

FORT CALHOUN OPERATOR LICENSE
AND REQUALIFICATION EXAMINATIONS
REPORT No. 50-285/OL-87-03

Licensee: Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

Docket: 50-285

License No: DPR-40

Operator License and Senior Operator requalification retake examinations at the Fort Calhoun Station (FCS).

Chief Examiner:

John L. Pellet
John L. Pellet, Examiner

6-22-87
Date Signed

Approved By:

Ralph A. Cooley
Ralph A. Cooley, Section Chief

6/22/87
Date Signed

Summary:

NRC administered one Reactor Operator (RO) license and five Senior Reactor Operator (SRO) requalification retake examinations at FCS during the week of June 1, 1987. All examinees successfully completed their examinations. As a result, NRC has issued the appropriate license and renewals. Satisfactory completion of the retake examinations satisfies NRC requirements for returning those individuals retested to license duties. This effort has no effect on the FCS requalification program evaluation, or the steps required to renew an operating license at FCS.

REPORT DETAILS

1. PERSONS EXAMINED

License Examinations:	TYPE: RO	TOTAL
	PASS: 1 - 100%	1 - 100%
	FAIL: 0 - 0%	0 - 0%
Requalification Examinations:	TYPE: SRO	TOTAL
	PASS: 5 - 100%	5 - 100%
	FAIL: 0 - 0%	0 - 0%

2. EXAMINERS

J. Peilet, NRC (Chief Examiner)
R. Cooley, NRC

3. EXAMINATION REPORT

Individual performance results are not included in this report because these reports are placed in the NRC Public Document Room.

a. EXAMINATION REVIEW COMMENT RESOLUTION

In general, editorial comments or changes made during the examination, review, or subsequent grading reviews are not addressed by this resolution section. This section reflects resolution of substantive comments made in Omaha Public Power District (OPPD) letter LIC-87-403. The modifications discussed below are included in the master examination key which is included elsewhere in this report (see 3.d), as are all other changes mentioned above but not discussed herein. Note that comments from the letter referenced are paraphrased below for brevity. The full text of the comments is available in the referenced letter, which is attached (see 3.e).

5.02/1.03 Add, "To limit the consequences of a CEA ejection," as a correct answer.

NRC: Accept. Key modified.

5.03/1.05 Delete the phrase, "the differential temperature across the core increases," since it is not required to answer the question, and will not occur in the normal FCS operating mode for the conditions given.

NRC: Accept. Key modified.

- 5.07/1.12 Power increases and power decreases should be considered as two separate answers, fully satisfying the question.

NRC: Reject. Power changes, whether increasing or decreasing, are the same fundamental condition.

- 6.03/2.03 This question should be deleted, since while individual CCW pump flow decreases, per the reference, total system flow increases due to additional pump(s) starting.

NRC: Accept. Key modified to delete question.

- 6.04 Accept a calculated value for spray flow.

NRC: Accept. Key modified.

- 6.07/3.06 For part e, accept 6 as an alternate correct answer.

NRC: Accept. Key modified.

- 6.08/2.08 For part a, the key is worded opposite of the correct answer, plus should also contain the requirement of the switch in the auto position.

NRC: Accept. Key modified.

- 6.09/2.09 For part a, add switch position as an initiator.

NRC: Reject. Switch position will not initiate the ramp, but rather permit it to occur. If listed in addition to correct answers, no credit will be subtracted.

For part b, placing the switch in the inhibit mode will also stop the ramp.

NRC: Accept. Key modified.

- 6.10/3.11 Add as correct answers, to indicate subchannel deviation, to indicate power level, and to provide computer input (for tilt and sequencing calculations).

NRC: Accept. Key modified.

- 7.01/4.02 Add as correct answers, dosimetry requirements, radiological conditions, and special instructions.

NRC: Accept. Key modified.

8.01/4.13 For parts a and d, accept either 1 or 2 for either.

NRC: Accept. Key modified.

8.06 Accept Plant Review Committee (PRC) as well as plant supervisory staff since PRC is on the change form.

NRC: Accept. Key modified.

8.10 Accept, "keys for key lock holders," as an alternate answer for part a.

NRC: Requested answer is a subset of the keys used for normal operations, so the key is modified to accept for half credit if stated in lieu of the original answer.

b. JUNE 5, 1987 EXIT MEETING SUMMARY

At the conclusion of the site visit, the NRC examiners met with representatives of plant staff to discuss the site visit. The following personnel were present:

NRC
P. Harrell
J. Pellet

OPPD
J. Fluehr
L. Kusek
D. Munderloh
J. Tesarek

Mr. Pellet started the discussion by noting that the examiners as a group had encountered a positive, helpful attitude in everyone concerned. The following general topics were discussed.

- (1) As required by NUREG-1021, the Examiner Standards, preliminary results are no longer provided in the exit meeting.
- (2) NRC will attempt to return formal, final results within 30 days. Meeting this schedule is very dependent on timely receipt of FCS written comments.
- (3) The following candidate or procedure problems were observed during the site visit and are presented for the use of the facility. Note that a problem does not imply unacceptable performance but is simply an area where knowledge, skill, or support is less completely developed than in others.

- (a) Several cases were observed where the Emergency Operating Procedures (EOP) appeared to be insufficient to protect plant equipment from unnecessary damage. For example, EOPs do not appear to inform operators that operation of the Containment Spray pumps after an RAS without CPHS will rapidly result in pump damage. Reliance on operations staff recall during a stressful transient which would place the plant in this condition appears to be incautious.
 - (b) Several examinees appeared to have difficulty discussing expected plant response for events occurring at low power conditions.
 - (c) During discussion of events requiring immediate actions, NRC expects an examinee to be able to quickly and concisely describe all immediate action steps, without prompting. Several examinees had difficulty in so doing.
- (4) The new material (lesson plans and question bank) used in developing this examination is considerably better than that provided previously. However, several minor errors or inconsistencies were found during examination development. More importantly, the systems material especially seemed to emphasize design details at the expense of system operation and interaction information or the "big picture." It is understood that much of this material is initial issue, and that additional information will be added.

c. GENERIC COMMENTS

The generic comments below were generated during grading of the written examinations, and regional review of the oral examinations. They are provided for the benefit of the facility and no response or corrective actions are required.

- (1) Even though examinees were provided with a complete copy of the appropriate procedure during the examination, event classification was a problem because:
 - (a) Understanding of the barrier criteria, and when a barrier was challenged or failed was weak.
 - (b) Most examinees were unaware that the classification table for loss of offsite power only applied during power operation.

- (2) Most examinees did not understand why the charcoal absorber filter units were required to be maintained at a lower temperature when recovering from a LOCA than before or during.

d. EXAMINATION MASTER COPY

Master copies (questions and answers) for the R0 license examination and SRO requalification examination follow this page.

e. FACILITY EXAMINATION COMMENTS

The facility examination review comments in the form of OPPD letter LIC-87-403 follow the examination master copies. Supporting documentation provided with the comments is not included.

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

FACILITY: ET, CALHOUN
 REACTOR TYPE: PWR-CE
 DATE ADMINISTERED: 87/06/03
 EXAMINER: PELLET, J.
 CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:

Read the attached instruction page carefully. This examination replaces the current cycle facility administered requalification examination. Retraining requirements for failure of this examination are the same as for failure of a requalification examination prepared and administered by your training staff. 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 four (4) hours after the examination starts.

CATEGORY	% OF	CANDIDATE'S	% OF	
VALUE	TOTAL	SCORE	VALUE	CATEGORY
17.00	25.56			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
15.50	23.31			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
17.00	25.56			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
17.00	25.56			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
66.50			%	Totals
		Final Grade		

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

Candidate's Signature

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 on 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 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.

QUESTION 5.01 (1.50)

Describe the reactor response to dropping a peripheral rod during operation with the conditions below. Assume no operator action. (1.5)

- a. Reactor critical at 16% power.
- b. Beginning of cycle with positive MTC.
- c. Manual control of steam dumps.
- d. Manual turbine load control during a load increase.

QUESTION 5.02 (2.00)

What are three (3) reasons for the CEA Insertion limit? (2.0)

QUESTION 5.03 (1.00)

How and why does increasing boron concentration affect AXIAL power distribution? Assume the reactor is operating at 50% power. (1.0)

QUESTION 5.04 (1.00)

How and why does the Moderator Temperature Coefficient vary with respect to changes in control rod height? Assume boron concentration constant. (1.0)

QUESTION 5.05 (2.50)

- a. Which is larger, the fraction of fission neutrons born delayed (Beta) from thermal fission of U-235, from Pu-239, or the fraction born from the fast fission of U-238? (0.625)
- b. For NEGATIVE reactivity additions, will the stable period be longer, shorter, or the same at BOC as compared to EOC? (0.625)
- c. For POSITIVE reactivity additions, will the startup rate be faster, slower, or the same at BOC as compared to EOC? (0.625)
- d. From BOC to EOC, does the average delayed neutron fraction increase, decrease, or remain the same? (0.625)

QUESTION 5.06 (2.00)

Technical Specifications state: "A minimum of 23 feet of water above the top of the core shall be maintained whenever irradiated fuel is being handled."

- a. What is the absolute pressure at the top of the core with 23 feet of water above it. State assumptions for full credit. (1.5)
- b. If peak core exit temperature is 225 deg's F, will boiling occur at the top of the core? Show work for full credit. (0.5)

QUESTION 5.07 (1.00)

Describe the two (2) fundamental operating conditions (which may be encountered during normal power operations) when the differential temperature across the core is not equal to the differential temperature across the steam generators. (1.0)

QUESTION 5.08 (2.00)

If the Taverage program remains the same, what effect will extensive steam generator tube plugging have on the steam generator's pressure? Assume constant power levels before and after plugging. EXPLAIN. (2.0)

QUESTION 5.09 (1.00)

How does the coast-down flow provided by the reactor coolant pump flywheels affect establishing natural circulation flow conditions, and WHY? (1.0)

QUESTION 5.10 (2.00)

TRUE or FALSE?

- a. Critical rod height does NOT depend on how fast control rods are withdrawn. (0.5)
- b. Critical rod height dictates the reactor power level when criticality is achieved. (0.5)
- c. The SLOWER the approach to criticality, the LOWER the reactor power level will be when reaching criticality. (0.5)
- d. When reactor power is in the SOURCE range, changes in power level do not cause a change in T_{avg} . (0.5)

QUESTION 5.11 (1.00)

Why is it recommended that a positive displacement pump be started only with the discharge valve open while a centrifugal pump should be started only with the discharge valve closed? (1.0)

QUESTION 6.01 (2.00)

Describe automatic operation of the Auxiliary Feedwater System after receipt of a valid AFAS with NO operator action. Include component actuations and cycles, with setpoints. (2.0)

QUESTION 6.02 (1.00)

What two (2) CVCS pump trips are overridden on a safeguards sequencer start? Setpoints NOT required. (1.0)

QUESTION 6.03 (1.00)

Why is Component Cooling Water system (CCW) flow lower during post-DBA conditions than during normal operation? (1.5)

QUESTION 6.04 (1.00)

How much pressurizer spray flow (either gpm or %) is required to counter-balance all 900 kw of heaters? (1.0)

QUESTION 6.05 (1.00)

What will cause the Waste Disposal System malfunction alarm on CB-10-11 to actuate and once actuated, how is it cleared? (1.0)

QUESTION 6.06 (2.50)

Give the setpoint AND whether each can be bypassed for the reactor trips listed below. (2.5)

- a. High power
- b. High SUR
- c. Low flow
- d. Low SG level
- e. Low SG pressure
- f. High pressurizer pressure
- g. TMLF
- h. ASG¹
- i. APD
- j. Containment pressure

QUESTION 6.07 (1.50)

MATCHING. Match the appropriate RPS trip to the reasons for bypass below. Each trip may be used more than once or not at all.

- | | | |
|-----|---|-------------------------------|
| --- | a. Allows for low power physics testing. | 1. High rate of power change. |
| --- | b. Bypassed when NI's less than 15% because of NI inadequacies. | 2. Low RCS flow. |
| --- | c. Allows clutch energization when plant is in cold shutdown. | 3. Low SG press. |
| --- | d. Bypassed when NI's < 1EE-04% to eliminate spurious trips. | 4. TM/LP. |
| --- | e. Adequate protection provided when power < 15%. | 5. Loss of load. |
| | | 6. APD |

QUESTION 6.08 (2.00)

- a. What are three (3) of the four conditions necessary for a "fast" transfer of the 4,160 volt buses? (1.5)
- b. What is the total dead time for a "fast" transfer? (0.25)
- c. If a fast transfer is inhibited due to lack of one of the conditions above, what is the expected impact on the plant? (0.25)

QUESTION 6.09 (2.50)

- a. What three (3) conditions initiate the Feedwater Regulating system protective ramp function? (1.5)
- b. Once initiated, how can the ramp be stopped, other than by use of the ramp stop button on the man/auto station? (0.5)
- c. What is the status of the feedwater regulating valve and controller at the conclusion of the rampdown phase? (0.5)

QUESTION 6.10 (1.00)

Other than the Reactor Regulating system, what two (2) uses are made of the NI power range control channels? (1.0)

QUESTION 6.11 (1.00)

- a. Why is it necessary to maintain the charcoal filter units in the Containment Air Cooling and Filtering System less than 500 deg's F at all times? (0.5)
- b. Why is it necessary to maintain charcoal filter unit temperatures less than 360 deg's F as containment air temperatures return to normal after a LOCA? (0.5)

QUESTION 7.01 (2.00)

What are three (3) of the five types of information which are provided by a Radiation Work Permit [RWP]? (2.0)

QUESTION 7.02 (1.00)

- a. What is the dose threshold for posting an area as a Very High Radiation Area? (0.5)
- b. What entry control is required in addition to issuance of an RWP and continuous Health Physics coverage? (0.5)

QUESTION 7.03 (2.00)

What are four (4) of the five events which require emergency boration per AOP-3, "Emergency Boration"? (2.0)

QUESTION 7.04 (1.00)

What objective is assigned to the Assistant Reactor Operator by AOP-7, "Forced Evacuation of Control Room"? (1.0)

QUESTION 7.05 (1.00)

Per AOP-27, "Uncontrolled CEA Withdrawal":

- a. What action should be taken immediately in response to uncontrolled CEA withdrawal? (0.5)
- b. If this action does not terminate the withdrawal, what action should then be taken? (0.5)

QUESTION 7.06 (2.00)

What four (4) criteria must be satisfied to throttle or stop SI? (2.0)

QUESTION 7.07 (3.00)

For each of the immediate actions listed below from EOP-01, "Reactor Trip," describe what should be verified or performed to complete the action. If the EOP requires that you confirm a trend or setpoint then state it in your answer for full credit. (3.0)

- a. Depress the manual reactor trip pushbutton and verify what three (3) parameters? (1.0)
- b. Trip the turbine and verify what two (2) parameters? (0.5)
- c. Verify RCS inventory control via what two (2) parameters? (0.5)
- d. Verify forced circulation core heat removal by verifying what three (3) parameters? (1.0)

QUESTION 7.08 (1.00)

What three (3) parameters are combined with reactor power to determine compliance with the reactor core safety limit in Technical Specifications? (1.0)

QUESTION 7.09 (2.00)

What are three (3) of the four conditions that, after completion of the reactor trip immediate actions, require entry into the Functional Recovery Procedure? (2.0)

QUESTION 7.10 (2.00)

Given each of the events described below, along with Figure OSC - 1.1, "EAL Criteria for Emergency Classification," classify each event separately to the correct EAL. Note that some events may not fall into any EAL. State any assumptions used in making a classification.

- a. While operating at 100% power, steady state, a bomb threat is received stating that an explosive device has been placed in the control room. Upon conducting a search of the control room, what appears to be such a device is discovered. Examination of the device indicates that it may be triggered by radio control or movement. (0.5)
- b. While moving fuel in the core, during refueling outage, all offsite power is lost due to line damage from high winds. After discussion with North Omaha, offsite power will be restored in 20~24 hours. Onsite power systems operate according to design, with adequate fuel oil for at least 120 hours of operation. (0.5)
- c. While operating at 100% power, steady state, a double ended rupture of one RCS cold leg occurs. (0.5)
- d. While operating at 100% power, steady state, a main steam line break occurs downstream of containment but upstream of the main steam isolation valve. Subsequently, calculated steam generator tube leakage increases from 0.2 gpm at steady state to 40 gpm with no indication of secondary activity in the intact loop. (0.5)

QUESTION 8.01 (2.00)

MATCHING. Match each of the colors and descriptions with the correct tag type below. One color and one description should be used for each tag type. Individual colors and descriptions may be used more than once or not at all. (TYPICAL ANSWER: a. 0, 9) (2.0)

TAG TYPE		COLOR	
---	a. DANGER, DO NOT OPERATE	1.	white/red
---	b. CAUTION	2.	red/white
---	c. TEMPORARY CLEARANCE	3.	orange
---	d. HOLD ORDER	4.	yellow

DESCRIPTION			

5.	Used by System Operations for electrical system switching.		
6.	Special instruction in component operation.		
7.	Operation will damage equipment or pose personnel hazard.		
8.	Equipment will be operated in a test position or mode.		

QUESTION 8.02 (1.00)

What is the purpose of the Shift Supervisor sign-off before and after performance of surveillance tests (1.0)

QUESTION 8.03 (1.00)

What are the Technical Specification AND administrative (if different) limits on primary-to-secondary leakage through steam generator tubes for both steam generators? (1.0)

QUESTION 8.04 (2.50)

Complete the following table dealing with Fort Calhoun operating modes per Technical Specifications. (2.5)

Mode	Reactor Power	Reactivity	RCS Temperature	Boron Conc.
Power	(a)	(b)		
Hot Standby		(c)	(d)	
Hot Shutdown		(e)	(f)	
Cold Shutdown			(g)	(h)
Refueling Shutdown			(i)	(j)

QUESTION 8.05 (2.00)

Explain how the section of Technical Specification reproduced below represents a relaxation on what would otherwise be required? (2.0)

2.0.1 (2) When a system, subsystem, train, component, or device is determined to be inoperable solely because its emergency power source is inoperable, or solely because its normal power source is inoperable, it may be considered operable for the purpose of satisfying the requirements of its applicable Limiting Condition for Operation, ...

QUESTION 8.06 (1.50)

What three (3) requirements must be satisfied to make a temporary (On-the-Spot) change to a procedure? (1.5)

QUESTION 8.07 (1.50)

What are the administrative dutie(s) of the Shift Supervisor to complete a temporary tagging after the top half is hung on the appropriate valve?(1.5)

QUESTION 8.08 (2.50)

- a. Complete the following sentences from Standing Order No. G-52, "Plant Staff Working Hours."
1. An individual shall not be permitted to work more than 16 hours straight (excluding ____). (0.5)
 2. An individual shall not be permitted to work more than ____ in any 24 hour period, nor more than ____ hours in any seven day period. (0.75)
 3. A break of at least ____ shall be allowed between work periods. A work period is defined as ____ or more. (0.75)
- b. Who, by job title, must approve exceeding any of these guidelines? (0.5)

QUESTION 8.09 (1.50)

- a. How are mistakes in the official control room log corrected? (0.5)
- b. Who is responsible for maintaining the official control room log? (0.5)
- c. TRUE or FALSE? All operating logs must be kept in black pen? (0.5)

QUESTION 8.10 (1.50)

- a. Which keys may be removed from the Operations Key Depository without completion of the Key Log sheet? (0.5)
- b. Which keys may be removed from the Operations Key Depository by other than the Shift Supervisor? When and by whom? (1.0)

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 5.01 (1.50)

The reactor will become subcritical due to the dropped rod (0.5). The RCS will cool until TM/LP or main steam line isolation terminate the cooldown (0.5). Because MTC is positive, the reactor will remain subcritical as long as the reactor is cooler than normal (0.5). [1.5]

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03

ANSWER 5.02 (2.00)

1. Maintain acceptable power distribution limits (peaking factors).
2. Maintain minimum shutdown margin.
3. CEA misalignment effects limited to acceptable levels.
4. CEA ejection effects limited to accept. levels. (Any 3/4 @ 0.667 ea.)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.04-0001

ANSWER 5.03 (1.00)

Increasing boron concentration moves power up the core (0.5) because the denser water at the bottom of the the core makes the boron worth more. (The rate of change of MTC is not linear per degree F.) Boron makes ASI more negative. (CONCEPT - 0.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.05-0001

ANSWER 5.04 (1.00)

MTC becomes more negative as rods are lowered into the core (0.5) because leakage becomes more significant and thermal utilization decreases (0.5).

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.06-0001

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 5.05 (2.50)

- a. From U-238.
- b. Same.
- c. Slower.
- d. Decrease.

[4 answers @ 0.625 ea.]

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-04-3.00-0001

ANSWER 5.06 (2.00)

- a. Assume density = $\rho = 62 \text{ \#/ft}^3$, $P_{\text{atmos}} = 14.2 \text{ psia}$ (0.5)
 $P = 62 * 23 / [1 \text{ ft}^2 / 144 \text{ in}^2] + 14.2 \text{ psia}$ (0.5)
 $P = 24 \text{ psia}$ (0.5)
- b. $T_{\text{sat}} @ 24 \text{ psia} \sim 238 \text{ deg's F}$ so no boiling expected @ core exit. (0.5)

REFERENCE

FCS Thermo Sect. 1.2, QC#: 007-007-01-C-16-1.02-0006

ANSWER 5.07 (1.00)

- 1. During power changes.
 - 2. When SG steaming unequal.
- [2 answers @ 0.5 ea.]

REFERENCE

FCS Thermo Sect. 1.2, QC#: 007-007-01-C-17-2.01-0002

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 5.08 (2.00)

Psg will be lower (0.75)
because: $Q = uA(T_{ave} - T_{stm})$ (0.25)
with Q, u, & Tave constant (0.25)
and A decreased (0.25)
so Tstm must decrease (0.25)
and since SG is saturated, Pstm will also decrease. (0.25)

REFERENCE

FCS Thermo Sect. 3.2, QC#: 007-007-01-C-18-3.02-0001

ANSWER 5.09 (1.00)

Coast-down delays natural circulation (0.5) because it takes longer to
establish a significant core differential temperature (0.5).

REFERENCE

FCS Thermodynamics NRC Exam, QC#: 007-007-01-C-21-6.01-0001

ANSWER 5.10 (2.00)

- a. T
- b. F
- c. F
- d. T

[4 answers @ 0.5 ea.; 2.0]

REFERENCE

FCS Rx Theory; QC#: 007-005-01-C-04-5.05-0001

ANSWER 5.11 (1.00)

A PD pump started with the discharge valve closed may develop excess
discharge pressure (0.5) while a cent. pump started with the discharge
valve open may draw excessive power or motor amps (0.5).

REFERENCE

FCS THTFF LP 6.3.3, p. 6.3-5, 6

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 6.01 (2.00)

After auto start with low level, SG level will increase from 32% WR (0.4) to 60% WR (0.4), at which point AFAS will reset (0.4), closing the discharge valves (HCV-1107/8 A/B) (0.4). The pumps will continue to run until manually shut down (0.4).

REFERENCE

FCS LP 7-11-1, rev. 1, p. 63

ANSWER 6.02 (1.00)

1. Low oil pressure (9 psig) (0.5)
2. Low suction header pressure (10 psia) (0.5)

REFERENCE

FCS LP 7-11-2, rev. 1, p. 65

ANSWER 6.03 (.00)

DO NOT GRADE! Question deleted per facility comments - system flow incr.

During post-DBA conditions, fewer loads are supplied (0.75), system flow resistance is higher (0.75), and flow is consequently lower. (1.0)
(non-essential loads are isolated)

REFERENCE

FCS LP 7-11-6, rev. 1, p. 20

ANSWER 6.04 (1.00)

53 gpm or 17% (Either of 2 answers; +/- 10%; 1.0)

(Calculated value ok if method & assumptions correct & answer < 100 gpm.)

REFERENCE

FCS LP 7-11-20, rev. 1, p. 39

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 6.05 (1.00)

It actuates when any alarm is received on AI-100 (0.5) and clears when the alarm on AI-100 has been acknowledged (0.5).

REFERENCE

FCS LP 7-11-31, rev. 1, p. 48

ANSWER 6.06 (2.50)

- a. 19% < PWR < 107%; no
- b. 2.6 dpm; yes
- c. 95%; yes
- d. 31.2%; no
- e. 500 psia; yes
- f. 2400 psia; no
- g. variable from 1750 psia minimum; yes
- h. 135 psid; no
- i. variable; yes
- j. 5 psig; no

{20 answers @ 0.125 ea.; 2.5}

REFERENCE

FCS QC#: 007-012-02-C-25-1.03-0004

ANSWER 6.07 (1.50)

- a-4 or 2; b-6; c-3; d-1; e-5 or 6

{5 answers @ 0.3 ea.; 1.5}

REFERENCE

FCS QC#: 007-012-02-C-25-1.07-0002

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 6.08 (2.00)

- a. 1. Sources are in synchronism
2. NO uncleared fault(s) exist on the bus being transferred
3. The alternate source is at the proper voltage
4. The original supply breakers have opened (Any 3/5 @ 0.5 ea.)
5. Switch ["43"] is in auto
- b. 6~8 cycles (0.25)
- c. Reactor trip (loss of aux. systems / fluid transients - CONCEPT) (0.25)

REFERENCE

FCS LP 7-13-2, rev. 2, p. 36, 37

ANSWER 6.09 (2.50)

- a. 1. Turbine trip
2. Feedwater Regulating system in automatic
3. Feedwater regulating valve > 5% open (3 answers @ 0.5 ea.; 1.5)
- b. 1. Reset the turbine trip (0.25)
2. Place auto/inhibit switch in the inhibit position (0.25)
- c. Controller in manual (0.25) with valve 5~10% open (0.25) (0.5)

REFERENCE

FCS LP 7-12-15, rev. 1, p. 34-36

ANSWER 6.10 (1.00)

1. Input to power ratio calculator
2. Display axial shape index (Any 2/4 answers @ 0.5 ea.; 1.0)
3. Indicate subchannel deviation
4. Indicate power level

REFERENCE

FCS LP 7-12-19, rev. 1, p. 61, 62

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 6.11 (1.00)

- a. To prevent charcoal ignition (0.5)
- b. To prevent release of contaminants absorbed by the charcoal (0.5)

REFERENCE

FCS LP 7-14-2, rev. 1, p. 68

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 7.01 (2.00)

1. Clothing & protective equipment required
2. Allowed individual exposures (without additional authorization)
3. Job to be performed
4. Description of the hazards involved
5. Monitoring requirements (Any 3/8 answers @ 0.666 ea; 2.0)
6. Dosimetry
7. Radiological conditions
8. Special instructions

REFERENCE

FCS Radiation Protection Manual, rev. 33, p. VII-2-9

ANSWER 7.02 (1.00)

- a. 1000 mr/hr (0.5)
- b. Locked access doors (or provisions of TS 5.11.2 ...) (0.5)

REFERENCE

FCS Radiation Protection Manual, rev. 18, p. VII-3-5

ANSWER 7.03 (2.00)

1. Uncontrolled plant cooldown
2. Failure of more than 1 CEA to insert following a reactor trip
3. Unexplained reactivity anomaly with all CEA's inserted
4. CEA's inserted 12" below the PDIL
5. Forced evacuation of the Control Room (Any 4/5 @ 0.5 ea.; 2.0)

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

REFERENCE

FCS AOP-3, rev. 0, p. AOP-3-1

ANSWER 7.04 (1.00)

The ARO's chief objective is to regain access to the control room as soon as possible. (1.0)

REFERENCE

FCS AOP-7, rev. 1, p. AOP-7-5

ANSWER 7.05 (1.00)

a. Place the CEA drive control selector switch to "OFF" (0.5)

b. Manually trip the reactor (& go to EOP-1) (0.5)

REFERENCE

FCS AOP-27, rev. 0, p. AOP-27-2

ANSWER 7.06 (2.00)

1. Rcs subcooling ≥ 20 deg's F
2. Pressurizer level $\geq 45\%$ AND not decreasing
3. At least 1 S/G available (feed/steam flow) for RCS heat removal
4. RVLMS indicates core covered (4 answers @ 0.5 ea.; 2.0)

REFERENCE

FCS AOP-23, rev. 1, p. AOP-23-2

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 7.07 (3.00)

- a. 1. Reactor power decreasing
- 2. Negative startup rate
- 3. No more than 1 CEA NOT inserted (3 answers @ 0.33 ea.; 1.0)
- b. 1. All stop valves closed
- 2. All intercept valves closed (2 answers @ 0.25 ea.; 0.5)
- c. 1. Pressurizer level 30-70% trending to 45-60%
- 2. RCS subcooling ≥ 20 deg's F (2 answers @ 0.25 ea.; 0.5)
- d. 1. At least 1 RCP operating
- 2. Core delta T ≤ 10 deg's F
- 3. RCS subcooling ≥ 20 deg's F (3 answers @ 0.33 ea.; 1.0)

REFERENCE

FCS EOP-01, rev. 1, p. 3, 4, 6, 8

ANSWER 7.08 (1.00)

- 1. RCS flow / # RCP operating
- 2. RCS cold leg temperature
- 3. Pressurizer / RCS pressure (3 answers @ 0.33 ea.; 1.0)

REFERENCE

FCS TS, Amend. 70, p. 1-1

ANSWERS -- FT, CALHOUN

-87/06/03-PELLET, J.

ANSWER 7.09 (2.00)

1. No immediate diagnosis or cause after completing reactor trip IA's.
2. Any event for which guidance cannot be identified.
3. EOP actions are not satisfying safety function status check acceptance criteria.
4. 2 or more events occurring simultaneously. (Any 3/4 @ 0.667 ea.; 2.0)

REFERENCE

FCS EOP-20, rev. 1, p. 2

ANSWER 7.10 (2.00)

- a. Alert (CR evacuation may be anticipated) (0.5)
- b. None (Station power tree only at power, no barrier damage) (0.5)
- c. S. A. E. (Failure of 2 FPB; G.A.E. if explain challenge to 3rd) (0.5)
(RCPB, Cntmnt failed; clad fnc of subcooling loss)
- d. S. A. E. (Failure of 2 FPB; MSLB w/ SGTR & uncontrolled release) (0.5)

REFERENCE

FCS EPIP-OSC-1, rev. 11, OSC Figure OSC - 1.1

* ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 8.01 (2.00)

a. 1/2, 7

b. 4, 6

c. 3, 8

d. 1/2, 5

(8 answers @ 0.25 ea.; 2.0)

REFERENCE

FCS Standing Order 0-20, rev. 17, p. 1

ANSWER 8.02 (1.00)

For notification only (does not constitute approval)

REFERENCE

FCS Special Order 28

ANSWER 8.03 (1.00)

TS: 1 gpm

FAC: 0.3 gpm

(2 answers @ 0.5 ea.; 1.0)

REFERENCE

FCS Special Order 35, rev. 0

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 8.04 (2.50)

- a. >2%
- b. critical
- c. critical
- d. (Tavg) > 515 deg's F
- e. (SDM) >= 4.0% dK/K
- f. (Tavg) > 515 deg's F
- g. (Tcold) < 210 deg's F
- h. ppm req'd for 3% dK/K SDM
- i. (Tcold) < 210 deg's F
- j. 1800 ppm (SDM >= 5% dK/K)

(10 answers @ 0.25 ea.; 2.5)

REFERENCE

FCS TS, p. 1, 2, 2-50

ANSWER 8.05 (2.00)

If this specification did not exist, then any time a safety system power source were inoperable, all associated devices would also be considered inoperable (1.0). This specification allows them to be considered operable as long as redundant power sources are still available (1.0). (CONCEPT)

REFERENCE

FCS TS, p. 2-0

ANSWER 8.06 (1.50)

- 1. Intent unaltered (not an USQD).
- 2. Approved by 2 members of plant super.staff (PRC), at least 1 an SRO.
- 3. The change is documented, reviewed by the PRC, & approved by the Manager-FCS within 14 days of implementation. (3 answers @ 0.5ea.; 1.5)

REFERENCE

FCS Standing Order G-30, rev. 18, p. 3

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 8.07 (1.50)

1. Log it in [the Temporarily Tagged Equipment Log] (0.75)
2. Forward it to the Operations Engineer (0.75)

REFERENCE

FCS Standing Order G-48, rev. 2, p. 1

ANSWER 8.08 (2.50)

- a.
 1. shift turnover time (0.5)
 2. 16 hours, 72 [2 answers @ 0.375 ea.; 0.75]
 3. 8 hours, 8 hours [2 answers @ 0.375 ea.; 0.75]
- b. Manager - FCS [or his designate]

REFERENCE

FCS Standing Order G-52, rev. 1, p. 2

ANSWER 8.09 (1.50)

- a. Mistakes are lined out and initialed. (0.5)
- b. The Reactor Operator [assisted by the ARO]. (0.5)
- c. False [Logs outside CR may be kept in pencil.] (0.5)

REFERENCE

FCS Standing Order O-24, rev. 4, p. 1-4

ANSWER 8.10 (1.50)

- a. Keys used by Operations in normal performance of their duties. (0.5)
[Keys used in key lock holders - 0.25 - subset of full answer.]
- b. RPS bypass keys [0.33] may be removed by the Reactor Operator [0.33]
when needed during absence of the SS from the Control Room [0.34].

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

REFERENCE

FCS Standing Order J-26, rev. 13, p. 2

TEST CROSS REFERENCE

PAGE 1

QUESTION	VALUE	REFERENCE
05.01	1.50	JJP0001906
05.02	2.00	JJP0001908
05.03	1.00	JJP0001910
05.04	1.00	JJP0001911
05.05	2.50	JJP0001913
05.06	2.00	JJP0001916
05.07	1.00	JJP0001917
05.08	2.00	JJP0001918
05.09	1.00	JJP0001920
05.10	2.00	JJP0001953
05.11	1.00	JJP0001989

	17.00	
06.01	2.00	JJP0001924
06.02	1.00	JJP0001926
06.03	.00	JJP0001927
06.04	1.00	JJP0001930
06.05	1.00	JJP0001931
06.06	2.50	JJP0001935
06.07	1.50	JJP0001936
06.08	2.00	JJP0001939
06.09	2.50	JJP0001940
06.10	1.00	JJP0001944
06.11	1.00	JJP0001949

	15.50	
07.01	2.00	JJP0001972
07.02	1.00	JJP0001973
07.03	2.00	JJP0001977
07.04	1.00	JJP0001979
07.05	1.00	JJP0001982
07.06	2.00	JJP0001983
07.07	3.00	JJP0001984
07.08	1.00	JJP0001987
07.09	2.00	JJP0001990
07.10	2.00	JJP0001991

	.00	
08.01	2.00	JJP0001985
08.02	1.00	JJP0001992
08.03	1.00	JJP0001993
08.04	2.50	JJP0001994
08.05	2.00	JJP0001995
08.06	1.50	JJP0001996
08.07	1.50	JJP0001997
08.08	2.50	JJP0001998
08.09	1.50	JJP0001999

QUESTION	VALUE	REFERENCE
08.10	1.00	JJP0002050
	17.00	
	66.50	

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: FT. CALHOUN
 REACTOR TYPE: PWR-CE
 DATE ADMINISTERED: 87/06/03
 EXAMINER: PELLET, J.
 CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:

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	CANDIDATE'S	% OF	
VALUE	TOTAL	SCORE	VALUE	CATEGORY
<u>25.00</u>	<u>25.38</u>	_____	_____	1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
<u>23.50</u>	<u>23.86</u>	_____	_____	2. PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
<u>25.00</u>	<u>25.38</u>	_____	_____	3. INSTRUMENTS AND CONTROLS
<u>25.00</u>	<u>25.38</u>	_____	_____	4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
<u>98.50</u>		_____	_____%	Totals
		Final Grade		

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

Candidate's Signature

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 on 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 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.

QUESTION 1.01 (1.50)

Describe the reactor response to dropping a peripheral rod during operation with the conditions below. Assume no operator action. (1.5)

- a. Reactor critical at 16% power.
- b. Beginning of cycle with positive MTC.
- c. Manual control of steam dumps.
- d. Manual turbine load control during a load increase.

QUESTION 1.02 (1.50)

How and WHY does Plutonium-239 production affect core reactivity? (1.0)

QUESTION 1.03 (2.00)

What are three (3) reasons for the CEA Insertion limit? (2.0)

QUESTION 1.04 (2.00)

How does Integral Rod Worth change (INCREASE, DECREASE, NO CHANGE) for an INCREASE in each of the following core parameters. State any assumptions needed for your answers. Consider each case separately.

- a. Taverage. (0.5)
- b. Poison concentration. (0.5)
- c. Reactor power, 1 to 100%. (0.5)
- d. Core age, BOC to EOC. (0.5)

QUESTION 1.05 (1.00)

How and why does increasing boron concentration affect AXIAL power distribution? Assume the reactor is operating at 50% power. (1.0)

QUESTION 1.06 (1.00)

How and why does the Moderator Temperature Coefficient vary with respect to changes in control rod height? Assume boron concentration constant. (1.0)

QUESTION 1.07 (1.00)

How is AXIAL power shape affected by a power change? (1.0)

QUESTION 1.08 (2.50)

- a. Which is larger, the fraction of fission neutrons born delayed (Beta) from thermal fission of U-235, from Pu-239, or the fraction born from the fast fission of U-238? (0.625)
- b. For NEGATIVE reactivity additions, will the stable period be longer, shorter, or the same at BOC as compared to EOC? (0.625)
- c. For POSITIVE reactivity additions, will the startup rate be faster, slower, or the same at BOC as compared to EOC? (0.625)
- d. From BOC to EOC, does the average delayed neutron fraction increase, decrease, or remain the same? (0.625)

QUESTION 1.09 (1.50)

During a dilution to criticality, the operator dilutes boron concentration to 800 ppm. The source range count rate levels at 1857 cps. The initial count rate was 400 cps at 1150 ppm boron with $K_{eff}=0.940$.

- a. What is the inverse CR ratio (1/M) value? (0.5)
- b. What is the new value of K_{eff} ? (1.0)

QUESTION 1.10 (.50)

Select the letter which corresponds to the best answer: (0.5)

With the reactor critical at $1\text{EE}-04\%$, rod withdrawal is used to increase power one decade. At $1\text{EE}-03\%$:

- a. the rod position will be higher than initial because more fuel must be exposed to the available neutrons to maintain the higher power.
- b. the rod position will be higher than initial to overcome the isothermal power defect.
- c. the rod position will be lower than initial due to the increased neutron population associated with the higher power level.
- d. the rod position will be the same as the initial because the outward rod motion required to increase power equals the inward motion required to stabilize at a new power level.

QUESTION 1.11 (2.00)

Technical Specifications state: "A minimum of 23 feet of water above the top of the core shall be maintained whenever irradiated fuel is being handled."

- a. What is the absolute pressure at the top of the core with 23 feet of water above it. State assumptions for full credit. (1.5)
- b. If peak core exit temperature is 225 deg's F , will boiling occur at the top of the core? Show work for full credit. (0.5)

QUESTION 1.12 (1.00)

Describe the two (2) fundamental operating conditions (which may be encountered during normal power operations) when the differential temperature across the core is not equal to the differential temperature across the steam generators. (1.0)

QUESTION 1.13 (2.00)

If the Taverage program remains the same, what effect will extensive steam generator tube plugging have on the steam generator's pressure? Assume constant power levels before and after plugging. EXPLAIN. (2.0)

QUESTION 1.14 (1.00)

Why does a decrease in circulating water temperature result in a decrease in the absolute pressure in the condenser? (1.0)

QUESTION 1.15 (1.00)

How does the coast-down flow provided by the reactor coolant pump flywheels affect establishing natural circulation flow conditions, and WHY? (1.0)

QUESTION 1.16 (1.00)

Why is secondary mass flow rate only about 10% of the primary mass flow rate? (1.0)

QUESTION 1.17 (2.50)

Briefly explain how each of the following factors operate to change fuel centerline temperature over core life.

- a. Fuel pellet swell. (0.625)
- b. Clad creep. (0.625)
- c. Clad crud buildup. (0.625)
- d. Gas gap fission product contamination. (0.625)

QUESTION 2.01 (2.00)

What are the three (3) sources of makeup to the Emergency Feedwater Tank and which is the preferred or normal source? (2.0)

QUESTION 2.02 (1.50)

Complete the following statements with respect to the Chemical and Volume Control system (CVCS) design basis. Each blank may be completed with a single number. (1.5)

The CVCS is capable of maintaining pressurizer level within the Technical Specification bounds of (a) % and (b) % during:

- (1) A heatup or cooldown of (c) deg's F/hr.
- (2) A step change of (d) % of full power.
- (3) A ramp change of (e) % of full power per minute.

QUESTION 2.03 (1.00)

Why is Component Cooling Water system (CCW) flow lower during post-DBA conditions than during normal operation? (1.5)

QUESTION 2.04 (3.00)

Answer the following questions relating to starting a main feed pump. Assume this is the first pump, started cold. (3.0)

- a. How many condensate pumps must be operating? (0.75)
- b. How many consecutive starts may be attempted? (0.75)
- c. How should the temperature of the seal water lines change when the feed pump goes from standby to normal operation? (0.75)
- d. What should be the status of the warmup valves before starting the feed pump? (0.75)

QUESTION 2.05 (1.00)

How much pressurizer spray flow (either gpm or %) is required to counter-balance all 900 kw of heaters? (1.0)

QUESTION 2.06 (2.00)

What are five (5) circuits or components actuated by the SIAS lock-out relays? (2.0)

QUESTION 2.07 (2.50)

Give the setpoint AND whether each can be bypassed for the reactor trips listed below. (2.5)

- a. High Power
- b. High SUR
- c. Low flow
- d. Low SG level
- e. Low SG pressure
- f. High pressurizer pressure
- g. TMLP
- h. ASGT
- i. APD
- j. Containment pressure

QUESTION 2.08 (2.00)

- a. What are three (3) of the four conditions necessary for a "fast" transfer of the 4,16V volt buses? (1.5)
- b. What is the total dead time for a "fast" transfer? (0.25)
- c. If a fast transfer is inhibited due to lack of one of the conditions above, what is the expected impact on the plant? (0.25)

QUESTION 2.09 (1.50)

- a. At what power level is the extended range mode of the NI WR log channel disabled, AND to what count rate does this correspond? (0.5)
- b. How is the detection circuitry different for the NI WR log channels when in the extended range operating mode? (0.5)
- c. How is the indication different for the NI WR log channels when in the extended operating mode? (0.5)

QUESTION 2.10 (1.50)

What three (3) RPS reactor trips receive an input from the reactor power range safety channels? (1.5)

QUESTION 2.11 (2.00)

Describe the sequence of events following RAS (SIRWT low concurrent with PPLS). Include motive power for automatic actions. (2.0)

QUESTION 2.12 (2.00)

What are the normal AND alternate supply sources (NOT transformer) to the four 4,160V buses 1A1, 1A2, 1A3, and 1A4? (2.0)

QUESTION 2.13 (1.00)

- a. Why is it necessary to maintain the charcoal filter units in the Containment Air Cooling and Filtering System less than 500 deg's F at all times? (0.5)
- b. Why is it necessary to maintain charcoal filter unit temperatures less than 360 deg's F as containment air temperatures return to normal after a LOCA? (0.5)

QUESTION 2.14 (1.50)

The control room ventilation system is controlled by a five position mode selector switch (A-D & OFF) located on AI-44 in the control room. Describe briefly the operating modes represented by three (3) of the four (4) position not including "OFF" (3 of A, B, C, and D). (1.5)

QUESTION 3.01 (2.00)

Describe automatic operation of the Auxiliary Feedwater System after receipt of a valid AFAS with NO operator action. Include component actuations and cycles, with setpoints.

(2.0)

QUESTION 3.02 (1.00)

What two (2) CVCS pump trips are overridden on a safeguards sequencer start? Setpoints NOT required.

(1.0)

QUESTION 3.03 (2.00)

MATCHING. Match each of the actions with the appropriate pressurizer level deviation from setpoint. Level deviations may be used more than once or not at all.

(2.0)

ACTION		LEVEL DEVIATION	
---	a. 36 GPM letdown flow.	1.	-5.0 % increasing
---	b. Clear backup heater signal	2.	-2.0 % increasing
---	c. Backup heaters on	3.	0.0 (@ setpoint)
---	d. Hi level alarm	4.	+1.7 % increasing
---	e. Permit start 2nd & 3rd chg pumps	5.	+2.6 % increasing
---	f. Backup signal to start all chg pumps	6.	+5.0 % increasing
---	g. Minimum letdown flow of 26 gpm	7.	+8.0 % increasing
---	h. Clear low level error alarm	8.	+14.0 % increasing
---	i. Start 2nd charging (chg) pump	9.	+7.8 % decreasing
---	j. 2nd & 3rd chg pumps off	10.	+3.8 % decreasing
		11.	-2.0 % decreasing
		12.	-2.9 % decreasing
		13.	-3.3 % decreasing
		14.	-6.0 % decreasing

QUESTION 3.04 (1.00)

What will cause the Waste Disposal System malfunction alarm on CB-10-11 to actuate and once actuated, how is it cleared?

(1.0)

QUESTION 3.05 (2.50)

- a. How do the Containment Spray test switches affect the spray valves both with and without a Containment Spray Actuation Signal (CSAS) present? (1.5)
- b. If a valid CSAS occurs during test, with the spray valve (HC-344 or 345) overridden, what are two (2) ways the operator could open the spray valve? (1.0)

QUESTION 3.06 (1.50)

MATCHING. Match the appropriate RPS trip to the reasons for bypass below. Each trip may be used more than once or not at all.

- | | | |
|--------|--|-------------------------------|
| --- a. | Allows for low power physics testing. | 1. High rate of power change. |
| --- b. | Bypassed when NI's less than 15% because of NI inadequacies. | 2. Low RCS flow. |
| --- c. | Allows clutch energization when plant is in cold shutdown. | 3. Low SG press. |
| --- d. | Bypassed when NI's < 1EE-04% to eliminate spurious trips. | 4. TM/LP. |
| --- e. | Adequate protection provided when power < 15%. | 5. Loss of load. |
| | | 6. APD |

QUESTION 3.07 (1.50)

With Engineered Safeguards Control system in emergency standby status, which of the following action(s) would occur if the PPLS test switch on AI-30A were placed in "TEST?" (1.5)

- a. 86A / PPLS trips.
- b. 86B / SIAS trips.
- c. 86A1 / SIAS trips.
- d. 480V Load shed channel A occurs.
- e. 480V Load shed channel B occurs.
- f. Two (and only two) HPSI loop isolation valves open.
- g. Eight HPSI loop isolation valves open.

QUESTION 3.08 (1.00)

Why is it important to reset PPLS and CPHS lockout relays before resetting SIAS lockout relays? (1.0)

QUESTION 3.09 (2.50)

- a. What three (3) conditions initiate the Feedwater Regulating system protective ramp function? (1.5)
- b. Once initiated, how can the ramp be stopped, other than by use of the ramp stop button on the man/auto station? (0.5)
- c. What is the status of the feedwater regulating valve and controller at the conclusion of the rampdown phase? (0.5)

QUESTION 3.10 (1.50)

What three (3) systems receive a signal from the Nuclear Instrumentation Wide Range (NI WR) Log channels AND what signal does each receive? (1.5)

QUESTION 3.11 (1.00)

Other than the Reactor Regulating system, what two (2) uses are made of the NI power range control channels? (1.0)

QUESTION 3.12 (2.50)

Three (3) level transmitters (LT-903X, LT-903Y, & LT-903Y-1) supply a measurement of downcomer level used by the Feedwater Regulating system (FRS) to control SG RC-2A level. (2.5)

- a. What is one (1) of the two (2) uses that may be made by the FRS of the level signal from LT-903X? (0.5)
- b. What are three (3) of the four (4) uses that may be made by the FRS of the level signal from LT-903Y? (1.5)
- c. What is the single use by FRS of the level signal from LT-903Y-1? (0.5)

QUESTION 3.13 (1.50)

What are three (3) possible causes for annunciation of the "Inverter Trouble" alarms at A15? (1.5)

QUESTION 3.14 (1.50)

Where are the three (3) thermostats located for the three zones of the control room ventilation system? (1.5)

QUESTION 3.15 (2.00)

What are the four (4) ENGINE trips for the emergency diesel generator which are overridden on an emergency start? (2.0)

QUESTION 4.01 (2.00)

- a. What are the normal O. P. P. D. permissible accumulated dose (PAD) as set by the Radiation Protection Manual:
1. daily, (0.4)
 2. weekly, (0.4)
 3. quarterly, and (0.4)
 4. yearly. (0.4)
- b. By what factor are the daily and weekly PAD's increased during major maintenance or refueling projects? (0.4)

QUESTION 4.02 (2.00)

What are three (3) of the five types of information which are provided by a Radiation Work Permit (RWP)? (2.0)

QUESTION 4.03 (1.00)

- a. What is the dose threshold for posting an area as a Very High Radiation Area? (0.5)
- b. What entry control is required in addition to issuance of an RWP and continuous Health Physics coverage? (0.5)

QUESTION 4.04 (1.00)

Why does OP-8, "Reactor Shutdown," note that for a short duration shutdown, all Reactor Coolant Pumps should be left in operation? (1.0)

QUESTION 4.05 (2.00)

What are four (4) of the five events which require emergency boration per AOP-3, "Emergency Boration?" (2.0)

QUESTION 4.06 (2.00)

- a. Complete the following notes from AOP-5, "Emergency Shutdown":
1. Limit load change rate to _____. (0.5)
 2. Limit turbine first stage shell inner metal temperature rate of change to _____. (0.5)
 3. Load change (SHOULD/SOULD NOT) be stopped if boration is required to maintain regulating CEA's above the PDIL. (0.5)
- b. During an emergency shutdown, at what power level should the reactor be manually tripped? (0.5)

QUESTION 4.07 (1.00)

What objective is assigned to the Assistant Reactor Operator by AOP-7, "Forced Evacuation of Control Room?" (1.0)

QUESTION 4.08 (2.00)

Complete the following operator actions required by AOP-10, "Loss of Circulating Water": [Blanks may represent one or more words, phrases, or numbers.]

- a. If all circulating water flow is lost to the condensers and cannot be restored, _____. (0.5)
- b. Terminate any _____ by closing HCV-691 or HCV-692. (0.5)
- c. Ensure Steam Generator pressure is maintained at _[1]_ by operation of the _[2]_ and _[3]_. (0.5)
- d. Start _____ prior to turbine speed reaching 900 rpm. (0.5)

QUESTION 4.09 (2.00)

Complete the following operator actions required by AOP-11, "Loss of Component Cooling Water":

If component cooling water flow cannot be restored within _(a)_ minutes or a high temperature alarm is annunciated for _(b)_, _(c)_, or _(d)_ then:

1. _(e)_.
2. Stop _(f)_.
3. Stop all _(g)_.
4. If component cooling water cannot be restored, provide _(h)_ for those components so equipped.

QUESTION 4.10 (1.00)

Per AOP-27, "Uncontrolled CEA Withdrawal":

- a. What action should be taken immediately in response to uncontrolled CEA withdrawal? (0.5)
- b. If this action does not terminate the withdrawal, what action should then be taken? (0.5)

QUESTION 4.11 (2.00)

What four (4) criteria must be satisfied to throttle or stop SI? (2.0)

QUESTION 4.12 (3.00)

For each of the immediate actions listed below from EOP-01, "Reactor Trip," describe what should be verified or performed to complete the action. If the EOP requires that you confirm a trend or setpoint then state it in your answer for full credit. (3.0)

- a. Depress the manual reactor trip pushbutton and verify what three (3) parameters? (1.0)
- b. Trip the turbine and verify what two (2) parameters? (0.5)
- c. Verify RCS inventory control via what two (2) parameters? (0.5)
- d. Verify forced circulation core heat removal by verifying what three (3) parameters? (1.0)

QUESTION 4.13 (2.00)

MATCHING. Match each of the colors and descriptions with the correct tag type below. One color and one description should be used for each tag type. Individual colors and descriptions may be used more than once or not at all. (TYPICAL ANSWER: e. 0, 9) (2.0)

TAG TYPE		COLOR	
---	a. DANGER, DO NOT OPERATE	1.	white/red
---	b. CAUTION	2.	red/white
---	c. TEMPORARY CLEARANCE	3.	orange
---	d. HOLD ORDER	4.	yellow
DESCRIPTION			
5.	Used by System Operations for electrical system switching.		
6.	Special instruction in component operation.		
7.	Operation will damage equipment or pose personnel hazard.		
8.	Equipment will be operated in a test position or mode.		

QUESTION 4.14 (1.00)

Explain the difference between a "channel check," and a "channel calibration," as defined in Technical Specifications. (1.0)

QUESTION 4.15 (1.00)

What three (3) parameters are combined with reactor power to determine compliance with the reactor core safety limit in Technical Specifications? (1.0)

1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION,
THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

PAGE 19

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 1.01 (1.50)

The reactor will become subcritical due to the dropped rod (0.5). The RCS will cool until TM/LP or main steam line isolation terminate the cooldown (0.5). Because MTC is positive, the reactor will remain subcritical as long as the reactor is cooler than normal (0.5). (1.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03

ANSWER 1.02 (1.50)

Production adds positive reactivity (0.75) since Pu-239 (fissionable) is generated from non-fuel U-238 (0.75) (1.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.02-0001

ANSWER 1.03 (2.00)

1. Maintain acceptable power distribution limits (peaking factors).
2. Maintain minimum shutdown margin.
3. CEA misalignment effects limited to acceptable levels.
4. CEA ejection effects limited to accept. levels. (Any 3/4 @ 0.667 ea.)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.04-0001

ANSWER 1.04 (2.00)

- a. Incr.
- b. Decr.
- c. NC.
- d. Incr.

(4 answers @ 0.5 ea.)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.04-0003

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 1.05 (1.00)

Increasing boron concentration moves power up the core (0.5) because the denser water at the bottom of the the core makes the boron worth more. (The rate of change of MTC is not linear per degree F.) Boron makes ASI more negative. (CONCEPT - 0.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.05-0001

ANSWER 1.06 (1.00)

MTC becomes more negative as rods are lowered into the core (0.5) because leakage becomes more significant and thermal utilization decreases (0.5).

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-03-3.06-0001

ANSWER 1.07 (1.00)

Power increase moves axial peak lower in core (ASI more +) & reverse. (1.0)

REFERENCE

FCS RX Theory, QC#: 007-005-01-C-03-5.03-0001

ANSWER 1.08 (2.50)

- a. From U-238.
- b. Same.
- c. Slower.
- d. Decrease.

(4 answers @ 0.625 ea.)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-04-3.00-0001

1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION,
THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

PAGE 21

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 1.09 (1.50)

a. $CR1/CR2 = 400/1857 \sim 0.215 \pm 10\%$ (0.5)

b. $CR1/CR2 = [1-K2]/[1-K1]$ (0.5)

$K2 = 1-[CR1/CR2][1-K1] = 0.9871 \pm 10\%$ (0.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-04-5.03-0001

ANSWER 1.10 (.50)

d. (0.5)

REFERENCE

FCS Rx Theory, QC#: 007-005-01-C-04-5.05-0003

ANSWER 1.11 (2.00)

a. Assume density = $\rho = 62 \text{ \#/ft}^3$, Patmos = 14.2 psia (0.5)

$P = 62 \times 23 / [1 \text{ ft}^2 / 144 \text{ in}^2] + 14.2 \text{ psia}$ (0.5)

$P = 24 \text{ psia}$ (0.5)

b. $T_{sat} @ 24 \text{ psia} \sim 238 \text{ deg's F}$ so no boiling expected @ core exit. (0.5)

REFERENCE

FCS Thermo Sect. 1.2, QC#: 007-007-01-C-16-1.02-0006

ANSWER 1.12 (1.00)

1. During power changes.

2. When SG steaming unequal.

[2 answers @ 0.5 ea.]

REFERENCE

FCS Thermo Sect. 1.2, QC#: 007-007-01-C-17-2.01-0002

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 1.13 (2.00)

Psg will be lower (0.75)
because: $Q = uA(T_{ave} - T_{stm})$ (0.25)
with Q, u, & T_{ave} constant (0.25)
and A decreased (0.25)
so T_{stm} must decrease (0.25)
and since SG is saturated, P_{stm} will also decrease. (0.25)

REFERENCE

FCS Thermo Sect. 3.2, QC#: 007-007-01-C-18-3.02-0001

ANSWER 1.14 (1.00)

As circulating water temperature decreases, condensate temperature also decreases. Condenser pressure is determined by the saturated vapor pressure of the condensate so it decreases also. (CONCEPT) (1.0)

REFERENCE

FCS Thermo Sect. 5.2, QC#: 007-007-01-C-20-5.02-0001

ANSWER 1.15 (1.00)

Coast-down delays natural circulation (0.5) because it takes longer to establish a significant core differential temperature (0.5).

REFERENCE

FCS Thermodynamics NRC Exam, QC#: 007-007-01-C-21-6.01-0001

ANSWER 1.16 (1.00)

Secondary mass undergoes phase change (CONCEPT). (1.0)

REFERENCE

FCS Thermo NRC Exam, QC#: 007-007-01-C-24-9.04-0003

1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION,
THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

PAGE 23

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 1.17 (2.50)

- a. Narrows the gas gap, which acts to decrease centerline temp. (0.625)
- b. Narrows the gas gap, which acts to decrease centerline temp. (0.625)
- c. Decreases clad/coolant heat transfer coefficient, which acts to increase fuel centerline temperature. (0.625)
- d. Reduces heat transfer properties of the gas gap, which acts to increase fuel centerline temperature. (0.625)

REFERENCE

FCS Thermo Sect. 10.3, QC#: 007-007-01-C-25-0.03-0001

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 2.01 (2.00)

1. Demin. water (0.5) - normal source (0.5) (1.0)
2. Condensate system (pump discharge) (0.5)
3. Fire protection system (temporary hookup) (0.5)

REFERENCE

FCS LP 7-11-1, rev. 1, p. 15, 16

ANSWER 2.02 (1.50)

- a. 40
 - b. 69
 - c. 75
 - d. 10
 - e. 10
- [5 answers @ 0.3 ea.; +/- 10% accuracy for full credit; 1.5]

REFERENCE

FCS LP 7-11-2, rev. 1, p. 20

ANSWER 2.03 (.00)

DO NOT GRADE! Question deleted per facility comments - system flow incr.

During post-DBA conditions, fewer loads are supplied (0.75), system flow resistance is higher (0.75), and flow is consequently lower. (1.0)
(non-essential loads are isolated)

REFERENCE

FCS LP 7-11-6, rev. 1, p. 20

ANSWER 2.04 (3.00)

- a. 1
- b. 2
- c. Temperature difference (in-out) should disappear.
- d. Isolated. [4 answers @ 0.75 ea. - 3.0]

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

REFERENCE

FCS LP 7-11-11, p. 47-53

ANSWER 2.05 (1.00)

53 gpm or 17%

[Either of 2 answers; +/- 10%; 1.0]

[Calculated value ok if method & assumptions correct & answer < 100 gpm.]

REFERENCE

FCS LP 7-11-20, rev. 1, p. 39

ANSWER 2.06 (2.00)

1. VIAS L-0 relays
 2. Open HPSI loop injection valves
 3. Open LPSI loop injection valves
 4. Close SI check valve leakage cooler outlet PCV's
 5. Input signal to OPLS
 6. 480v load shed
 7. Actuates auxiliary SIAS relays
 8. Multiple SIAS alarms and annunciators
- [Any 5/8 @ 0.4 ea.; 2.0]

REFERENCE

FCS LP 7-12-5, rev. 1, p. 42-44

ANSWER 2.07 (2.50)

- a. 19% < PWR < 107%; no
 - b. 2.6 dpm; yes
 - c. 95%; yes
 - d. 31.2%; no
 - e. 500 psia; yes
 - f. 2400 psia; no
 - g. variable from 1750 psia minimum; yes
 - h. 135 psid; no
 - i. variable; yes
 - j. 5 psig; no
- [20 answers @ 0.125 ea.; 2.5]

REFERENCE

FCS QC#: 007-012-02-C-25-1.03-0004

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 2.08 (2.00)

- a. 1. Sources are in synchronism
2. NO uncleared fault(s) exist on the bus being transferred
3. The alternate source is at the proper voltage
4. The original supply breakers have opened [Any 3/5 @ 0.5 ea.]
5. Switch ("43") is in auto
- b. 6~8 cycles (0.25)
- c. Reactor trip [loss of aux. systems / fluid transients - CONCEPT] (0.25)

REFERENCE

FCS LP 7-13-2, rev. 2, p. 36, 37

ANSWER 2.09 (1.50)

- a. 4EE-05 % or 1000 cps (+/- factor of 2) (0.5)
- b. Both fission chambers are energized instead of one (0.5)
- c. [CB-4] power meter and recorder indicate in counts per second (0.5)

REFERENCE

FCS LP 7-12-18, rev. 1, p. 53, 54

ANSWER 2.10 (1.50)

1. TM/LP (thermal margin / low pressure)
2. APD (axial power distribution)
3. High power [3 answers @ 0.5 ea.; 1.5]

REFERENCE

FCS LP 7-12-19, rev. 1, p. 14, 15

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 2.11 (2.00)

1. Containment sump suction valves open - MOV's
2. SIRWT isolation valves close - AOV's
3. LPSI pumps trip
4. ECCS recirculation return isolation valves close - AOV's

(4 answers @ 0.5 ea.; motive power - 0.1; action - 0.4; 2.0)

REFERENCE

FCS LP 7-11-22, rev. 1, p. 20, 21

ANSWER 2.12 (2.00)

BUS	NORMAL	ALTERNATE
1A1	22 KV MG	161 KV BLAIR
1A2	22 KV MG	161 KV BLAIR
1A3	161 KV BLAIR	22 KV MG
1A4	161 KV BLAIR	22 KV MG

(8 answers @ 0.25 ea.; 2.0)

REFERENCE

FCS LP 7-13-1, rev. 1, p. 13, 14

ANSWER 2.13 (1.00)

- a. To prevent charcoal ignition (0.5)
- b. To prevent release of contaminants absorbed by the charcoal (0.5)

REFERENCE

FCS LP 7-14-2, rev. 1, p. 68

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 2.14 (1.50)

A: Normal operation (Adjustable fresh air input)

B: Filtered air makeup (As above but outside air filtered)

C: 100% return air (All recirculation - no fresh air intake)

D: 100% fresh air (inlet & outlet @ 100% open) {Any 3/4 @ 0.5 ea.; 1.5}

REFERENCE

FCS LP 7-14-6, rev. 1, p. 20, 21

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 3.01 (2.00)

After auto start with low level, SG level will increase from 32% WR (0.4) to 60% WR (0.4), at which point AFAS will reset (0.4), closing the discharge valves (HCV-1107/8 A/B) (0.4). The pumps will continue to run until manually shut down (0.4).

REFERENCE

FCS LP 7-11-1, rev. 1, p. 63

ANSWER 3.02 (1.00)

1. Low oil pressure (9 psig) (0.5)
2. Low suction header pressure (10 psia) (0.5)

REFERENCE

FCS LP 7-11-2, rev. 1, p. 65

ANSWER 3.03 (2.00)

a-3; b-10; c-6; d-7; e-10; f-14; g-2 OR 11; h-1; i-12; j-6

REFERENCE

FCS LP 7-11-2, rev. 1, p. 32

ANSWER 3.04 (1.00)

It actuates when any alarm is received on AI-100 (0.5) and clears when the alarm on AI-100 has been acknowledged (0.5).

REFERENCE

FCS LP 7-11-31, rev. 1, p. 48

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 3.05 (2.50)

- a. Without a CSAS, both spray valves are held closed by an alternate air path (0.75) if either test switch is in the TEST position (0.75).

With a CSAS, the spray valves will open regardless of the position of the test switches (1.0).

- b. 1. Place the control switch in AUTO.
2. Place the control switch in OPEN.
3. Position the valve using the HIC. (Any 2/3 answers @ 0.5 ea.; 1.0)

REFERENCE

FCS LP 7-12-6, rev. 1, p. 25, 26, 36

ANSWER 3.06 (1.50)

a-4 or 2; b-6; c-3; d-1; e-5 or 6 (5 answers @ 0.3 ea.; 1.5)

REFERENCE

FCS QC#: 007-012-02-C-25-1.07-0002

ANSWER 3.07 (1.50)

a, c, d, e, & g (5 answers @ 0.3 ea.; 1.5)

REFERENCE

FCS QC#: 007-012-03-C-05-2.03-0002

ANSWER 3.08 (1.00)

SIAS lockout relay coil will burn out if reset before clearing PPLS & CPHS.

REFERENCE

FCS QC#: 007-012-03-C-05-3.04-0001

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 3.09 (2.50)

- a.
 - 1. Turbine trip
 - 2. Feedwater Regulating system in automatic
 - 3. Feedwater regulating valve > 5% open [3 answers @ 0.5 ea.; 1.5]
- b.
 - 1. Reset the turbine trip (0.25)
 - 2. Place auto/inhibit switch in the inhibit position (0.25)
- c. Controller in manual (0.25) with valve 5~10% open (0.25) (0.5)

REFERENCE

FCS LP 7-12-15, rev. 1, p. 34-36

ANSWER 3.10 (1.50)

- 1. Auxiliary (remote) shutdown panel (AI-185) gets power indication. (0.5)
- 2. CRDM system gets (high) rate of change signal. (0.5)
- 3. RPS gets (high) rate of change signal. (0.5)

REFERENCE

FCS LP 7-12-18, rev. 1, p. 12

ANSWER 3.11 (1.00)

- 1. Input to power ratio calculator
- 2. Display axial shape index [Any 2/4 answers @ 0.5 ea.; 1.0]
- 3. Indicate subchannel deviation
- 4. Indicate power level

REFERENCE

FCS LP 7-12-19, rev. 1, p. 61, 62

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 3.12 (2.50)

- a. 1. Auto control using 3 element mode
- 2. Indication for manual control (1/2 @ 0.5)
- b. 1. High level override of reg valve
- 2. Auto control of bypass valve
- 3. Indication for manual control
- 4. Level alarms (hi and lo) (Any 3/4 @ 0.5 ea.; 1.5)
- c. Indication (on AI-179) (0.5)

REFERENCE

FCS LP 7-12-28, rev. 1, p. 19, 20

ANSWER 3.13 (1.50)

- 1. DC output voltage low
- 2. AC output voltage low (~105VAC)
- 3. Output grounded
- 4. Inverter not in sync (Any 3/4 @ 0.5 ea.; 1.5)

REFERENCE

FCS LP 7-13-4, rev. 1, p. 38

ANSWER 3.14 (1.50)

- 1. Control room
- 2. Shift supervisor's office
- 3. Computer room (3 answers @ 0.5 ea.; 1.5)

REFERENCE

FCS LP 7-14-6, rev. 1, p. 54

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 3.15 (2.00)

1. Low lube oil pressure
2. High crankcase pressure
3. High water temperature
4. Generator lockout

(4 answers @ 0.5 ea.; 2.0)

REFERENCE

FCS QC#: 007-013-06-C-05-1.09-0002

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.01 (2.00)

- a. 1. 100 mr
- 2. 300 mr
- 3. 1250 mr
- 4. 5000 mr

b. 3

(5 answers @ 0.4 ea.)

REFERENCE

FCS Radiation Protection Manual, rev. 33, p. VII-2-4

ANSWER 4.02 (2.00)

- 1. Clothing & protective equipment required
- 2. Allowed individual exposures (without additional authorization)
- 3. Job to be performed
- 4. Description of the hazards involved
- 5. Monitoring requirements (Any 3/8 answers @ 0.666 ea; 2.0)
- 6. Dosimetry
- 7. Radiological conditions
- 8. Special instructions

REFERENCE

FCS Radiation Protection Manual, rev. 33, p. VII-2-9

ANSWER 4.03 (1.00)

- a. 1000 mr/hr (0.5)
- b. Locked access doors (or provisions of TS 5.11.2 ...) (0.5)

REFERENCE

FCS Radiation Protection Manual, rev. 18, p. VII-3-5

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.04 (1.00)

RCP's should be left on because starting with the system at temperature puts a significant temperature transient on the RCP seals. (1.0)

REFERENCE

FCS OP-8, rev. 8, p. OP-8-3

ANSWER 4.05 (2.00)

1. Uncontrolled plant cooldown
2. Failure of more than 1 CEA to insert following a reactor trip
3. Unexplained reactivity anomaly with all CEA's inserted
4. CEA's inserted 12" below the PDIL
5. Forced evacuation of the Control Room (Any 4/5 @ 0.5 ea.; 2.0)

REFERENCE

FCS AOP-3, rev. 0, p. AOP-3-1

ANSWER 4.06 (2.00)

- a.
 1. 10% / minute
 2. 150 deg's F / hour
 3. should NOT
- b. 20% (4 answers @ 0.5 ea.; Accept +/- 10% for full credit; 2.0)

REFERENCE

FCS AOP-5, rev. 0, p. AOP-5-1

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.07 (1.00)

The ARO's chief objective is to regain access to the control room as soon as possible. (1.0)

REFERENCE

FCS AOP-7, rev. 1, p. AOP-7-5

ANSWER 4.08 (2.00)

- a. manually trip the reactor (& go to EOP-1) (0.5)
- b. radioactive liquid release (0.5)
- c. 1. 850-900 psia (0.25)
2. steam dump 3. bypass valves (0.125 ea.; swap 2-3 OK; 0.25)
- d. turbine oil lift pumps (0.5)

REFERENCE

FCS AOP-10, rev. 0, p. AOP-10-2

ANSWER 4.09 (2.00)

- a. 5
- b. RCP lube oil coolers
- c. RCP seal bleedoff temperature
- d. CEDM seal temperatures (b/c/d any order OK)
- e. Manually trip the reactor (& go to EOP-1)
- f. the RCP's indicating high temperatures
- g. RCP's prior to 5 minutes
- h. Raw Water (8 answers @ 0.25 ea.; 2.0)

REFERENCE

FCS AOP-11, rev. 0, p. AOP-11-1, 2

4. PROCEDURES -- NORMAL, ABNORMAL, EMERGENCY AND
RADIOLOGICAL CONTROL

PAGE 37

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.10 [1.00]

- a. Place the CEA drive control selector switch to "OFF" [0.5]
- b. Manually trip the reactor (& go to EOP-1) [0.5]

REFERENCE

FCS AOP-27, rev. 0, p. AOP-27-2

ANSWER 4.11 [2.00]

- 1. Rcs subcooling ≥ 20 deg's F
- 2. Pressurizer level $\geq 45\%$ AND not decreasing
- 3. At least 1 S/G available (feed/steam flow) for RCS heat removal
- 4. RVLMS indicates core covered [4 answers @ 0.5 ea.; 2.0]

REFERENCE

FCS AOP-23, rev. 1, p. AOP-23-2

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.12 (3.00)

- a. 1. Reactor power decreasing
- 2. Negative startup rate
- 3. No more than 1 CEA NOT inserted (3 answers @ 0.33 ea.; 1.0)
- b. 1. All stop valves closed
- 2. All intercept valves closed (2 answers @ 0.25 ea.; 0.5)
- c. 1. Pressurizer level 30-70% trending to 45-60%
- 2. RCS subcooling ≥ 20 deg's F (2 answers @ 0.25 ea.; 0.5)
- d. 1. At least 1 RCP operating
- 2. Core delta T ≤ 10 deg's F
- 3. RCS subcooling ≥ 20 deg's F (3 answers @ 0.33 ea.; 1.0)

REFERENCE

FCS EOP-01, rev. 1, p. 3, 4, 6, 8

ANSWER 4.13 (2.00)

- a. 1/2, 7
- b. 4, 6
- c. 3, 8
- d. 1/2, 5 (8 answers @ 0.25 ea.; 2.0)

REFERENCE

FCS Standing Order 0-20, rev. 17, p. 1

4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND
RADIOLOGICAL CONTROL

PAGE 39

ANSWERS -- FT. CALHOUN

-87/06/03-PELLET, J.

ANSWER 4.14 (1.00)

A "check," is a qualitative evaluation, based on other readings while a
"calibration," is an actual adjustment. (CONCEPT) (1.0)

REFERENCE

FCS TS, Amend. 86, p. 4

ANSWER 4.15 (1.00)

1. RCS flow / # RCP operating
2. RCS cold leg temperature
3. Pressurizer / RCS pressure (3 answers @ 0.33 ea.; 1.0)

REFERENCE

FCS TS, Amend. 70, p. 1-1

TEST CROSS REFERENCE

PAGE 1

QUESTION	VALUE	REFERENCE
01.01	1.50	JJP0001906
01.02	1.50	JJP0001907
01.03	2.00	JJP0001908
01.04	2.00	JJP0001909
01.05	1.00	JJP0001910
01.06	1.00	JJP0001911
01.07	1.00	JJP0001912
01.08	2.50	JJP0001913
01.09	1.50	JJP0001914
01.10	.50	JJP0001915
01.11	2.00	JJP0001916
01.12	1.00	JJP0001917
01.13	2.00	JJP0001918
01.14	1.00	JJP0001919
01.15	1.00	JJP0001920
01.16	1.00	JJP0001921
01.17	2.50	JJP0001922

	25.00	
02.01	2.00	JJP0001923
02.02	1.50	JJP0001925
02.03	.00	JJP0001927
02.04	3.00	JJP0001929
02.05	1.00	JJP0001930
02.06	2.00	JJP0001933
02.07	2.50	JJP0001935
02.08	2.00	JJP0001939
02.09	1.50	JJP0001942
02.10	1.50	JJP0001943
02.11	2.00	JJP0001945
02.12	2.00	JJP0001947
02.13	1.00	JJP0001949
02.14	1.50	JJP0001950

	23.50	
03.01	2.00	JJP0001924
03.02	1.00	JJP0001926
03.03	2.00	JJP0001928
03.04	1.00	JJP0001931
03.05	2.50	JJP0001934
03.06	1.50	JJP0001936
03.07	1.50	JJP0001937
03.08	1.00	JJP0001938
03.09	2.50	JJP0001940
03.10	1.50	JJP0001941
03.11	1.00	JJP0001944
03.12	2.50	JJP0001946
03.13	1.50	JJP0001948

TEST CROSS REFERENCE

PAGE 2

QUESTION	VALUE	REFERENCE
03.14	1.50	JJP0001951
03.15	2.00	JJP0001952
	25.00	
04.01	2.00	JJP0001971
04.02	2.00	JJP0001972
04.03	1.00	JJP0001973
04.04	1.00	JJP0001974
04.05	2.00	JJP0001977
04.06	2.00	JJP0001978
04.07	1.00	JJP0001979
04.08	2.00	JJP0001980
04.09	2.00	JJP0001981
04.10	1.00	JJP0001982
04.11	2.00	JJP0001983
04.12	3.00	JJP0001984
04.13	2.00	JJP0001985
04.14	1.00	JJP0001986
04.15	1.00	JJP0001987
	25.00	
	98.50	