changed to reflect that assuming spent fuel is not required for full credit answer. The reference lists prompt or initial actions to be taken by a fuel handling accident involving spent or new fuel and these actions are not significantly different. It is expected that a marginally satisfactory operator would inherently possess the knowledge to: (1) evacuate the area, and (2) inform supervision. These minimum actions are required in either case.

6.02 The question asks to list what inputs are supplied to Steam Generator Water Fuel Control. At CPSES, a constant level program is used; therefore, the input from turbine impulse pressure has been removed.

Resolution: Agree. Key modified.

7.03/9.10 CPSES does not require memorization of procedures or attachments other than immediate action steps. We require the individual to be familiar with the procedure and be able to use the procedures to operate the plant.

Resolution: Neither answer was changed to reflect the generic comment above. Question 7.03 did not solicit detailed knowledge, but rather conceptual knowledge of how to determine the location of a leaking component. Any viable method of locating the leak was accepted as a correct answer for full credit. Questions 7.10 sought only to identify equipment operated to specifically preclude voiding and did not solicit detailed procedural knowledge.

B. Exit Meeting Summary

At the conclusion of the CPSES site visit, the examiners met with utility representatives to discuss results of the examinations. The following personnel were present for the exit meeting.

<u>NRC</u>	<u>Utility</u>
R. Cooley	L. Barnes
D. Graves	R. Jones
D. Kelly	R. Seidel
S. McCrory	C. Turner
J. Whittemore	

All candidates were reported to have clearly passed the oral examinations. It was explained to those present that the written examination grades would not be available for at least one month and that the oral exam evaluations did not necessarily reflect written examinations performance.

Areas of general weakness were reported to the facility. The identified weaknesses were found to exist with more than one candidate. The identified weaknesses were as follows:

1. Candidates experienced difficulty in utilizing the unit Curve and Data Book.



2. Candidates exhibited a lack of familiarity with portable radiation survey instruments.
3. Senior Reactor Operator candidates exhibited poor conceptual knowledge of basic plant transients and plant response to abnormalities.
4. Senior Reactor Operator candidates were not familiar with procedures for proper document control, how to assure that drawings are current, and how to tell if design changes have been incorporated.

The utility was informed that preliminary examination results would be available in approximately 30 days.

The meeting concluded with the examiners thanking the utility for their efforts towards the examination effort.

CPSES EXAMINATION REPORT

No. 50-455/OL-85-02

C. CPSES EXAMINATION AND KEY

Date Administered: 4/1/85

Exam Type: Reactor Operator and Senior Operator  
Cold License.

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

FACILITY: COMANCHE PEAK 1  
 REACTOR TYPE: PWR-WEC4  
 DATE ADMINISTERED: 85/04/01  
 EXAMINER: WHITTEMORE, J.  
 APPLICANT: \_\_\_\_\_

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

FINAL GRADE \_\_\_\_\_%

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

\_\_\_\_\_  
APPLICANT'S SIGNATURE

QUESTION 5.01 (2.40)

- a. How will differential boron worth vary with:
1. Increasing RCS temperature ? (0.4)
  2. Increasing Concentration ? (0.4)
  3. Core age ? (0.4)
- b. How will power coefficient vary with:
1. Reactor power at Beginning of life ? (0.4)
  2. Core age ? (0.4)
- c. How does the total power defect change with fuel burnup ? (0.4)

QUESTION 5.02 (1.80)

- a. Describe the most effective method for dampening Xenon oscillations. (1.2)
- b. At a constant power, what is the approximate period of time for a complete oscillation to occur ? (0.6)

QUESTION 5.03 (2.60)

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. (1.4)
- b. After 30 days power is increased to 100%. Explain any further reactivity changes required. [Specific reactivity values are NOT required] (1.2)

NOTE! Indicate approximate time and duration of reactivity changes.

QUESTION 5.04 (1.20)

Complete the following table by supplying the missing words or phrases. Indicate direction, magnitude, and rate where applicable.

Rx. Period	Rx. Power Response	Start Up Rate	
a. Small positive	Rapid increase	(            )	
b. (            )	Constant	(            )	
c. Large negative	(            )	Small negative	(1.2)

QUESTION 5.05 (2.50)

- a. For an operator taking data for a 1/M plot, how will the Shut-down 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 5.06 (2.75)

- a. How and why will the magnitude of the Fuel Temperature Coefficient (FTC) change as fuel temperature changes ? (1.25)
- b. Explain the effect on the magnitude of the FTC due to :
  1. Core power (0.75)
  2. Core burnup (0.75)



QUESTION 5.07 (1.90)

- a. Why is it necessary to install neutron sources in the Comanche Peak cores ? (1.0)
- b. Why is it desirable to incorporate overlap into the rod programming scheme ? (0.9)

QUESTION 5.08 (2.80)

From the statements below, choose the most correct words or phrases (in parentheses) and write them on your answer sheet:

- a. The ratio of peak to average value of power distribution is known as (peaking factor, thermal limit). (0.4)
- b. The value of the Heat Flux Hot Channel factor will (increase, decrease, remain constant ) when power is decreased. (0.4)
- c. The Heat Flux Hot Channel factor limit (assures, does not assure) that DNB will not occur during normal operation. (0.4)
- d. Calculation of Enthalpy Rise Hot Channel factor assumes core power is (uniform, not uniform) and flow through each channel is (the same, different) throughout the core. (0.8)
- e. With a (higher, lower) value of Enthalpy Rise Hot Channel factor, the coolant is (closer to, further away from) DNB conditions. (0.8)

QUESTION 5.09 (2.80)

- a. Explain what happens to the enthalpy change ( $h = \text{BTU/LBM}$ ) on the secondary side of the steam generator as power is increased. (1.2)
- b. Theoretically, if RCS flow were doubled, the core  $\Delta T$  would halve, resulting in less complicated reactivity effects and better core power distribution. Why wouldn't this design change be cost effective ? (1.6)

QUESTION 5.10 (1.00)

A motor operated centrifugal pump is operating at rated flow when the discharge valve is throttled towards the shut direction. Which of the following statements best describes the parameter changes that will occur ?

- a. Flow constant, discharge pressure constant, motor amps increase, NPSH increases.
- b. Flow decreases, discharge pressure increases, motor amps increase, NPSH increases.
- c. Flow decreases, discharge pressure increases, motor amps increase, NPSH decreases.
- d. Flow decreases, discharge pressure increases, motor amps decreases, NPSH increases.

(1.0)

QUESTION 5.11 (3.25)

Unit 1 is at 40% power when a single Reactor Coolant Pump (RCP) stops. Assume rod control in manual and no automatic or operator action occurs.

- a. Describe what happens to the temperature of the affected loop and explain. (0.75)
- b. Describe what happens to the delta T across all steam generators and the vessel or core. Explain. (1.0)
- c. Describe what happens to unaffected steam generator pressure and explain. (0.75)
- d. Explain the effect of stopping the RCP on individual loop and total coolant flow. (0.75)

## QUESTION 6.01 (2.40)

During normal operation at 75% power a single Power Range channel upper detector fails high. Procedures ABN-703A requires that the failed channel be defeated. Explain why the following actions must be taken.

- a. Place the Rod Stop Bypass switch in bypass. (0.6)
- b. Place the Power Mismatch switch in bypass. (0.6)
- c. Place the Upper and Lower Section Selector switches to the failed channel. (0.6)
- d. Select the failed channel on the Comparator Channel Defeat switch. (0.6)

## QUESTION 6.02 (2.90)

- a. What are the three plant parameter input signals used by the three element Steam Generator Feedwater Control System? (Do not include turbine impulse pressure or steam pressure.) (0.9)
- b. What is the purpose of the turbine impulse pressure signal used in the S/G Level Control System? (0.5)
- c. Considering the Steam Generator Level Control System, indicate the effects of a high failure of the Steam Header Pressure detector. Assume power at 50%, and no operator action. Consider instrument failure with Feed Pump speed control in automatic AND in manual. (1.5)

## QUESTION 6.03 (2.70)

- a. In the steam dump control system, what parameters or signals are sensed to provide arming signals for turbine trip and loss of load? Provide logic where applicable. (1.2)
- b. Describe how and when the steam dump valves will receive a trip open signal. (1.5)

## QUESTION 6.04 (3.20)

- a. Describe the instrument logic and setpoints necessary to insert the Reactor Coolant low flow trips into the protection system for 1 and 2 loop loss of flow. (1.2)
- b. Explain how and why the undervoltage AND underfrequency low flow reactor trips operate differently. (2.0)

## QUESTION 6.05 (3.20)

- a. What is the normal atmosphere inside the Pressurizer Relief Tank ? Why ? (0.8)
- b. When relieving pressurizer safeties into the tank at approx. 650 degrees and 2250 psi, why isn't the safe operating pressure (~100#) of the tank exceeded ? (1.0)
- c. What are the 2 methods available to cool the tank and what is the DISADVANTAGE of each method ? (1.4)

## QUESTION 6.06 (3.00)

- a. For long term post accident cooldown, how might the ECCS lineup differ for a small versus a large coolant system rupture, and why would a different lineup be necessary ? (1.2)
- b. What provisions are available to prevent overpressurization of the Residual Heat Removal (RHR) system ? (0.8)
- c. Describe how the RHR pumps are protected from vibrating or overheating when running for safety injection and RCS pressure increases above pump shut off head due to isolating the leak. (1.0)

## QUESTION 6.07 (2.70)

- a. Assume that one of the unit start-up transformers is out of service for maintenance and the other becomes disabled by a lightning strike during an outage condition. Describe alternate methods of supplying the unit class and non-class 6.9 KV buses. (1.2)
- b. What determines if a 6.9 KV bus power supply will undergo a fast or slow transfer ? (1.5)

## QUESTION 6.08 (1.40)

Briefly explain how to isolate a 118 VAC Class 1E inverter for maintenance and still maintain the inverter loads. (1.4)

## QUESTION 6.09 (1.90)

Answer the following questions about the Auxiliary Feed System(AFW).

- a. What prevents lowering the Condensate Storage Tank level below Technical Specification limit since it also supplies other systems ? (0.6)
- b. What automatic action will occur upon AFW auto start and Safety Injection to ensure maximum available water for the AFW system ? (0.8)
- c. Although the Service Water system is normally separated from the AFW system by 2 normally closed valves, what prevents contamination of AFW due to valve leakage ? (0.5)

## QUESTION 6.10 (1.60)

- a. What plant conditions are required before the Pressurizer Pressure Safety Injection signal can be blocked ? (0.5)
- b. How is the signal unblocked ? (0.5)
- c. Name any other function(s) generated by this signal ? (0.6)

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



QUESTION 7.01 (3.00)

During initial fuel load:

- a. After inserting a fuel assembly into the core, when can the grippers be released ? (0.6)
- b. If loading is suspended for a 10 hr. period due to problems with vessel level, what are 2 requirements that must be satisfied before continuing fuel load ? (1.0)
- c. Where are fuel status boards maintained ? (0.9)
- d. What is unique about the first fuel assembly inserted into the vessel, after the temporary neutron detectors are in place ? (0.5)

QUESTION 7.02 (2.60)

- a. For control of the plant in hot standby from outside the control room, what are the general guidelines to be used in the decision to transfer control of equipment to the Hot Shutdown Panel ? (1.0)
- b. Why is it not desirable to transfer control of pressurizer pressure and level upon control room evacuation ? (0.8)
- c. If access to the control room or cable spreading room is not possible, how can safety injection be blocked for cooldown ? (0.8)

QUESTION 7.03 (3.00)

- a. For leakage INTO the Component Cooling System (CCW), initial action required of the operator is to stop safeguards equipment in the affected train. What equipment is affected ? (0.9)
- b. Describe how the system is manipulated to find which loop has the leaking component. (1.2)
- c. Once the loop is identified, what are 3 checks that can be performed to identify the leaking component ? (0.9)

QUESTION 7.04 (2.40)

- a. Although not a common occurrence, federal regulations will allow a radiation worker to receive a quarterly whole body exposure of 3 Rem. What conditions must be satisfied for an individual to be allowed this higher than normal exposure ? (1.2)
- b. How are individuals at Comanche Peak normally prevented from inadvertently removing temporary radiation shielding ? (0.4)
- c. What is the immediate action required of an individual in a radiation area finding that his pocket dosimeter is off scale ? (0.8)

QUESTION 7.05 (2.80)

- a. The procedure for a dropped control rod directs the operator to stabilize the plant before attempting retrieval. How is the plant stabilized ? (0.75)
- b. When withdrawing a high worth rod from a dropped condition, how should the reactivity be compensated for ? (0.75)
- c. How can the operator verify the position of a control rod with failed position indication ? (0.5)
- d. With a unit at full power, what must be done if a non-indicating control rod position cannot be verified ? Why ? (0.8)

QUESTION 7.06 (2.00)

In the event it becomes necessary to evacuate the control room:

- a. Where will the various control room licensed personnel for unit 1 proceed to ? (1.2)
- b. How will the Shift Supervisor communicate with other plant operations personnel ? (0.8)

QUESTION 7.07 (2.80)

- a. State 4 parameters that should be monitored to aid in identifying a steam generator with a tube rupture. (1.2)
- b. State 4 actions that must be performed to isolate a steam generator with a tube rupture. (1.6)

QUESTION 7.08 (2.50)

During blackout conditions you are able to manually start an Emergency Diesel Generator:

- a. How will you manually load the safeguards bus if a Safety Injection signal exists ? Why ? (1.5)
- b. What is the first load you would place on the bus ? Why ? (1.0)

QUESTION 7.09 (1.50)

For a Reactor coolant system water inventory balance (leak rate) test:

- a. What are the time and plant conditions specified for a successful test ? (0.7)
- b. Describe how the CVCS volume change is determined for the test ? (0.8)

QUESTION 7.10 (2.40)

During natural circulation cooldown:

- a. What are 2 restrictions imposed by the procedure to minimize the possibility of void formation ? [0.8]
- b. What equipment is required to be operating by EOS-02 to minimize the possibility of vessel head formation ? [0.4]
- c. When cooling down with a void and it becomes possible to restore forced flow, where (relative values) would you adjust pressurizer temperature and level before and after attaining forced coolant flow ? [1.2]

## QUESTION 8.01 (2.60)

a. What are the minimum requirements for licensed personnel when :

1. Two units are in mode 5 ?

2. One unit in mode 6, no fuel movement in progress, and the other in mode 1 ?

3. Both units in mode 1 ?

(1.8)

NOTE! Be specific as to the type of license required and required location.

b. What is the general nature of the Shift advisors responsibilities and to whom does he report ?

(0.8)

## QUESTION 8.02 (2.90)

a. Is it permissible at Comanche Peak to disable a "Nuisance" annunciator ? Explain.

(0.8)

b. What precaution must be exercised when disabling an annunciator for maintenance ?

(0.8)

c. As the oncoming Shift Supervisor, how could you recognize an annunciator or instrument that was out of service ?

(0.5)

d. Where could you obtain information on the disabled indication ?

(0.8)

## QUESTION 8.03 (2.90)

a. Who are the 3 individuals that must review and approve a Radiation Work Permit (RWP) for anticipated exposure in excess of 1 Man-Rem ?

(0.9) .

b. For how long may RWP's and General Access Permits(GAP's) be active ?

(1.0)

c. Under what specific conditions may an individual enter a Radiation Controlled Area without a GAP/RWP ?

(1.0)



## QUESTION 8.04 (2.50)

- a. Explain the 3 types of temporary changes to procedures. Include time limits or expiration times where appropriate. (1.5)
- b. Explain the different terms in the following procedure designation:  
  
OPT-TP-85A-2 (1.0)

## QUESTION 8.05 (2.50)

- a. While touring the facility you suspect that a visible electrical jumper may be modifying or bypassing a safety system. Explain why this jumper SHOULD or SHOULD NOT be tagged. (1.0)
- b. Who is responsible for removing a temporary bypass from a safety system, who verifies removal, and where is removal documented ? (1.5)

## QUESTION 8.06 (3.10)

- a. Upon activation of the emergency plan, what are the 2 basic duties to be performed by the Shift Advisor ? (0.8)
- b. Describe how the responsibility for Emergency Coordinator would shift after declaring an Unusual Event that gradually escalates to a Site Emergency. (1.0)
- c. Name all individuals by (title) who can assume responsibility as:
  - 1. Technical Support Center Manager ?
  - 2. Operations Support Center Manager ? (1.3)

## QUESTION 8.07 (2.40)

- a. List the 3 different evacuation alarm sounds and what they are used for. (0.9)
- b. What 3 items of information should be included in a Site Evacuation announcement? (0.9)
- c. After a site evacuation, what 2 individuals can authorize entry for essential personnel? (0.6)

## QUESTION 8.08 (2.80)

- a. How is a valid Quadrant Power Tilt Ratio (QPTR) obtained with one Power Range instrument inoperable? (1.2)
- b. Why are the detector current values normalized in the calculation? (0.8)
- c. How many penalty minutes would be assessed for the following Axial Flux Difference conditions at Beginning of life?

POWER LEVEL	TIME	AFD	
1. 90%	10 min.	+6%	
2. 60%	20 min.	-5%	
3. 45%	12 min.	-7%	
4. 10%	1 hour	+9%	(0.8)

## QUESTION 8.09 (1.80)

During operation at full power the Reactor Operator informs the SRO in the control room that the plant is being operated in violation of a safety limit.

- a. What are the specific safety limits of concern? (0.8)
- b. Why is the above scenario very unlikely to ever occur? (1.0)

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

QUESTION 8.10 (1.50)

- a. What comprises Non-Compliance with a Technical Specification ? (0.75)
- b. Is it ever allowable to enter an operational mode without meeting the Limiting Conditions for Operation for the mode being entered ? Explain. (0.75)

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

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 5.01 (2.40)

- a. 1. Decreases
- 2. Decreases
- 3. Increases [0.4 ea.] (1.2)
- b. 1. Becomes more positive
- 2. Becomes more negative [0.4 ea.] (0.8)
- c. Increases (0.4)

REFERENCE

WJE 52

Westinghouse Thermal-Hydraulic Principles, Pp. 12- 36,37,50,

ANSWER 5.02 (1.80)

- a. Hold delta I at the target value when it is on the upswing by inserting control rods [0.6] and compensate for insertion by boron dilution. [0.6] (1.2)
- b. 24-28 hrs. accept 22-30 hrs. (0.6)

REFERENCE

WJE 54

IPO-003A, P.18

ANSWER 5.03 (2.60)

- a. The operator must withdraw rods or dilute the RCS to compensate for the build up of Xenon to equilibrium in 45-55 hours [0.8] and Samarium in 400-500 hours. [0.6] (1.4)
- b. Again Xenon will increase to a new higher equilibrium value in 45-55 hours. [0.6] Samarium reactivity will not change. [0.6] (Both may undergo a slight dip before increasing to or returning to equilibrium) (1.2)

REFERENCE

WJE 58

Curve Book fig's 1.12, 1.13, 1.16

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 5.04 (1.20)

- a. Large positive (0.3)
- b. Infinite, zero (0.6)
- c. Slow decrease (0.3)

REFERENCE

WJE 59

Westinghouse Fundamentals of Nuclear Physics, P. 7-17

ANSWER 5.05 (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

WJE 4

Westinghouse Fundamentals of Nuclear Physics, Pp. 8-55,58,59

ANSWER 5.06 (2.75)

- a. The magnitude of FTC decreases as fuel temperature increases [0.5] because the self shielding of the fuel decreases as the resonance peaks decrease in height. [0.75] (1.25)
- b. 1. Fuel temperature increases as power increases, [0.5] thus the magnitude of FTC decreases. [0.25] (0.75)  
2. Fuel temperature decreases as core ages [0.5] so the FTC will decrease. [0.25] (0.75)



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

REFERENCE

WJE 5

Westinghouse Fundamentals of Nuclear Physics, P.6-41

ANSWER 5.07 (1.90)

- a. Sources are necessary so the operator is able to monitor sub-critical multiplication, [0.5] and to ensure that instruments are reliable. [0.5] (1.0)
- b. Overlap improves differential rod worth (more linear), [0.5] and minimizes severe axial flux peaking (during transients). [0.4] (0.9)

REFERENCE

WJE 64

Facility question bank, NSSM-1 and CP-21

ANSWER 5.08 (2.80)

- a. Peaking Factor (0.4)
- b. Increase. (0.4)
- c. Does not assure. (0.4)
- d. Not uniform, [0.4] The same [0.4] (0.8)
- e. High, [0.4] further away from [0.4] OR  
Lower, [0.4] closer to [0.4] (0.8)

REFERENCE

WJE 51

Thermal-Hydraulic Principles, Pp. 13- 30 thru 36

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 5.09 (2.80)

- a. Although saturation temperature of the S/G exit steam decreases slightly as power increases [0.3] the feedwater temperature increases [0.3] due to improved effectiveness of the feedwater heaters. [0.3] This results in a net smaller increase across the S/G with increasing power. [0.3] (1.2)
- b. In order to achieve more flow you would need:
1. More flow paths [0.4] or larger pumps and pipes [0.6] which result in more engineering and material cost. [0.6]
  - OR;
  2. Higher pump speed, [0.8] changing flow in this manner would result in pumping power requirements increasing exponentially. [0.8]

Accept either answer for full credit. (1.6)

REFERENCE

WJE 53

Westinghouse Thermal Hydraulic Principles, Pp. 12-12,13

ANSWER 5.10 (1.00)

ANSWER----- d.

REFERENCE

WJE 8

Westinghouse Thermal-Hydraulic Principles, Pp. 10-36 thru 10-47

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 5.11 (3.25)

- a. Most of the coolant from the operating loops flows through the core, but some will flow backwards through the idle loop (due to the delta P across the core). [0.25] The net result is that the idle loop temperature becomes Tcold of the operating loops. [0.5] (0.75)
- b. Since power demand has not changed, the remaining loops must make up for power not being supplied by the idle loop. [0.5] With delta T across the idle steam generator essentially zero (may be slightly reversed), the delta T across the operating S/G's and the core will increase. [0.5] (1.0)
- c. With no heat transfer across the idle S/G, delta T (Tave.- Tstm) must increase for the operating S/G's. [0.5] This means that operating S/G temperature and pressure must decrease. [0.25] (0.75)
- d. Total flow will stabilize somewhere above 75% [0.5] as the loss of 1 pump will decrease total head, increasing the flow rate of the operating pumps. [0.25] (0.75)

REFERENCE

WJE 9

Westinghouse Thermal-Hydraulic Principles, Pp. 12-15,16

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 6.01 (2.40)

- a. Defeat the 103% overpower rod stop. (0.6)
- b. Defeats the failed P/R channel input to Rod Control. (0.6)
- c. Removes the faulty input to the Detector Current Comparator (Current Deviation Alarm) (axial) (0.6)
- d. Removes the faulty channel input to the Channel Current Comparator (Channel Deviation Alarm) (quadrant) (0.6)

## REFERENCE

WJE 74

ABN-703A, P. 3 &amp; System Description III-1, Pp.20-24

ANSWER 6.02 (2.90)

- a. 1. Feedwater Flow.
- 2. Steam Flow.
- 3. S/G Water Level. (Error signal) [0.3 ea.] (0.9)
- b. To provide a level setpoint. (0.5)
- c. With the feed pumps in manual, there is no effect to consider [0.5] With the pumps in auto the initial effect will be for pump speed to increase and FCV's to close down. [0.5] The system should maintain S/G level. [0.5] (Allow full credit for Rx. trip due to high S/G level.) (1.5)

## REFERENCE

WJE 75

System Description IV-8, P.14 &amp; IV-3, P.10

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 6.03 (2.70)

- a. Loss of load: Turbine impulse pressure rate of decrease. (0.4)
- Turbine trip: 4 turbine stop valves closed. (0.4)
- 2/3 turbine control oil pressures low. (0.4)
- b. Only in the Tave mode [0.4] when sufficient Tave-Tref deviation exist to require high (50% or 100%) steam dump demand. [0.6]
- Air is routed directly to valve actuators (through arming solenoids) bypassing the pneumatic positioner. [0.5] (1.5)

## REFERENCE

WJE 18

System description III-7, Pp. 4,7,8

ANSWER 6.04 (3.20)

- a. 1. Single loop loss of flow will insert if 2/4 power ranges are above 48%. (0.4)
2. Two loop loss of flow will insert if 2/4 power ranges >10% [0.3] OR; [0.2] 1/2 impulse pressures > 10% [0.3] (0.8)
- b. The undervoltage trip is to provide a trip signal on loss of power to the RCP's. [0.4] The reactor will trip and RCP's continue to provide coastdown flow. [0.4] The underfrequency trip provides protection for a grid disturbance. [0.4] The RCP breakers and reactor are tripped [0.4] to prevent deceleration and loss of coastdown flow. [0.4] (2.0)

## REFERENCE

WJE 21

System Description III-9,, Pp.9,10,48

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 6.05 (3.20)

- a. Nitrogen, [0.4] to prevent inleakage of air and accumulating a mixture of H<sub>2</sub> & O<sub>2</sub>. [0.4] (0.8)
- b. Steam is discharged into the tank through a sparger underwater. [0.5] The steam is cooled and condensed by mixing with water near ambient temperature. [0.5] (1.0)
- c. 1. Spraying with cool reactor makeup water [0.4] produces radioactive liquid waste. [0.3] (0.7)
2. Circulating water through the RCDT HX [0.4] takes an abnormally long time to cool the tank. [0.3] (0.7)

## REFERENCE

WJE 22

System Description II-1, P.5.5

ANSWER 6.06 (3.00)

- a. During conditions where RCS pressure is above RHR pump shut off head and the RWST is at low level. [0.6] The RHR pump discharge can be directed to the suction of the SI and Centrifugal Charging pumps, or RHR pumps may be stopped. [0.6] 1/2 credit for: Hot leg recirc. (1.2)
- b. System inlet valves close on increasing pressure. [0.4] High capacity pump suction relief valves. [0.4] (0.8)
- c. Part of the heat exchanger outlet flow is recircled back to the RHR pump suction. [0.5] A recirc flow control valve opens on low flow (575 GPM) and closes on increased flow (1200GPM). [0.5] (1.0)

## REFERENCE

WJE 24

System Description II-6, Pp. 7,8,14



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 6.07 (2.70)

a. The non-class buses can be supplied by opening the 22 KV Main Generator disconnect [0.3] and feeding back from the main transformers to the Aux. transformers. [0.3] The class buses can be supplied by the non-class buses after they are powered as above [0.3] or supplied by the diesels. [0.3] (1.2)

b. A slow transfer will occur if:

1. Normal breaker open.
2. Running bus voltage < 35% normal.
3. Bus feeders tripped.
4. Alternate bus voltage > 85% [0.375 ea.]

OR; A fast transfer will occur if:

1. Sufficient alternate power supply voltage.
2. Phases matched within 40 degrees.
3. Non 1E bus [0.5 ea.]

Accept either answer for full credit. (1.5)

## REFERENCE

WJE 27

System Description VII-1, Pp. 17,40,41

ANSWER 6.08 (1.40)

It will be necessary to open the DC and AC feeders to the inverter. [0.5] Power can be supplied to the AC loads via the By-pass transformer. [0.5] by operation of the panel transfer switch. [0.4] (1.4)

## REFERENCE

WJE 28

Dwng. # 2323-E1-0018

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITEMORE, J.

ANSWER 6.09 (1.90)

- a. Other systems supplied by the tank are prevented from lowering the tank level below minimum by the elevation of their supply nozzles. (0.6)
- b. Auto start - Isolates condensate make-up and reject lines (0.4)  
S.I. - De-energizes condensate transfer pump. (0.4)
- c. There is a normally open high point leak off between the normally shut valves. (0.5)

REFERENCE

WJE 29

System Description VIII-8, Pp. 6-8

ANSWER 6.10 (1.60)

- a. May be blocked when PZR pressure is below 1960 psig. (0.5)
- b. Unblocked automatically when pressure goes above 1960 psig. (0.5)
- c. Increasing pressure (above 1960 psig) automatically opens the accumulator discharge valves. (0.6)

REFERENCE

WJE 83

Facility question bank, Log-4

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 7.01 (3.00)

- a. Only after ICRR reference data has been taken and found not to indicate any abnormalities. (0.6)
- b. 1. Determine a new ICRR reference value. [0.5]  
2. Perform a response check on all neutron indication. [0.5] (1.0)
- c. 1. Fuel Bldg.  
2. Containment  
3. Control room [0.3 ea.] (0.9)
- d. It has a neutron source. (0.5)

REFERENCE

WJE 55

ISU-001A, Pp. 12,35,39,40

ANSWER 7.02 (2.60)

- a. Should not be transferred unless control of the equipment is needed [0.5] or evacuation was due to a fire [0.5] (1.0)
- b. Leaving the system in auto does not require the operator's constant attention, [0.4] and the heater /level interlock is overridden in local. [0.4] (0.8)
- c. The affected equipment must have control shifted to the "HSP".  
OR;  
Power supply breakers must be racked out.  
(Either answer for full credit.) (0.8)

REFERENCE

WJE56

IPO-008A, Pp. 3,10,15

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 7.03 (3.00)

- a. CCP, SI Pump, RHR Pump, CS Pump, Control Rm. A/C units, Safety Chill Water System. [0.15 ea.] (0.9)
- b. Shift to the standby loop and equipment supplied by it. [0.3] If surge tank level increase stops, leak was in the affected safeguards or the non-safeguards loops. [0.3] Shift the non-safe loop to the stand by loop. [0.3] If level increases, the leak is in the non-safeguards loop. [0.3] (1.2)
- c. Check CCW outlet temp, activity, or boron. [0.3 ea.] (0.9)

REFERENCE

WJE 57

ABN 502A, Pp. 5, 7

ANSWER 7.04 (2.40)

- a. 1. Proper managerial approval.  
2. Lifetime permissible exposure not exceeded. (5{N-18})  
3. Exposure history documented. [0.4 each] (1.2)
- b. All temporary shielding is identifiable by an attached shielding evaluation tag. (0.4)
- c. Inform co-workers, [0.4] exit area and report to Radiation Protection. [0.4] (0.8)

REFERENCE

WJE 84

Radiation Worker Training, Pp. 23, 29, 34

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 7.05 (2.80)

- a. Manipulate turbine load to match Tave and Tref.  
[Accept dilution for 3/4 credit as dilution is not feasible at EOL.] (0.75)
- b. Increase turbine load as Tave increases to match Tave/Tref[0.4]  
or borate [0.35] (0.75)
- c. Determine position with in-core detector measurements. (0.5)
- d. Reduce power (to 50%) [0.6] to ensure power distribution peaking  
factor limits are not exceeded. [0.2]  
[Allow full credit for any conservative action] (0.8)

REFERENCE

WJE 34  
ABN 712A

ANSWER 7.06 (2.00)

- a. Shift Supervisor and R0 to hot shutdown panel. [0.8] Relief R0  
to the switch transfer panel. [0.4] (1.2)
- b. Gaitronics [0.4] and the Safe Shutdown sound powered phone  
system. [0.4] (0.8)

REFERENCE

WJE 35  
ABN 905A

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 7.07 (2.80)

- a. 1. Narrow range level  
2. Blowdown rad. monitor  
3. S/G sample activity  
4. Steam line rad monitor  
5. Feed flow > steam flow [any 4, 0.3 ea.] (1.2)
- b. 1. Isolate AFW  
2. Close MSIV's  
3. Verify S/G PORV's closed  
4. Isolate steam to AFW pump  
5. Isolate feedwater  
6. Isolate B/D and sample [any 4, 0.4 ea.] (1.6)

REFERENCE

WJE 37

Facility question bank, ERG 21,22,

ANSWER 7.08 (2.50)

- a. Reset the SI signal OR; place control switches in "Pull o  
Lock" [either method 0.75] to prevent energizing unwanted loads  
and jeopardizing newly acquired power source. [0.75] (1.5)
- b. A station service water pump [0.5] to supply diesel cooling  
water. [0.5] (1.0)

REFERENCE

WJE 39

ECA 0.0, P.5

ANSWER 7.09 (1.50)

- a. Steady state [0.35] for a minimum of 3 hours. [0.35] (0.7)
- b. Add the total amount of make up [0.4] and the VCT volume change.  
[0.4] (0.8)



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

REFERENCE

WJE 40

OPT 303

ANSWER 7.10 (2.40)

- a. The procedure requires a slow cooldown rate (50 degrees/hr.) [0.4]  
and maintaining a high (60 degree ) subcooling margin. [0.4] (0.8)
- b. Must run all available CRDM cooling fans. (0.4)
- c. Before starting RCP's, pressurizer temperature should be adjusted  
so that RCS temperature will be subcooled (when bubble shifts to  
pressurizer), [0.3] and level should be high. [0.3] After start-  
ing, adjust level to normal [0.3] and pressurizer temperature to  
provide normal required subcooling of the RCS. [0.3] (1.2)

REFERENCE

WJE 90

EOS-0.2, Pp.4,5 & EOS-0.4, Pp.3,4

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 8.01 (2.60)

- a. 1. Two SRO's on site, [0.3] and one RO in each control room. [0.3]
2. One SRO in control room, and another on site, [0.3] two RO's in control room, and another on site. [0.3]
3. Same as #2 above. [0.6] (1.8)
- b. Responsible to assist the Shift Supervisor in evaluating operating activities [0.4] reports to the Operations Supervisor [0.4] (0.8)

## REFERENCE

WJE 41

ODA 103, Pp. 8,10

ANSWER 8.02 (2.90)

- a. Yes, [0.4] if the Shift Supervisor feels it is a detriment to proper plant operation. [0.4] (0.8)
- b. An annunciator card can affect 2 alarms [0.4] and a required alarm might be disabled. [0.4] (0.8)
- c. Should have an out of service sticker attached. (0.5)
- d. Off going Shift Supervisor.  
OR; The Annunciator/Instrument out of service log.  
(Full credit for either answer) (0.8)

## REFERENCE

WJE 42

ODA 401

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 8.03 (2.90)

- a. 1. Radiation Protection Supervisor
- 2. ALARA Coordinator
- 3. Shift Supervisor [0.3 each] (0.9\_
- b. 1. GAP's are normally effective for a calendar year. [0.4]
- 2. RWP's are active for the duration of the specific task [0.3] or a calendar month, whichever is least. [0.3] (1.0)
- c. During emergencies [0.5] the Shift Supervisor may authorize entry into a RCA without paper work if continuous radiation protection coverage is provided. [0.5] (1.0)

REFERENCE

WJE43

HPA 112, Pp.4,5

ANSWER 8.04 (2.50)

- a. 1. One time only, [0.3] for when it is anticipated that the procedure will not be used again. [0.2]
- 2. Extended, [0.3] required for a limited period of time, but may be used several times for 30 days. [0.2]
- 3. Permanent, [0.3] is a change to a procedure that will become permanent and is effective for 90 days [0.2] (1.5)
- b. OPT-----Manual affected by temporary procedure
- TP-----Temporary Procedure
- 85-----Year issued
- A-----Unit 1 (B= unit 2)
- 2-----Sequential # affecting OPT manual in 1985 [0.2 ea.] (1.0)

REFERENCE

WJE 44

STA-204, P.3 & STA 205, Pp. 2,4

ANSWERS -- COMANCHE PEAK 1

-85/C4/01-WHITTEMORE, J.

ANSWER 8.05 (2.50)

- a. All temporary bypasses on safety systems should be tagged [0.5] unless it is installed and removed by an approved station procedure. [0.5] (1.0)
- b. Removal- a person responsible for the modification, or individual designated by the Shift Supervisor. (0.5)
- Verification- Supervisor of person performing the work or designated member of operations. (0.5)
- Documentation- Temporary Modification and Safety Function Bypass log. (0.5)

## REFERENCE

WJE 45

STA- 602, Pp. 3,4,6

ANSWER 8.06 (3.10)

- a. Advise and assist the Shift Supervisor as directed or needed. (0.8)
- b. Initially the Shift Supervisor will act as Emergency Coordinator until augmentation when the TSC is manned. [0.2] The TSC Mgr. becomes responsible [0.3] until the EOF is manned and the EOF Mgr. becomes responsible. [0.3] (1.0)
- c. TSC-----Mgr. Plant Operations  
Eng. Superintendent  
Operations Superintendent  
Maintenance Superintendent [0.2 each] (0.8)
- OSC----- Mech. Maint. Engr.  
Elec. Maint. Engr.  
Mech. Maint. Sup. [0.167 ea.] (0.5)

## REFERENCE

WJE 46

EPP-112, P.4 &amp; Epp-204 P.4

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 8.07 (2.40)

- a. 1. Siren - Radiological emergencies  
2. Steady - Fire emergencies  
3. Pulse - Other emergencies [0.3 ea.] (0.9)
- b. 1. Procedure  
2. Route  
3. Any hazards to be avoided [0.3] (0.9)
- c. Emergency coordinator [0.3] and Security Supervisor [0.3] (0.6)

## REFERENCE

WJE 47

EPP-208, P.4 &amp; EPP-210, P.7

ANSWER 8.08 (2.80)

- a. The calculation is performed using operable detectors [0.6] and QPTR is verified consistent with tilt factors using the in-core detectors [0.6] (1.2)
- b. Always normalized to the same high power value for consistency so that problems will be detected at lower power levels. (0.8)
- c. 1. 10 min.  
2. 0  
3. 6min.  
4. 0 [0.2ea.] (0.8)

## REFERENCE

WJE 48

OPT-302, P.2 &amp; OPT-403, P.4

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 8.09 (1.80)

- a. 1. Core safety limit.
- 2. RCS pressure limit. [0.4 ea.] (0.8)
- b. Limiting Safety System setpoints will cause automatic shutdown to preclude operating outside of safe envelope, [0.5] and the RCS over pressure protection system will prevent exceeding RCS safe pressure limit. [0.5] (1.0)

REFERENCE

WJE 49

T.S. 2.1

ANSWER 8.10 (1.50)

- a. Non-compliance exists when the LCO's [0.25] and any associated Action Statements [0.25] are not met within the specified time interval. [0.25] (0.75)
- b. Yes, [0.5] when it is necessary to pass through or to a mode to comply with an action statement. [0.25] (0.75)

REFERENCE

WJE 50

T.S. 3.01 & 3.04



U. S. NUCLEAR REGULATORY COMMISSION  
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: COMANCHE PEAK 1  
REACTOR TYPE: PWR-WEC4  
DATE ADMINISTERED: 85/04/01  
EXAMINER: WHITTEMORE, J.  
APPLICANT: \_\_\_\_\_

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

FINAL GRADE \_\_\_\_\_%

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

\_\_\_\_\_  
APPLICANT'S SIGNATURE

QUESTION 1.01 (1.20)

Complete the following table by supplying the missing words or phrases. Indicate direction, magnitude, and rate where applicable.

Rx. Period	Rx. Power Response	Start Up Rate	
a. Small positive	Rapid increase	(                      )	
b. (                      )	Constant	(                      )	
c. Large negative	(                      )	Small negative	(1.2)

QUESTION 1.02 (3.00)

- a. Explain the terms beta bar and beta bar effective. Your answer should include an explanation of which term is larger in magnitude and why. (1.5)
- b. Explain how and why the above mentioned terms will affect reactor response throughout cycle life. (1.5)

QUESTION 1.03 (2.00)

- a. For a reactivity change in a subcritical reactor, show how the Subcritical Multiplication Factor (M), Keff, and initial and final count rates are related. (1.0)
- b. A reactor has a source count rate of 100 neutrons/second and a Keff of 0.6. What is the total or final stable count rate? Show how the answer is obtained. (1.0)

QUESTION 1.04 (2.50)

- a. For an operator taking data for a  $1/M$  plot, how will the Shut-down 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 1.05 (2.75)

- a. How and why will the magnitude of the Fuel Temperature Coefficient (FTC) change as fuel temperature changes ? (1.25)
- b. Explain the effect on the magnitude of the FTC due to :
  - 1. Core power (0.75)
  - 2. Core burnup (0.75)

QUESTION 1.06 (1.80)

- a. Explain how the Moderator Temperature Coefficient (MTC) can vary axially within the core. (0.8)
- b. What effect will adding boric acid to the Reactor Coolant System have on the MTC ? EXPLAIN. (1.0)

QUESTION 1.07 (1.75)

After 30 days at 50% power, plant power is raised to 100%. Explain the reactivity adjustments the operator may have to make due to fission product poisons until stable conditions are reached. Your answer should discuss both major poisons. (1.75)

QUESTION 1.08 (1.00)

A motor operated centrifugal pump is operating at rated flow when the discharge valve is throttled towards the shut direction. Which of the following statements best describes the parameter changes that will occur ?

- a. Flow constant, discharge pressure constant, motor amps increase, NPSH increases.
- b. Flow decreases, discharge pressure increases, motor amps increase, NPSH increases.
- c. Flow decreases, discharge pressure increases, motor amps increase, NPSH decreases.
- d. Flow decreases, discharge pressure increases, motor amps decrease, NPSH increases.

(1.0)

QUESTION 1.09 (3.25)

Unit 1 is at 40% power when a single Reactor Coolant Pump (RCP) stops. Assume rod control in manual and no automatic or operator action occurs.

- a. Describe what happens to the temperature of the affected loop and explain. (0.75)
- b. Describe what happens to the delta T across all steam generators and the vessel or core. Explain. (1.0)
- c. Describe what happens to unaffected steam generator pressure and explain. (0.75)
- d. Explain the effect of stopping the RCP on individual loop and total coolant flow. (0.75)

QUESTION 1.10 (2.25)

- a. What is the major reason that nuclear steam plants do not have a constant overall plant efficiency at all power levels ? (0.5)
- b. How does the extraction steam system specifically affect plant efficiency at high versus low power levels ? Why ? (0.75)
- c. Explain how increasing condenser circulating water flow may act to improve OR decrease overall plant efficiency. (1.0)

QUESTION 1.11 (1.75)

- a. Positive displacement pumps can be classified as either reciprocating or rotary. What are 2 of the 3 types of Rotary Positive Displacement pumps ? (1.0)
- b. The ideal performance curve for a positive displacement pump would be a straight line. Why is this not true in an actual situation ? (0.75)

QUESTION 1.12 (1.75)

- a. How does requiring the operator to observe limits of Axial Flux Difference and Quadrant Power Tilt Ratio prevent exceeding core thermal limits ? (1.0)
- b. Explain why significantly reduced RCS flow conditions will affect proximity to the Critical Heat Flux. (0.75)

## QUESTION 2.01 (3.20)

- a. What is the normal atmosphere inside the Pressurizer Relief Tank ? Why ? [0.8]
- b. When relieving pressurizer safeties into the tank at approx. 650 degrees and 2250 psi, why isn't the safe operating pressure (~100#) of the tank exceeded ? [1.0]
- c. What are the 2 methods available to cool the tank and what is the DISADVANTAGE of each method ? [1.4]

## QUESTION 2.02 (3.90)

- a. 1. What conditions (interlocks) must be met to open the letdown isolation valves (LCV 459 & 460) ? [0.6]  
2. What will cause closure of the isolation valves ? [0.6]  
3. What will cause closure of the ORIFICE isolation valves ? [0.9]
- b. Besides seal return water, what other fluid streams might be affected should the Seal Water Heat Exchanger be placed out of service ? Disregard cooling water flow. [0.8]
- c. Explain how recirc flow is provided for the centrifugal charging pumps after the receipt of a Safety Injection signal. [1.0]

## QUESTION 2.03 (3.00)

- a. For long term post accident cooldown, how might the ECCS lineup differ for a small versus a large coolant system rupture, and why would a different lineup be necessary ? [1.2]
- b. What provisions are available to prevent overpressurization of the Residual Heat Removal (RHR) system ? [0.8]
- c. Describe how the RHR pumps are protected from vibrating or overheating when running for safety injection and RCS pressure increases above pump shut off head due to isolating the leak. [1.0]



## QUESTION 2.04 (2.70)

- a. Briefly describe how operation of the Reactor Coolant Pumps will be affected should the following inadvertant signals occur:
1. Phase "A" containment isolation. (0.6)
  2. Phase "B" containment isolation. (0.6)
- b. Briefly, in general terms, describe what action occurs for:
1. Control Room Emergency Recirculation signal. (0.5)
  2. Control Room Emergency Ventilation signal. (0.5)
  3. Control Room Ventilation Isolation signal. (0.5)

NOTE!\_\_ Mention of specific fans, dampers, filters, valves, etc; is NOT required to answer this question for full credit.

## QUESTION 2.05 (3.40)

- a. Explain the difference between the Normal and Emergency Diesel Generator Start/Stop Switches on the Main Control Board. (1.2)
- b. What specific Diessel Generator controls are located on the Remote Shutdown Panel ? (0.8)
- c. What specific conditions cause the diesels to auto start ? (0.9)
- d. What is(are) the power supply(ies) for diesel control power and field flashing power ? (0.5)

## QUESTION 2.06 (2.70)

- a. Assume that one of the unit start-up transformers is out of service for maintenance and the other becomes disabled by a lightning strike during an outage condition. Describe alternate methods of supplying the unit class and non-class 6.9 KV buses. (1.2)
- b. What determines if a 6.9 KV bus power supply will undergo a fast or slow transfer ? (1.5)



## QUESTION 2.07 (1.40)

Briefly explain how to isolate a 118 VAC Class 1E inverter for maintenance and still maintain the inverter loads. (1.4)

## QUESTION 2.08 (1.90)

Answer the following questions about the Auxiliary Feed System(AFW).

- a. What prevents lowering the Condensate Storage Tank level below Technical Specification limit since it also supplies other systems ? (0.6)
- b. What automatic action will occur upon AFW auto start and Safety Injection to ensure maximum available water for the AFW system ? (0.8)
- c. Although the Service Water system is normally separated from the AFW system by 2 normally closed valves, what prevents contamination of AFW due to valve leakage ? (0.5)

## QUESTION 2.09 (2.80)

- a. List 8 major pieces of equipment used to remove a new fuel assembly from the shipping container, temporarily place in storage, and subsequently load it into the reactor. (1.6)
- b. How does the manipulator operator know that the crane is positioned precisely for withdrawing or inserting a fuel assembly ? (1.2)

## QUESTION 3.01 (2.20)

- a. Briefly describe how the Nuclear instrument system is designed to terminate inadvertent dilution of the Reactor Coolant System, during shutdown or low power conditions. The answer should include setpoint(s), an explanation of how the feature is blocked or overridden, and automatic actions that occur. (1.2)
- b. Describe 2 circuits associated with the Power Range Nuclear Instrument that will alert the operator to abnormal flux distribution.

## QUESTION 3.02 (2.70)

- a. Control rod speed in automatic is determined by a "Total Error" signal. What signals are used to determine the total error signal? (0.8)
- b. State the automatic rod speed for the following total error signals:
1. 1 Degree
  2. 2.5 Degrees
  3. 4.5 Degrees (0.9)
- c. State where and why the non-linear and variable gain units are used in the automatic control of rod speed. (1.0)

## QUESTION 3.03 (2.10)

- a. What are the 2 separate rod position conditions that will generate a rod deviation alarm? (0.7)
- b. What are the 2 auto rod withdrawal blocks that are NOT manual blocks? (0.7)
- c. What are the plant parameters used to calculate the control rod insertion limits? (0.7)

## QUESTION 3.04 (3.80)

- a. List the control and protection outputs of the following signals. State logic where appropriate. Disregard alarms and indication.

1. Individual loop Tave. (0.8)
2. Auctioneered low Tave. (0.3)
3. Auctioneered high Tave. (1.2)

- b. List the outputs for the following. State logic where appropriate and disregard indication and alarms.

1. Loop N-16 power. (1.2)
2. Auctioneered N-16 power. (0.3)

## QUESTION 3.05 (3.10)

- a. The pressurizer pressure controller is described as a proportional plus integral plus derivative controller. Explain what the various terms mean. (1.5)

- b. Describe what would occur if Pressurizer Level Transmitter LT-459 failed in the low direction while selected for control. Assume no operator action before protective action occurs. (1.6)

## QUESTION 3.06 (2.70)

- a. In the steam dump control system, what parameters or signals are sensed to provide arming signals for turbine trip and loss of load? Provide logic where applicable. (1.2)

- b. Describe how and when the steam dump valves will receive a trip open signal. (1.5)

## QUESTION 3.07 (2.70)

- a. What are 2 of the 3 reasons that make it necessary to control the speed of the Main Feed Pumps ? (0.8)
- b. Other than manual, what 3 signals will override the level control signal and shut the feedwater control valves ? (0.9)
- c. How and why is reactor power used in controlling the feedwater control bypass valve ? (1.0)

## QUESTION 3.08 (2.50)

- a. What are the parameters that will vary or modify the Overtemperature N-16 trip setpoint. Explain how each parameter affects the setpoint. (1.5)
- b. What is the purpose of the Overpower N-16 trip ? (0.5)
- c. What protection is afforded by the Power Range Negative Rate trip ? (0.5)

## QUESTION 3.09 (3.20)

- a. Describe the instrument logic and setpoints necessary to insert the Reactor Coolant low flow trips into the protection system for 1 and 2 loop loss of flow. (1.2)
- b. Explain how and why the undervoltage AND underfrequency low flow reactor trips operate differently. (2.0)

QUESTION 4.01 (2.40)

- a. Although not a common occurrence, federal regulations will allow a radiation worker to receive a quarterly whole body exposure of 3 Rem. What conditions must be satisfied for an individual to be allowed this higher than normal exposure ? (1.2)
- b. How are individuals at Comanche Peak normally prevented from inadvertently removing temporary radiation shielding ? (0.4)
- c. What is the immediate action required of an individual in a radiation area finding that his pocket dosimeter is off scale ? (0.8)

QUESTION 4.02 (2.00)

- a. While acting as manipulator operator you observe the new fuel assembly that was just released fall over and strike another assembly:
  - 1. What immediate action should you take ? (0.8)
  - 2. After immediate action is carried out, what should be done with a fuel assembly in the vessel that appears to be damaged ? (0.6)
- b. What should be done if the hoist load starts decreasing before a fuel assembly is bottomed in the vessel ? (0.6)

QUESTION 4.03 (3.05)

- a. For low failures of a Source or Intermediate range nuclear instrument channel the operator must take action dependent on power level at the time of failure. Indicate how required actions vary, depending on power level, and explain why, for both instruments. (1.8)
- b. For a power range channel failure, why is the operator required to remove "Control Power" fuses from the affected channel drawer ? (0.75)
- c. Why will a Power Range failure cause automatic control rod response if it fails high, but not when it fails low ? (0.5)

QUESTION 4.04 (2.80)

- a. The procedure for a dropped control rod directs the operator to stabilize the plant before attempting retrieval. How is the plant stabilized ? (0.75)
- b. When withdrawing a high worth rod from a dropped condition, how should the reactivity be compensated for ? (0.75)
- c. How can the operator verify the position of a control rod with failed position indication ? (0.5)
- d. With a unit at full power, what must be done if a non-indicating control rod position cannot be verified ? Why ? (0.8)

QUESTION 4.05 (2.00)

In the event it becomes necessary to evacuate the control room:

- a. Where will the various control room licensed personnel for unit 1 proceed to ? (1.2)
- b. How will the Shift Supervisor communicate with other plant operations personnel ? (0.8)

QUESTION 4.06 (3.25)

Answer the following questions about plant start up:

- a. How and why do Shutdown Margin requirements change when going from mode 4 to mode 5 ? (0.75)
- b. Why do precautions NOT allow admitting steam to the Main or Feed Pump turbines when the reactor is critical below 1% power ? (0.75)
- c. Why must the highest reading source range read at least 2 counts before withdrawing rods for start up ? (0.75)
- d. What action should be taken if the reactor achieves criticality with rods below the insertion limit ? (1.0)



QUESTION 4.07 (2.80)

- a. State 4 parameters that should be monitored to aid in identifying a steam generator with a tube rupture. (1.2)
- b. State 4 actions that must be performed to isolate a steam generator with a tube rupture. (1.6)

QUESTION 4.08 (2.70)

- a. Explain the term "Adverse Containment" that appears in the Emergency procedures and why the operator is given different limitations with adverse conditions. (1.5)
- b. For depressurization after a tube rupture, how will the operator depressurize if:
  - 1. Reactor Coolant Pumps (RCP's) running.
  - 2. RCP's stopped, letdown in service.
  - 3. RCP's stopped, letdown isolated. (1.2)

QUESTION 4.09 (2.50)

During blackout conditions you are able to manually start an Emergency Diesel Generator:

- a. How will you manually load the safeguards bus if a Safety Injection signal exists ? Why ? (1.5)
- b. What is the first load you would place on the bus ? Why ? (1.0)

QUESTION 4.10 (1.50)

For a Reactor coolant system water inventory balance (leak rate) test:

- a. What are the time and plant conditions specified for a successful test ? (0.7)
- b. Describe how the CVCS volume change is determined for the test ? (0.8)



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 1.01 (1.20)

- a. Large positive (0.3)
- b. Infinite, zero (0.6)
- c. Slow decrease (0.3)

REFERENCE

WJE 1

Westinghouse Fundamentals of Nuclear Physics, P. 7-17

ANSWER 1.02 (3.00)

- a. Beta bar is the average delayed neutron fraction or the weighted average fraction for the different fissionable materials present. [0.5] Beta bar effective is the effective fraction [0.25] and is smaller as it is the product of beta bar and an importance factor. [0.25] The importance factor is generally less than one as delayed neutrons are less likely to cause fission. [0.5] (Will accept an explanation of how the importance factor is affected by Fast Fission and Non-leakage factors) (1.5)
- b. Beta bar and Beta Bar effective will decrease in value over cycle life [0.5] due to the changing concentrations of the different fissionable isotopes in the core. [0.5] Smaller values of the effective fraction means that the reactor period will be smaller or the reactor will respond quicker for a given reactivity change, as the core ages. [0.5] (1.5)

REFERENCE

WJE 2

Westinghouse Fundamentals of Nuclear Physics, Pp.7-31,33,34,36,48

ANSWER 1.03 (2.00)

- a.  $1/M = C_o/C_i = 1 - K_{eff}$  (1.0)
- b. Total count rate =  $S / 1 - K_{eff} = 100 / 1 - 0.6 = 250$  neutrons/sec. (1.0)

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

REFERENCE

WJE 3

Westinghouse Fundamentals of Nuclear Physics, Pp.8-18, 27

ANSWER 1.04 (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

WJE 4

Westinghouse Fundamentals of Nuclear Physics, Pp. 8-55,58,59

ANSWER 1.05 (2.75)

- a. The magnitude of FTC decreases as fuel temperature increases [0.5] because the self shielding of the fuel decreases as the resonance peaks decrease in height. [0.75] (1.25)
- b. 1. Fuel temperature increases as power increases, [0.5] thus the magnitude of FTC decreases. [0.25] (0.75)  
2. Fuel temperature decreases as core ages [0.5] so the FTC will decrease. [0.25] (0.75)

REFERENCE

WJE 5

Westinghouse Fundamentals of Nuclear Physics, P.6-41

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 1.06 (1.80)

- a. The higher temperature at the core outlet and the non-linear change in density [0.4] means that the MTC will be higher at top of the core. [0.4] (0.8)
- b. Decrease the magnitude [0.5] as at a higher concentration, more boron will be expanded from the core for a temperature change, adding positive reactivity. [0.5] (1.0)

REFERENCE

WJE 6

Westinghouse Fundamentals of Nuclear Physics, P.6-42 AND Curve Book Fig.1.8

ANSWER 1.07 (1.75)

The operator should only have to compensate for Xenon which will initially dip [0.5] and then attain it's 100% equilibrium concentration in 45-55 hours. (0.75) Samarium (may initially experience a slight dip in concentration) but should end up at the same equilibrium value. [0.5] (1.75)

REFERENCE

WJE 7

CPSES Curve Book, Fig's 1.12, 1.13, 1.14

ANSWER 1.08 (1.00)

ANSWER----- d.

REFERENCE

WJE 8

Westinghouse Thermal-Hydraulic Principles, Pp. 10-36 thru 10-47

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 1.09 (3.25)

- a. Most of the coolant from the operating loops flows through the core, but some will flow backwards through the idle loop (due to the delta P across the core). [0.25] The net result is that the idle loop temperature becomes T<sub>cold</sub> of the operating loops. [0.5] (0.75)
- b. Since power demand has not changed, the remaining loops must make up for power not being supplied by the idle loop. [0.5] With delta T across the idle steam generator essentially zero (may be slightly reversed), the delta T across the operating S/G's and the core will increase. [0.5] (1.0)
- c. With no heat transfer across the idle S/G, delta T (T<sub>ave</sub> - T<sub>stm</sub>) must increase for the operating S/G's. [0.5] This means that operating S/G temperature and pressure must decrease. [0.25] (0.75)
- d. Total flow will stabilize somewhere above 75% [0.5] as the loss of 1 pump will decrease total head, increasing the flow rate of the operating pumps. [0.25] (0.75)

REFERENCE

WJE 9

Westinghouse Thermal-Hydraulic Principles, Pp. 12-15,16

ANSWER 1.10 (2.25)

- a. The plant is designed to be most efficient at full power. (0.5)
- b. At high power levels, extraction steam pressure (and flow rate) increase. [0.25] This causes more heat to be transferred across heaters, increasing efficiency. [0.5] (0.75)
- c. Increased heat transferred may result in a lower condenser pressure, increasing efficiency. OR; Increasing heat transfer past the point of minimum condenser pressure will subcool the condensate and decrease efficiency. (1.0)  
Accept either answer for full credit.

REFERENCE

WJE 10

Westinghouse Thermal-Hydraulic Principles, Pp. 12-24,25,26

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 1.11 (1.75)

- a. 1. Rotary Vane
- 2. Gear Pump
- 3. Screw Pump

[any 2, 0.5 each]

(1.0)

- b. At the pump's design pressure limit back leakage past moving parts will occur and volume flow rate decreases.

(0.75)

REFERENCE

WJE 11

Westinghouse Thermal-Hydraulic Principles, Pp.10-49,50

ANSWER 1.12 (1.75)

- a. By controlling power(flux) distribution within the core, the maximum heat generation and fuel temperature is limited. [0.5]  
By limiting the difference in flux between portions of the core, the maximum heat generation in an area is limited. [0.5]

(1.0)

- b. A reduction in flow rate causes an increase in coolant temperature.

(0.75)

REFERENCE

WJE 12

Westinghouse Thermal-Hydraulic Principles, Pp.13-11,12,13

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 2.01 (3.20)

- a. Nitrogen, [0.4] to prevent inleakage of air and accumulating a mixture of H<sub>2</sub> & O<sub>2</sub>. [0.4] (0.8)
- b. Steam is discharged into the tank through a sparger underwater. [0.5] The steam is cooled and condensed by mixing with water near ambient temperature. [0.5] (1.0)
- c. 1. Spraying with cool reactor makeup water [0.4] produces radioactive liquid waste. [0.3] (0.7)
2. Circulating water through the RCDT HX [0.4] takes an abnormally long time to cool the tank. [0.3] (0.7)

## REFERENCE

WJE 22

System Description II-1, P.5.5

ANSWER 2.02 (3.90)

- a. 1. All orifice isolation valves must be shut. [0.3]  
Pressurizer level > 17%. [0.3] (0.6)
2. Pressurizer level - 17%. [0.3]  
Loss of air or power. [0.3] (0.6)
3. Pressurizer level - 17%.  
LCV 459&460 close.  
Loss of air or power. [0.3 each] (0.9)
- b. 1. Excess letdown. [0.4]  
CCP miniflow recirc. [0.4] (0.8)
- c. Normal recirc valves will close on an "S" signal [0.3] and emergency recirc valves will open. [0.3] Downstream of emergency recirc re 2 relief valves which will open to provide a recirc path to the RWST. [0.4] (1.0)

## REFERENCE

WJE 23

System Description II-2, Pp. 6,7,8,19



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 2.03 (3.00)

- a. During conditions where RCS pressure is above RHR pump shut off head and the RWST is at low level. [0.6] The RHR pump discharge can be directed to the suction of the SI and Centrifugal Charging pumps, or RHR pumps may be stopped. [0.6] 1/2 credit for: Hot leg recirc. (1.2)
- b. System inlet valves close on increasing pressure. [0.4]  
High capacity pump suction relief valves. [0.4] (0.8)
- c. Part of the heat exchanger outlet flow is recircled back to the RHR pump suction. [0.5] A recirc flow control valve opens on low flow [575 GPM] and closes on increased flow [1200GPM]. [0.5] (1.0)

## REFERENCE

WJE 24

System Description II-6, Pp. 7,8,14

ANSWER 2.04 (2.70)

- a. 1. RCP seal return will isolate, [0.3] but a relief valve will direct return flow to the PRT until normal seal flow can be re-established. [0.3] (0.6)
2. Virtually all cooling will be lost to the RCP's [0.3] which must be restored quickly or the pumps must be tripped. [0.3] (0.6)
- b. 1. The system goes on closed loop recirculation. (0.5)
2. Aligns control room ventilation for Oxygen replenishment. (0.5)
3. Totally isolates control room from out side air (to preclude entry of toxic gas). (0.5)

## REFERENCE

WJE 25

System Description II-7, Pp. 15,16,27,36



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 2.05 (3.40)

- a. Normal-- This switch places the unit in parallel mode on starting [0.2] and the generator breaker must be open before stopping. [0.2] All trips are in effect. [0.2] (0.6)
- Emergency-- This switch will bypass all trips except differential and overspeed. [0.3] and will open the generator breaker prior to stopping the engine. [0.3] (0.6)
- b. 1. D/G output breaker control.  
2. Remote/local transfer switch. [0.4 each] (0.8)
- c. 1. Undervoltage.  
2. Blackout.  
3. Safety injection. [0.3 each] (0.9)
- d. 125 VDC. (0.5)

## REFERENCE

WJE 26

System Description VII-4, Pp.37,42

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 2.06 (2.70)

a. The non-class buses can be supplied by opening the 22 KV Main Generator disconnect [0.3] and feeding back from the main transformers to the Aux. transformers. [0.3] The class buses can be supplied by the non-class buses after they are powered as above [0.3] or supplied by the diesels. [0.3] (1.2)

b. A slow transfer will occur if:

1. Normal breaker open.
2. Running bus voltage < 35% normal.
3. Bus feeders tripped.
4. Alternate bus voltage > 85% [0.375 ea.]

OR; A fast transfer will occur if:

1. Sufficient alternate power supply voltage.
2. Phases matched within 40 degrees.
3. Non 1E bus [0.5 ea.]

Accept either answer for full credit. (1.5)

## REFERENCE

WJE 27

System Description VII-1, Pp. 17,40,41

ANSWER 2.07 (1.40)

It will be necessary to open the DC and AC feeders to the inverter. [0.5] Power can be supplied to the AC loads via the By-pass transformer. [0.5] by operation of the panel transfer switch. [0.4] (1.4)

## REFERENCE

WJE 28

Dwng. # 2323-E1-0018

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 2.08 (1.90)

- a. Other systems supplied by the tank are prevented from lowering the tank level below minimum by the elevation of their supply nozzles. (0.6)
- b. Auto start - Isolates condensate make-up and reject lines. (0.4)  
S.I. - De-energizes condensate transfer pump. (0.4)
- c. There is a normally open high point leak off between the normally shut valves. (0.5)

## REFERENCE

WJE 29

System Description VIII-8, Pp. 6-8

ANSWER 2.09 (2.80)

- a. 

1. Fuel Bldg. overhead crane.	6. Transfer Car.
2. Inspection Machine.	7. Fuel Bldg. Upender.
3. New Fuel Elevator.	8. Containment Upender.
4. Fuel Bldg. Bridge Crane.	9. Manipulator Crane [0.2 ea.]
5. RCCS change fixture.	[any 8, 0.2 ea.]

 (1.6)
- b. The bridge and trolley are positioned in relation to a pre-established grid pattern referenced to the core by an X-Y coordinate servo system, read directly by the operator. [1.0] A Video system allows the operator to view fuel assemblies position and movement. [0.2] (1.2)

## REFERENCE

WJE 30

System Description X-1, Pp. 5,6,17

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 3.01 (2.20)

- a. The source range provides a doubling signal set to actuate when flux doubles (within 9 minutes). [0.6] The signal will shift charging pump suction from the VCT to the RWST. [0.3] The feature is manually blocked for approach to criticality, with a back up block provided by P-6. [0.3] (1.2)
- b. Detector current comparator compares each upper and lower detector with the average of the other upper and lower detector currents. [0.25] a (2%) deviation will cause an alarm. [0.25] (0.5)
- The output of each channel is compared with the other 3 channels. [0.25] If 1 channel deviates (by more than 2%) from the lowest of the other channels an alarm will occur. [0.25] (0.5)

## REFERENCE

WJE 13

System Description III-1, Pp.8,11

ANSWER 3.02 (2.70)

- a. 1. Temperature error signal.  
2. Power mismatch signal. [0.4 ea.]
- OR;
1. Auct. Tave.  
2. Tref.  
3. Auct. Hi Power. [0.27 ea.] Accept either answer. (0.8)
- b. 1. May be 0 or 8 steps/min.  
2. 8 steps/min.  
3. 56 steps/min. [0.3 each] (0.9)
- c. Both are used in the power mismatch circuit. [0.4] The non-linear gain unit causes a larger change in power to have a larger effect on rod speed. [0.3] The variable gain unit imposes a lower gain at higher power levels. (prevents overshoot) [0.3] (1.0)

## REFERENCE

WJE 14

System Description III-3, Pp.11,12

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 3.03 (2.10)

- a. 1. Any shutdown rod < 210 steps. (0.35)  
2. any 2 rods in a bank > 6 steps apart. (0.35)
- b. 1. Low power auto rod withdrawal block. (0.35)  
2. Bank "D" auto rod withdrawal block. (0.35)
- c. 1. Tave. (0.35)  
2. % N-16 power. (0.35)
- NOTE: Tave set to "0", allow full credit if omitted.

## REFERENCE

WJE 15

System Description III-3, P.13 &amp; III-4, Pp. 9,17

ANSWER 3.04 (3.80)

- a. 1. Low Tave for feedwater isolation. -- 2/4 (0.4)  
Low Low Tave for steam dump block. -- 2/4 (0.4)
2. C-16, Stop turbine loading. (0.3)
3. RIL (0.3)  
Steam dump control. (0.3)  
Rod control. (0.3)  
Pressurizer level control. (0.3)  
(Reactivity computer not required)
- b. 1. OT N-16 trip--2/4 (0.3)  
OT N-16 runback--2/4 (0.3)  
OP N-16 trip--2/4 (0.3)  
OP N-16 runback--2/4 (0.3)
2. RIL (0.3)

## REFERENCE

WJE 16

System Description III-5, P.11

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 3.05 (3.10)

a. Proportional- Controller output is proportional to input. (0.5)

Integral- Output is modified by the amount of time a deviation exists between pressure and setpoint. (0.5)

Derivative- Output is modified by the rate of change between pressure and setpoint. (0.5)

b. Charging flow will increase, and pressurizer heaters will turn off. [0.6] Letdown isolates. [0.3] Auto make up will maintain VCT level. Reactor will trip due to high pressurizer level.[0.7] (1.6)

## REFERENCE

WJE 17

System Description III-6, P.4 &amp;IV-13, p.12

ANSWER 3.06 (2.70)

a. Loss of load: Turbine impulse pressure rate of decrease. (0.4)

Turbine trip: 4 turbine stop valves closed. (0.4)

2/3 turbine control oil pressures low. (0.4)

b. Only in the Tave mode [0.4] when sufficient Tave-Tref deviation exist to require high (50% or 100%) steam dump demand. [0.6] Air is routed directly to valve actuators (through arming solenoids) bypassing the pneumatic positioner. [0.5] (1.5)

## REFERENCE

WJE 18

System description III-7, Pp. 4,7,8

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 3.07 (2.70)

- a. 1. To maintain valve position in the linear range at low power.  
2. Reduce pump power requirements.  
3. Reduce feed control valve erosion. [any 2, 0.4 each] (0.8)
- b. 1. High S/G level.  
2. Rx. trip and low Tave.  
3. Safety injection. [0.3 each] (0.9)
- c. Auctioneered high power [0.3] is used to anticipate changing load on the S/G. [0.3] This will improve the response of the bypass valve. [0.4] (1.0)

## REFERENCE

WJE 19

System Description III-8, Pp.2,5,6

ANSWER 3.08 (2.50)

- a. T-cold [0.3] acts to lower trip setpoint when t-cold is above normal full power value. [0.2] (0.5)
- RCS pressure [0.3] lowers setpoint when pressure is below rated pressure. [0.2] (0.5)
- Delta-q [0.3] lowers setpoint if flux difference increases. [0.2] (0.5)
- b. Protects against high power density (KW/FT.) (0.5)
- c. DNB, [0.3] in the event of multiple rod drops. [0.2] (0.5)

## REFERENCE

WJE 20

System Description III-9, Pp.6-8



ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 3.09 (3.20)

- a. 1. Single loop loss of flow will insert if 2/4 power ranges are above 48%. (0.4)
2. Two loop loss of flow will insert if 2/4 power ranges >10% [0.3] OR; [0.2] 1/2 impulse pressures > 10% [0.3] (0.8)
- b. The undervoltage trip is to provide a trip signal on loss of power to the RCP's. [0.4] The reactor will trip and RCP's continue to provide coastdown flow. [0.4] The underfrequency trip provides protection for a grid disturbance. [0.4] The RCP breakers and reactor are tripped [0.4] to prevent deceleration and loss of coastdown flow. [0.4] (2.0)

## REFERENCE

WJE 21

System Description III-9,, Pp.9,10,48

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 4.01 (2.40)

- a. 1. Proper managerial approval.
- 2. Lifetime permissible exposure not exceeded. (5{N-18})
- 3. Exposure history documented. [0.4 each] (1.2)
- b. All temporary shielding is identifiable by an attached shielding evaluation tag. (0.4)
- c. Inform co-workers, [0.4] exit area and report to Radiation Protection. [0.4] (0.8)

REFERENCE

WJE 31

Radiation Worker Training, Pp. 23,29,34

ANSWER 4.02 (2.00)

- a. 1. (Assume that the assembly struck may be spent fuel), notify Shift Supervisor [0.4] and immediately evacuate. [0.4] (0.8)
- 2. If practical, place in the containment fuel storage racks or in a location specified by supervisor as an interim measure. (0.6)
- b. Lift assembly clear of the vessel for inspection. (0.6)

REFERENCE

WJE 32

RFO 103, p.3 & RFO 302, P.9

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 4.03 (3.05)

- a. Source Range-- With power below the P-6 setpoint, the channel must be repaired before any positive reactivity addition [0.3] as it is not considered safe to increase power from this level with 1 channel of indication and protection, thus it is a Tech. Spec. requirement. [0.3] Above the P-6 setpoint, continue operation as protection from Source Range is already blocked.[0.3]

Intermediate Range-- The operator must not add positive reactivity if the failure occurs < the P-10 setpoint [0.3] as Tech. Specs. require 2 channels at this power level. [0.3] Above P-10, continue normal operation as there is adequate protection available (from the Power Range). [0.3]

(1.8)

- b. To insert certain trips into the protection system and preserve the required tripping logic.

(0.75)

- c. The control signal uses auctioneered high power.

(0.5)

REFERENCE

WJE 33

ABN 701A, 702A, 703A

ANSWER 4.04 (2.80)

- a. Manipulate turbine load to match Tave and Tref.  
(Accept dilution for 3/4 credit as dilution is not feasible at EOL.)

(0.75)

- b. Increase turbine load as Tave increases to match Tave/Tref[0.4]  
or borate [0.35]

(0.75)

- c. Determine position with in-core detector measurements.

(0.5)

- d. Reduce power (to 50%) [0.6] to ensure power distribution peaking factor limits are not exceeded. [0.2]  
(Allow full credit for any conservative action)

(0.8)

REFERENCE

WJE 34

ABN 712A

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 4.05 (2.00)

- a. Shift Supervisor and RO to hot shutdown panel. [0.8] Relief RO to the switch transfer panel. [0.4] (1.2)
- b. Gaitronics [0.4] and the Safe Shutdown sound powered phone system. [0.4] (0.8)

REFERENCE  
WJE 35  
ABN 905A

ANSWER 4.06 (3.25)

- a. SDM increases from 1% in mode 5 to 1.6% in mode 4 [0.5] so there more negative reactivity available in case of a steam line break above 200 degrees. [0.25] (0.75)
- b. Steaming these units may cause reactivity addition from cool-down [0.5] and result in an unwanted power excursion. [0.25] (0.75)
- c. There is a possibility of attaining criticality below the indicating range [0.5] and entering the source range with an uncontrollable start up rate. [0.25] (0.75)
- d. Emergency borate 100 PPM [0.5] and commence inserting all control rods. [0.5] (1.0)

REFERENCE  
WJE 36  
IPO-001A, P. 8 & IPO- 002A, Pp.5,6,11

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 4.07 (2.80)

- a. 1. Narrow range level  
2. Blowdown rad. monitor  
3. S/G sample activity  
4. Steam line rad monitor  
5. Feed flow > steam flow [any 4, 0.3 ea.] (1.2)
- b. 1. Isolate AFW  
2. Close MSIV's  
3. Verify PORV's closed  
4. Isolate steam to AFW pump  
5. Isolate feedwater  
6. Isolate B/D and sample [any 4, 0.4ea.] (1.6)

REFERENCE

WJE 37

Facility question bank, ERG 21,22,

ANSWER 4.08 (2.70)

- a. Containment pressure > 5 psig [0.3], > 10(E5) REM/Hr. [0.3], Integrated containment dose > 10(E-6) RAD [0.3]. Instrumentation used during emergencies will be affected by these adverse conditions [0.6] (1.5)
- b. 1. Normal spray.  
2. Auxiliary spray.  
3. Pzr. PORV'S [0.4 each] (1.2)

REFERENCE

WJE 38

EOS 3-1, Step 8

ANSWERS -- COMANCHE PEAK 1

-85/04/01-WHITTEMORE, J.

ANSWER 4.09 (2.50)

- a. Reset the SI signal OR; place control switches in "Pull To Lock" [either reason 0.75] to prevent energizing unwanted loads and jeopardizing newly acquired power source. [0.75] (1.5)
- b. A station service water pump [0.5] to supply diesel cooling water. [0.5] (1.0)

REFERENCE

WJE 39

ECA 0.0, P.5

ANSWER 4.10 (1.50)

- a. Steady state [0.35] for a minimum of 3 hours. [0.35] (0.7)
- b. Add the total amount of make up [0.4] and the VCT volume change. [0.4] (0.8)

REFERENCE

WJE 40

OPT 303