

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Operator Licensing Exam Report: 50-285/OL88-03 Operating License: DPR-40

Docket No: 50-285

Licensee: Omaha Public Power District (OPPD)
1623 Harney
Omaha, Ne 68012

Facility Name: Fort Calhoun Station (FCS)

Examination at: Fort Calhoun Station

Chief Examiner: *S. L. McCrory* 8/3/88
S. L. McCrory, Lead Examiner,
Operator Licensing Section,
Division of Reactor Safety Date

Approved by: *J. L. Pellet* 8/3/88
acting J. L. Pellet, Section Chief,
pc Operator Licensing Section,
Division of Reactor Safety Date

Summary

NRC Administered Examinations Conducted During The Week of July 26, 1988
(Report 50-285/OL88-03)

NRC administered examinations to one Reactor Operator and four Senior Reactor Operator applicants. All applicants passed all portions of the examination and have been issued the appropriate license.

8809190226 880909
PDR ADOCK 05000285
V PNU

DETAILS1. Persons Examined

		<u>SRO</u>	<u>RO</u>	<u>Total</u>
License Examinations:	Pass -	4	1	5
	Fail -	0	0	0

2. Examiners

S. L. McCrory, Chief Examiner
F. Jaggar

3. Examination Report

Performance results for individual examinees are not included in this report as it will be placed in the NRC Public Document Room and these results are not subject to public disclosure.

a. Examination Review Comment/Resolution

In general, editorial comments or changes made during the examination, or subsequent grading reviews are not addressed by this resolution section. This section reflects resolution of substantive comments made by FCS. The only comments addressed in this section are those which were not accepted for incorporation into the examination and/or answer key. Those comments accepted are incorporated into the master examination key, which is included in this report. Comments may be paraphrased for brevity. The full text of the comments is attached.

- (3.09) Part b asks for trip logic, not the number of channels required for a trip.
Response NRC considers the trip logic to include both the number of detectors needed to trip a channel and the number of channels needed to initiate a reactor trip signal.
- (4.03) The question should be deleted because there is an abnormal difference between CETs and RCS T-hot in the answer indicated in the key and no other answer is correct.
Response Due to the low flow rates during natural circulation and the relative sensitivities of RTDs and CETs, it is likely that RTD indication will appear to stabilize (temporarily) while CETs show a temperature decrease.
- (4.06) Expand the answer key for Part c to include: Meet MTC values as prescribed by the Reactor Engineer.
Response The question deals with restrictions on rod insertion. This response is concerned with rod withdrawal restrictions.

b. Site Visit Summary

- (1) At the end of the written examination administration, the facility licensee was provided a copy of the examination and answer key for the purpose of commenting on the examination content validity. It was explained to the facility licensee that regional policy was to have examination results finalized within 30 days. Thus, a timely response was desired to attain this goal.
- (2) The Chief Examiner communicated to the facility licensee via the senior resident inspector a concern that Abnormal Operating Procedures (AOPs) 6 and 7 lacked adequate guidance to the shift supervisor for implementation of the emergency plan. AOPs 6 and 7 provide guidance for plant control when evacuation of the control room is required. The procedures simply direct the shift supervisor to implement the emergency plan but do not instruct him as to where he should go to accomplish this. It was communicated to the Chief Examiner during the course of examination that shift supervisors had informally agreed to go to the technical support center to initiate the emergency plan when required to evacuate the control room. To avoid possible confusion, the AOPs should specify where the shift supervisor reports to initiate the emergency plan following control room evacuation.

c. General Comments

During examination development, it was determined that no lesson plans had been provided for certain systems covered in the Knowledge and Abilities (KAs) catalog, NUREG-1122. Further, some of the questions provided in the facility licensee examination bank referenced lesson plans which had not been provided to NRC for examination development. OPPD should review the systems listed in NUREG-1122 against existing lesson plans and training material and provide the NRC with any lesson plans or other training material related to those systems. Where lesson plans or training material do not exist for a specific system listed in NUREG-1122, OPPD should provide justification why licensed operators are not trained on those systems. Similarly, the Plant-Wide Generic KAs (194001 series) should be reviewed to determine existence of lesson plans or training material or a justification as to why it is not needed. Lesson plans currently held by the NRC RIV examiner staff are referenced in OPPD Letter LIC-88-385 of May 23, 1988.

d. Master Examination and Answer Key

Master copies of the FCS license examinations and answer keys are attached. The facility licensee comments, which have been accepted, are incorporated into the answer key.

e. Facility Examination Review Comments

The facility licensee comments regarding the written examination are attached. Those comments which were not acceptable for incorporation into the examination answer key have been addressed in the resolution section of this report.

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

FACILITY: ET. CALHOUN
 REACTOR TYPE: PWR-CE
 DATE ADMINISTERED: 88/07/26
 EXAMINER: MCCRODY, S.
 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 VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00	_____	_____	5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00	_____	_____	6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00	_____	_____	7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00	_____	_____	8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00		_____	_____%	Totals
		Final Grade		

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

Candidate's Signature

QUESTION 5.01 (1.00)

During a reactor startup, an initial reactivity addition causes power to increase from 20 to 40 CPS. A second reactivity addition causes power to change to 80 CPS. Which of the following statements is correct?

- a. The first reactivity addition was smaller.
- b. The second reactivity addition was smaller.
- c. The first and second reactivity additions were equal.
- d. There is insufficient data to determine a relationship between the reactivity additions. (1.0)

ANSWER 5.01 (1.00)

- b. The second reactivity addition was smaller. (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.13.1
001010K536 015000K506 ... (KA'S)

QUESTION 5.02 (1.00)

With the reactor critical at 5000 CPS, CEA withdrawal is used to increase power to 10000 CPS. Select the statement below that correctly describes the position of the CEA's after power is stabilized at 10000 CPS. (1.0)

- a. The rod position will be higher than previous as more fuel must be exposed to the neutron flux to maintain the higher power level.
- b. Rods will be further withdrawn to compensate for the temperature defect at the higher power.
- c. The rod position will be the same because the outward motion needed to attain a given startup rate equals the inward motion necessary to kill the startup rate.
- d. The final position will be lower due to the increasing delayed neutron population associated with the higher power level.

ANSWER 5.02 (1.00)

c. Rod position will be the same. (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.4.3
001000K510 ... (KA'S)

QUESTION 5.03 (1.00)

The moderator temperature coefficient (MTC) varies with certain plant conditions. The MTC: [choose one correct answer]

- a. Becomes more negative as boron concentration is increased.
- b. Varies due to temperature (T_{avg}) because of the non-linear density changes of water as temperature changes.
- c. Causes axial flux distribution to be tilted toward the top of the core at the beginning of life.
- d. Would be expected to introduce a large negative reactivity in the event of a major steam line break.

ANSWER 5.03 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.6.8
192004K103 ... (KA'S)

QUESTION 5.04 (1.00)

In the event of a rod ejection accident, which one will be the first reactivity coefficient to insert negative reactivity?

- a. Doppler coefficient.
- b. Pressure coefficient.
- c. Void coefficient.
- d. Moderator temperature coefficient.

ANSWER 5.04 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.7.5
192004K107 ... (KA'S)

QUESTION 5.05 (1.00)

It takes less reactivity to go prompt critical at:

- a. BOL because of the higher value of beta effective.
- b. BOL because of the lower value of beta effective.
- c. EOL because of the higher value of beta effective.
- d. EOL because of the lower value of beta effective.

ANSWER 5.05 (1.00)

D (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 4.5
192003K106 192003K107 192003K108 ... (KA'S)

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

QUESTION 5.06 (1.00)

Which one of the following statements is correct concerning the change in differential boron worth ($\% \Delta k/k$) with RCS boron concentration (range of 0 to 1600 ppm) and T_{ave} (range of 532 degF to 580 degF)?

- a. It increases as T_{ave} and RCS boron concentration increase.
- b. It decreases as RCS boron concentration increases but is constant as T_{ave} increases.
- c. It decreases as T_{ave} and RCS boron concentration increase.
- d. It increases as T_{ave} increases but is constant as RCS boron concentration increases.

ANSWER 5.06 (1.00)

C (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.5.4
192004K109 192004K110 ... (KA'S)

QUESTION 5.07 (1.00)

Voiding has occurred in the RCS, in the vicinity of the reactor vessel during a natural circulation cooldown. Which of the following CORRECTLY characterizes the process of collapsing the void?

- a. The void will superheat if an attempt is made to collapse it too fast. The rate of collapse will be governed largely by ambient heat loss from the void.
- b. The void will collapse at a rate equivalent to the rate of HPSI flow; therefore, full HPSI should be run until the void is fully collapsed.
- c. The void will be composed largely of hydrogen gas, and will therefore require degasifying of the RCS in order to begin collapsing it.
- d. The void will collapse immediately upon increasing the pressure above the local saturation pressure; the main concern is water hammer.

ANSWER 5.07 (1.00)

A (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
SECY 82-475
193007K104 ... (KA'S)

QUESTION 5.08 (1.00)

The ratio of Pu-239 and Pu-240 atoms to U-235 atoms changes over core life. Which one of the pairs of parameters below is most affected by this change?

- a. doppler coefficient and beta
- b. moderator temperature coefficient and doppler coefficient
- c. beta and moderator temperature coefficient
- d. moderator temperature coefficient and neutron generation time

ANSWER 5.08 (1.00)

A (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.7.5
192004K107 ... (KA'S)

QUESTION 5.09 (1.00)

A general rule is often stated "doubling the count rate halves the margin to criticality". This is mathematically stated by the equation:

$$CR1/CR2 = (1-K_{eff2})/(1-K_{eff1}).$$

Which one of the following statements is CORRECT concerning the above statement and equation?

- a. Equal changes in K_{eff} result in equal changes in subcritical multiplication level.
- b. Both K_{eff1} and K_{eff2} have to be less than 1.0.
- c. The equation only approximates the instantaneous change in count rate; once the equilibrium value is reached, the count rate will be higher.
- d. A second doubling of the count rate will result in the reactor becoming critical or supercritical.

ANSWER 5.09 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 5.1
001010K516 192003K101 ... (KA'S)

QUESTION 5.10 (1.00)

Which one of the following correctly describes the response of core delta T if the RCS coolant flow rate is reduced while the steam system is controlling to maintain 80% electrical output? The plant has been at 80% of full power, steady state, for 10 days. All control rods are fully withdrawn (ARO).

- a. Delta T will increase but nuclear power remains the same to provide the same megawatt thermal output.
- b. Delta T will remain the same but nuclear power will increase to provide the same megawatt thermal output.
- c. Delta T will remain the same since the turbine/generator output power has not changed.
- d. Delta T will increase and nuclear power must increase to provide more steam flow to the turbine.

ANSWER 5.10 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-22, LO 7.2-2
193007K108 ... (KA'S)

QUESTION 5.11 (1.00)

The reactor is critical at $10E-3$ % power when a S/G Atmospheric dump valve fails open. Assuming BOL conditions, no rod motion, and no reactor trip, choose the answer below that best describes the values of T_{avg} and nuclear power for the resulting new steady state. (POAH = point of adding heat).

- a. Final T_{avg} greater than initial T_{avg} , Final power above POAH.
- b. Final T_{avg} greater than initial T_{avg} , Final power at POAH.
- c. Final T_{avg} less than initial T_{avg} , Final power above POAH.
- d. Final T_{avg} less than initial T_{avg} , Final power at POAH.

ANSWER 5.11 (1.00)

C (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 1.3
192008115 ... (KA'S)

QUESTION 5.12 (1.00)

Which one of the following best supports the reason why Xenon reactivity increases sharply after a trip following 1000 hrs. of operation at 100% power?

- a. Iodine half-life is much shorter than Xenon half-life.
- b. Xenon decays less rapidly due to a reduction in the neutron flux.
- c. Iodine production is greatly reduced and Xenon production is greatly increased due to the reduction in neutron flux.
- d. Due to reduced neutron absorption, Iodine concentration increases, and Xenon decays directly from Iodine, thus Xenon increases.

ANSWER 5.12 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.12.6
192006K107 ... (KA'S)

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

QUESTION 5.13 (1.00)

Which one of the below requires the most heat removal during condensation?
(assume steam is of equal quality)

- a. two pounds of steam at 1200 psia.
- b. two pounds of steam at 600 psia.
- c. one pound of steam at 300 psia.
- d. one pound of steam at 0 psia.

ANSWER 5.13 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR

steam tables

FCS LP 7-7-16, LO 1.6-1

193003K125 ... (KA'S)

QUESTION 5.14 (1.00)

As core age increases during a cycle, the integral rod worth at 100% full
power of a regulating CEA located near the center of the core:

- a. increases due to the fact that temperature of the CEA is higher.
- b. increases due to the fact that the CEA is operating in a region of
higher neutron flux.
- c. decreases due to the fact that the temperature of the CEA is higher.
- d. decreases due to the fact that the boric-acid concentration in the
core is less.

ANSWER 5.14 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.4.6
192005K107 ... (KA'S)

QUESTION 5.15 (1.00)

The term "critical heat flux" refers to that heat flux between a fuel pin and the bulk of the primary coolant:

- a. at which the heat-transfer mechanism changes between natural convection and nucleate boiling.
- b. at which DNBR would equal 1.3.
- c. at which the heat-transfer mechanism changes between nucleate boiling and partial film boiling.
- d. which is 77% of that which would cause clad failure.

ANSWER 5.15 (1.00)

C (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-18, LO 3.3-2
193008K106 ... (KA'S)

QUESTION 5.16 (1.00)

A relief valve on a pipe opens at 885 psig. The temperature of the steam exhausted to the atmosphere is 320 deg. F. The fluid within the pipe is saturated steam. Using the steam tables provided, what is the approximate temperature of the fluid within the pipe, in the immediate vicinity of the relief valve? (Select one response from below.)

- a. 530 deg. F
- b. 400 deg. F
- c. 320 deg. F
- d. 212 deg. F

ANSWER 5.16 (1.00)

A (Saturated steam at 885 + 15 psia.) (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR

CE Steam Tables

FCS LP 7-7-17, LO 2.3-1

193004K115 ... (KA'S)

QUESTION 5.17 (1.00)

Which of the following statements concerning power defect is correct?

- a. The power defect is the difference between the measured power coefficient and the predicted power coefficient.
- b. The power defect increases the rod worth requirements necessary to maintain the desired shutdown margin following a reactor trip.
- c. Because of higher boron concentration, the power defect is more negative at the beginning of core life.
- d. The power defect necessitates the use of a ramped Tavg program to maintain an adequate subcooling margin.

ANSWER 5.17 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR

FCS 7-5-3, LO 3.11.3

001000K549 ... (KA'S)

QUESTION 5.18 (1.00)

With RCS pressure at 2100 psia, one of the seals in a RCP assembly fails. Assume original leakoff flow was 1.0 gpm and leakoff backpressure is 50 psia. Which ONE of the following is correct concerning both the pressure drop across each operable seal and leakoff flow?

- a. 1050 psid and 1.5 gpm
- b. 1050 psid and 1.2 gpm
- c. 1025 psid and 1.2 gpm
- d. 1025 psid and 1.5 gpm

ANSWER 5.18 (1.00)

C 1025 psid and 1.2 gpm (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-11-20, LO 1.7d
003000A201 ... (KA'S)

QUESTION 5.19 (1.00)

Which of the following statements about burnable poisons is NOT true?

- a. As core age increases burnable poison effects partially compensate for fission product buildup effects.
- b. Including burnable poison in the fuel affects the moderator temperature coefficient.
- c. As core age increases burnable poison effects partially compensate for fissile depletion of the fuel.
- d. Including burnable poison in the fuel affects the doppler coefficient.

ANSWER 5.19 (1.00)

D (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.3.2

192007K101 ... (KA'S)

QUESTION 5.20 (1.00)

The reactor trips from full power, equilibrium xenon conditions. Six (6) hours later the reactor is brought critical at $5 \times 10^{-4}\%$. If power level is maintained at $5 \times 10^{-4}\%$, which of the following statements is CORRECT concerning control rod motion?

- a. Rods will have to be withdrawn since xenon will closely follow its normal build-in rate.
- b. Rods will approximately remain as is as the xenon establishes its equilibrium value for this power level.
- c. Rods will have to be inserted since the critical reactor will burnout xenon.
- d. Rods will approximately remain as is since the xenon concentration is independent of time.

ANSWER 5.20 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-5, LO 5.3.11
192006K114 ... (KA'S)

QUESTION 5.21 (1.50)

For each of the following events, describe HOW and WHY RCP 'A' motor amperage will vary from its initial magnitude prior to the event.

- a. It is running with two (2) other RCPs and the fourth RCP is started.
- b. Its pump becomes mechanically uncoupled from the motor.
- c. Bearing degradation in the pump results in partial binding.

ANSWER 5.21 (1.50)

- a. The amps will decrease (0.2) because the flow through the pump decreases due to the increased backpressure from starting the fourth pump (0.3)
- b. Amps will decrease (0.2) because the motor no longer has a load (0.3).
- c. Amps will increase (0.2) because friction is increasing the load on the motor (0.3).

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-21, LO 6.1.3
191004K107 ... (KA/S)

QUESTION 5.22 (1.00)

The amount of heat being added by the reactor coolant pumps: [choose one correct answer]

- a. Is less than the RCS heat loss to ambient at operating temperature.
- b. Is less than the amount of heat being lost to letdown at operating temperature.
- c. Is insignificant at normal operating temperature.
- d. Causes total S/G thermal output to be greater than the thermal output of the core itself.

ANSWER 5.22 (1.00)

D or C (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-11-20
003000K506 ... (KA/S)

QUESTION 5.23 (1.00)

During a LOCA with a resultant loss of subcooling margin, Reactor Coolant Pumps (RCPs) are secured for which one of the following reasons.

- a. To prevent pump damage resulting from operation under two phase conditions.
- b. To prevent core damage resulting from phase separation upon subsequent loss of RCS flow.
- c. To reduce RCS pressure by removing the pressure head developed by the RCPs.
- d. To remove the thermal heat being added to the RCS by the operating RCPs.

ANSWER 5.23 (1.00)

A or B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR (P) PWR
000009K323 193008K114 ... (KA'S)

QUESTION 5.24 (1.00)

Which of the following statements about temperature measurement is NOT CORRECT?

- a. If the sensing wire of an RTD breaks, the instrument will read offscale high.
- b. If a thermocouple wire breaks, the instrument will read off scale low.
- c. The temperature range which can be measured by an RTD is smaller than that for a thermocouple.
- d. RTDs respond faster to temperature changes than thermocouples.

ANSWER 5.24 (1.00)

D (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
191002K114 ... (KA'S)

QUESTION 5.25 (.50)

As K_{eff} approaches unity, for the same increase in K_{eff} , a greater length of time is required to reach the new equilibrium level. This is a characteristic of:

- a. Moderator effects of neutron leakage.
- b. Increasing population of delayed neutrons.
- c. Reactivity change on power increases.
- d. Subcritical multiplication.

ANSWER 5.25 (.50)

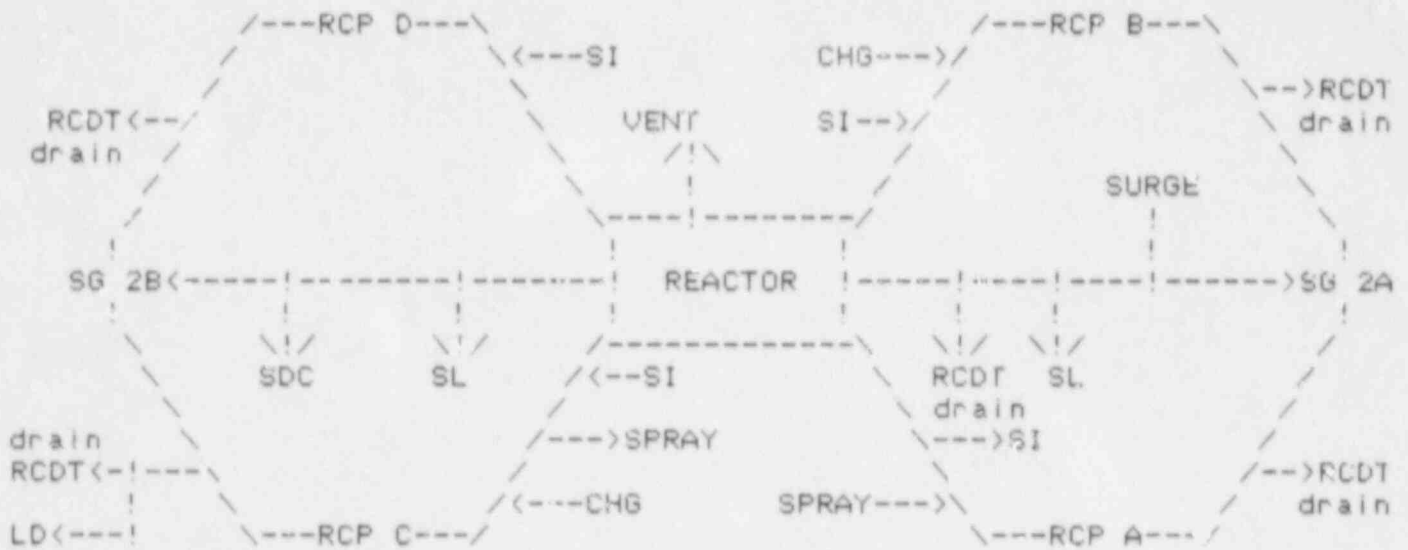
D (0.5)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS IP 7-5-4, LC 5.1
192003K101 ... (KA'S)

QUESTION 6.01 (2.50)

Using figure 2-1, show and label all major penetrations into the Reactor Coolant System. DO NOT include instrument or test penetrations. (Eighteen properly placed and labelled penetrations are required for full credit.)

ANSWER 6.01 (2.50)



(EIGHTEEN PENETRATIONS AT 0.139 EA)

REFERENCE
 FCS LP 7-11-20, OBJ. 1.2
 002000K100 ... (KAS)

QUESTION 6.02 (2.00)

- What two (2) conditions will generate a "Containment Vent Fan Off Normal"? (0.5)
- What is the failed position for the face dampers and bypass dampers on the containment cooling and filtering units? (0.5)
- When the handswitches for the dampers in part b are placed in the UNFILTERED position, what provides the motive force to position the dampers? (0.5)
- Why is it important to maintain charcoal bed temperatures below 360 deg.F even after containment air temperatures are returned to normal following a large break LOCA? (0.5)

ANSWER 6.02 (2.00)

- control switch in PULL-OUT
69 permissive switch not in AFTER CLOSE position
fan breaker not racked in
(any 2 at 0.25 ea)
- face dampers fail open (0.25)
bypass dampers fail shut (0.25)
- Control air (instrument air) (operates an air-piston to position the dampers for unfiltered operation.) (0.5)
- Prevent the release of contaminants absorbed by the charcoal. (0.5)

REFERENCE

FCS LP 7-14-2, LO 1.2, 1.6, 1.8
022000SG10 022000SG7 103000A401 ... (KA'S)

QUESTION 6.03 (3.00)

Using the CVCS line diagram provided, circle each component which receives a control signal as a result of a PPLS and indicate the expected response of the component to the control signal.

ANSWER 6.03 (3.00)

The following valves shut:

HCV 204
HCV 241
HCV 206
LCV 218-2
HCV 264
HCV 257
FCV 269
TCV 202
(0.2 ea)

The following valves open:

HCV 258
HCV 265
HCV 268
(0.2 ea)

All 3 charging pumps start (0.4)
Boric acid pumps A & B start (0.2 ea)

REFERENCE

FCS LP 7-11-2, LO 1.4
000009A104 004000A202 ... (KA'S)

QUESTION 6.04 (2.50)

- a. List three (3) locations from which AFW pump FW-6 may be started manually. (0.75)
- b. With the plant in hot shutdown and SG level being maintained by FW-6 via normal feed regulator valves, describe the response of AFW components to a prolonged loss of instrument air header pressure. Include the impact on SG level. (Assume NO operator action.) (1.75)

(clarification made during exam: normal=bypass)

ANSWER 6.04 (2.50)

- a.
1. CB-10 (Control Room)
 2. AI-66A (Control Room)
 3. Local station at the pump
 4. 4160 VAC switchgear bus 1A3 (pump motor breaker)
(any 3 at 0.25 ea)
- b.
1. The recirc valves (FCV 1368 & 1369) fail open. (0.25)
 2. The AFW control valves (HCV 1107A,B & 1108A,B) fail open. (0.5)
 3. The FW-10 Steam stop valves (YCV-1045 & 1045A/B) eventually open causing FW 10 to start and go on governor control. (0.5)
 4. SG level will increase until the SG is full (because the valves will not respond to the AFWAS reset signal at 60% level). (0.5)

REFERENCE

FCS LP 7-11-1, LO 1.0, 1.8
061000A207 061000SG9 ... (KA'S)

QUESTION 6.05 (2.50)

On the figure representing AI-41A, indicate the expected meter reading and light indications for a normal DC system line up and operation. Use arrows to mark the meter scales and indicate light status as ON, OFF, BRIGHT, or DIM.

ANSWER 6.05 (2.50)

SEE FIGURE AI-41A

Give full credit for voltages indicated between 130 - 140 VDC.

Give 1/2 credit for voltages indicated between 125 - 130 VDC.

Charger current must indicate between 170 - 200 amps.

Battery current should read 0 or slightly to the left of 0.

Both ground indication lights must be labelled as DIM

Both the power available lights (just below the ground lights) must be labelled as ON.

The "Normal Source" light above the selector push button must be labelled as ON and the adjacent "Emer Source" labelled as OFF

REFERENCE

FCS LP 7-13-4, LO 1.4
063C00A30, ... (KA'S)

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

QUESTION 6.06 (1.50)

A malfunction in the pressurizer pressure measurement "A" channel (A/P1A-102Y) causes the output to go to minimum.

- a. List two (2) RPS trip units which receive a signal from this channel and HOW each is affected by the malfunction. (0.75)
- b. Explain why the reactor will or will not trip (0.75)

ANSWER 6.06 (1.50)

- a. High Pressure and TM/LP (0.25 ea)
The high pressure trip unit will not be affected (since minimum output equates to a low pressure condition). (0.25) The TM/LP trip unit will go to the trip condition initiating a channel "A" trip and a pre-trip alarm. (0.25)
- b. A reactor trip will not occur (0.25) since the 2/4 logic is not satisfied by the single channel trip. (0.5)

REFERENCE

FCS LP 7-12-25, LO 1.03, 007-12-26-H-25-1.03-0001
000027A216 012000A202 ... (KA'S)

QUESTION 6.07 (2.00)

Pressurizer pressure is 2270 psig decreasing and pressurizer level is -3.0% from program level and decreasing. Indicate the status of each item below with OPEN, CLOSED, ON, OFF, MINIMUM, or MID (> minimum but < maximum) as appropriate. Assume that the reactor is operating at 100% and the charging pump Standby Switch is selected to CH-1B-1C. NOTE: Other terms may be used to describe component status if desired.

- a. Spray valves
- b. Proportional heaters
- c. Backup heaters
- d. Letdown flow control valves
- e. Charging pumps B and C (answer for each)

ANSWER 6.07 (2.00)

- a. Open
 - b. Off
 - c. Off
 - d. Minimum
 - e. B - On
C - Off
- (6 at 0.333 each)

REFERENCE

FCS LP 7-11-2, LO 4.1
010000K603 011000A102 ... (KA'S)

QUESTION 6.08 (2.00)

The qualified safety parameter display system (QSPDS) calculates and displays three (3) saturation margin monitoring (SMM) values.

- a. List the three (3) saturation margins and the temperature sensors (inputs) used to calculate each. If redundant sensors are available, state the criteria which determines the input used by the SMM (1.5)
- b. What signal is used to provide the saturation temperature? (0.5)

ANSWER 6.08 (2.00)

- a. RCS saturation margin - max of RTDs in the hot and cold legs (1.5)
Upper head saturation margin - max of the top three UHJTCs
CET saturation margin - representative CET
- b. Pressurizer pressure (0.5)

REFERENCE

FCS LP 2-12-23, LO 1.7, OI-QSPDS-1-9, REV 0
194001A115 ... (KA'S)

QUESTION 6.09 (2.00)

- a. What is the function of the Diverse Scram System (DSS)? (0.75)
- b. What plant parameter (include setpoint value and logic) will actuate the DSS? (1.25)

ANSWER 6.09 (2.00)

- a. Generate a reactor/turbine trip signal independent of the RPS under ATWS (failure of RPS to generate a trip signal) conditions. (0.75)
- b. Pressurizer pressure (0.5) at 2450 psia (0.25) on 2/4 detectors (0.25) tripping 1/2 channels (0.25).

REFERENCE

FCS LP 7-12-25, LO 5.1, 5.2
000029A209 10CFR50.62 ... (KA'S)

QUESTION 6.10 (2.00)

- a. At what power level is the extended range operation of the Wide Range Log Power Channels enabled AND what operator action is necessary to permit extended range operation? (0.5)
- b. How does extended range operation differ from normal operation of a Wide Range Log Power Channel? (0.5)
- c. When audio monitoring of count rate is required, what two (2) switches must be positioned to activate the audio circuit? (0.5)
- d. Aside from possible alarms, what is the control room indication of a non-functioning Campbell circuit for a particular Wide Range Log Power Channel as power is raised from $10E-6\%$ to $10E+1\%$? (0.5)

ANSWER 6.10 (2.00)

- a. Extended range operation is enabled below $4 \times 10E-7\%$ power. (0.25) The operator must take the extended range cutout switch to OFF (0.25) (at about 10 cps control room indicator).
- b. Gothe chambers provide signals that are summed to the channel in extended range with one detector's output disconnected when above approximately $10E-5\%$ power. (0.5)
- c. The selector switch on the audio amp must be set to + ; desired channel (0.25) and the toggle switch for the selected channel must be in the proper position (0.25).
- d. The indication from the affected channel will stop at about $10E-2\%$ power. (0.5) (The remaining channels will continue to show normal power increase.)

REFERENCE

FCS LP 7-12-18, LO 1.3, 1.5, 1.7, 1.9
015000A202 015000K401 ... (KA'S)

QUESTION 6.11 (3.00)

F 11 in the numbered blocks on the simplified ESC logic diagram with the proper initiation and actuation signals.

ANSWER 6.11 (3.00)

- | | |
|----------|-----------------------|
| 1. CRHS | 11. RAS |
| 2. SGLS | 12. SIAC |
| 3. CPHS | 13. DG Start |
| 4. PPLS | 14. CIAS |
| 5. STLS | 15. DG Brkr Prot O.R. |
| 6. SGLL | 16. AFWAS |
| 7. SGLP | 17. VIAS |
| 8. SGDP | 18. Sequencers |
| 9. SGIS | 19. OPLS |
| 10. CSAS | 20. SEA |

(0.15 EACH)

REFERENCE

FCS LP 7-12-14, LO 1.1
013000A301 ... (KA'S)

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

QUESTION 7.01 (2.50)

During a plant heatup from cold shutdown in accordance with OI-RC-3:

- a. What are the two (2) conditions, one of which must be met in order to preclude an RCS pressure surge prior to starting a Reactor Coolant Pump (PCP)? (1.0)
- b. What are the reasons for the upper and lower pressure limits for RCS pressure maintained at 250 deg's RCS temperature? (1.0)
- c. What are the two (2) specific indications to the operator that a steam bubble has been formed in the pressurizer even though level indication is still at maximum? (0.5)

ANSWER 7.01 (2.50)

- a. 1. A pressurizer bubble exists.
2. S/G secondary is less than 50 deg's above RCS temp. [0.5 ea.]
- b. Pressure is maintained so as not to lift PORV's OR to ensure pressure/temperature limits are not exceeded (low temperature over-pressurization) (0.5) and to be sufficient for RCP operation (NPSH) (0.5).
- c. Letdown flow > charging flow, [0.25] and pressure stable. [0.25]

REFERENCE

OI-RC-3, Pp. 2-7

OI-RC-9, P. 1

005000K104 010000G005 010000G004 011000A101 ... (KA'S)

QUESTION 7.02 (2.00)

During power changes:

- a. What are the two (2) documents referenced by OP-4 that place limits on rate of power change and CEA movement? (1.0)
- b. What must be done if it becomes necessary to change boron concentration to reposition CEAs during a load increase? (0.5)
- c. What are two (2) conditions that may restrict the operators choice to insert CEAs? (0.5)

ANSWER 7.02 (2.00)

- a. Technical Data Book [0.5] and Post Refueling Core Physics Testing and Power Ascension Procedure (SP-PRCPT-1) or OI-RR-1 (any 2 at 0.5 ea)
- b. The load change must be stopped. [0.5]
- c. PDIL or ASI limits [0.25 ea.]

REFERENCE

TDB, P. III-22

OP-4, Pp. 1,2

001000G005 ... (KA'S)

QUESTION 7.03 (2.50)

- a. During refueling, what must be done after the insertion of a fuel assembly into the core, before another assembly is loaded. A correct answer should include the reason for the action specified. (1.0)
- b. As part of the initial conditions required for fuel movement, what is done administratively to ensure that core flow is not interrupted during fuel movement. (0.75)
- c. During withdrawal of a fuel assembly from the core, it is noticed that an unexpected sustained increase in count rate is occurring. What is the required initial action, AND what should be done if the required initial action is not practical? (0.75)

ANSWER 7.03 (2.50)

- a. A count rate should be taken and a 1/M plot done [0.5] to ensure the next assembly loaded will not cause criticality. [0.5]
- b. Controls for both LPSI pumps [0.25] and valves in the flow path [0.25] are (cautioned) tagged. [0.25]
- c. Insert the fuel assembly [0.25] or emergency borate. [0.5]

REFERENCE

OP-11, Pp. 4, 7, 9

000036K103 ... (KA'S)

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

QUESTION 7.04 (1.00)

What is the MAXIMUM exposure an operator could receive in an area posted "CAUTION-RADIATION AREA" if he/she remained there for 30 minutes. Explain your answer. (1.0)

ANSWER 7.04 (1.00)

50 Millirem. [0.5] By definition, a RADIATION AREA is an area where a person could receive > 5 mrem/hr. but < 100 mrem/hr.
(0.5 Hrs.) (100 mrem/hr. = 50 mrem [0.5])

REFERENCE

FCS EQB

194001K103 ... (KA'S)

QUESTION 7.05 (2.00)

According to the Radiation Protection Manual:

- a. Describe the administrative method used to assure that OPPD personnel do not exceed a quarterly whole body exposure limit. State any appropriate values in the description. (1.0)
- b. An OPPD employee is providing escort for a visitor with documented exposure history during a refueling outage. What are the daily and weekly Permissible Accumulated Doses (PAD's) for the visitor and the employee? (1.0)

ANSWER 7.05 (2.00)

- a. When individuals reach quarterly exposures of 1.0 R or 2.4 R with a FORM-4, [0.5] a restriction is invoked allowing an additional exposure of 100 mrem until the TLD is processed. [0.25] When an additional 100 mrem is reached, entry is forbidden into any controlled area until exposure can be assessed. [0.25]
- b. Employee: Daily: 300 Mrem
Weekly: 900 Mrem
- Visitor: Daily: 300 Mrem
Weekly: 900 Mrem [0.25 ea.]

REFERENCE

Radiation Protection Manual, P. VII-8-1-1
194001K103 ... (KA'S)

QUESTION 7.06 (2.00)

According to ADP-19, Loss of Shutdown Cooling, what are the "LAST RESORT" methods (Flow Paths) for residual heat removal for each of the following conditions. For each case, describe the complete open/closed loop path.

- a. The reactor head installed. (1.0)
- b. The reactor head removed, transfer canal open. (1.0)

ANSWER 7.06 (2.00)

- a. SIRWT > HPSI Pumps into primary system > PORV's OR, Loop Drains > RCDT > RCDT drain pump back to SIRWT. [0.15 for each component in flow path and 0.05 for each manipulation to attain correct order.]
- b. Align Fuel Transfer Canal Drain Pump to take suction from SIRWT and discharge to Spent Fuel Pool. [0.5] Align SFP pumps to transfer water from SFP to SIRWT. [0.5]

REFERENCE

ADP-19, P. 3
LP 2-1-41, L.O. 1.0, 1.2
000025K101 000025K301 ... (KA'S)

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

QUESTION 7.07 (2.00)

- a. According to AOP-14 (Loss Of Coolant), the automatic response of the ECCS may be inadequate for long-term core cooling for large cold leg breaks. Describe an alternate flow path for providing HPSI flow to the core under these conditions, as suggested by AOP-14. (1.0)
- b. In AOP-14 and throughout the EOP's the Operator is CAUTIONED to promptly terminate containment spray as soon as termination criteria is met. What two (2) component/equipment categories warrant this consideration and WHY? (1.0)

ANSWER 7.07 (2.00)

- a. HPSI pump through the cross connect [0.2] into the charging header, [0.2] through the auxiliary spray valve, [0.2] into the pressurizer and surge line, [0.2] and into the RCS Hot Leg. [0.2]
- b. Containment spray may affect proper operation [0.4] of the:
 1. RCP's,
 2. non-qualified equipment
 3. instrumentation inside the containment.(any 2 at 0.3 ea)

REFERENCE

AOP-14, Pp. 7, 14 & EOP-03, P. 14
000011E312 026020A203 ... (KA'S)

QUESTION 7.08 (1.50)

- a. Describe the action (system manipulation) an operator would perform if a head bubble was suspected during natural circulation cooldown. (0.75)
- b. What action is then taken to confirm the existence of a bubble in the head? (0.75)

ANSWER 7.08 (1.50)

- a.
1. Verify letdown isolated
 2. Stop depressurization and, if required, repressurize RCS to greater than or equal to 20deg.F subcooling
 3. Pressurize and depressurize RCS within the limits of Fig. 4-2
 4. If necessary, operate PZR vent and/or reactor vessel head vent to clear trapped non-condensable gases.
(0.1875 ea)
- b. Monitor PZR level and/or RULMS (.5) for trending of RCS inventory(.25)

REFERENCE

LP 7-11-20, LO 3.7d, P. 62
002000A403 ... (KA'S)

QUESTION 7.09 (1.50)

OI-UA-2 gives the operator guidelines on how to IDENTIFY and ISOLATE a leak in the Auxiliary Building which causes a Stack High Radiation Alarm. State these guidelines. (1.5)

ANSWER 7.09 (1.50)

Shut down supply and exhaust fans. [0.5] Isolate all rooms. [0.5] Start one exhaust fan and open dampers one at a time while observing monitor until leak is found. [0.3] (Area monitors may be of some help.)

REFERENCE

FCS EQB
000060A202 ... (KA'S)

QUESTION 7.10 (2.00)

- a. During the performance of EOP-06, Loss of All Feedwater, the operator is cautioned, "Do not overreact to low S/G levels, add feedwater slowly". What are two (2) REASONS for this caution? (0.5)
- b. IF RCP's have been stopped, EOP-06 directs the operator to restart RCP's if six (6) criteria can be met. State four (4) of these criteria. Values are not required. (1.0)
- c. If Feedwater to at least one S/G cannot be restored, what is the preferred cooling method (name only, functional description is not required), and which Functional Recovery Procedure is utilized. (0.5)

ANSWER 7.10 (2.00)

- a.
 1. Prevent excessive cooldown rate.
 2. Prevent excessive PZR level and pressure transient.
 3. Prevent overfilling S/G's.
 4. Prevent water hammer damage. [Any 2, 0.25 ea.]
- b.
 1. At least one S/G available for heat removal.
 2. S/G temp. < (50 deg's. above) Tc.
 3. PZR steam space (> 60%)
 4. Minimum NPSH for RCP's
 5. CCW available
 6. PZR > (30%) and not decreasing. [any 4, 0.25 ea.]
- c. Once-through cooling, (HR-4) [0.25] found in the RCS and Core Heat Removal FRP (EOP-20). [0.25]

REFERENCE

EOP-06, Pp. 5, 9, 10
000054K102 059000G010 ... (KA'S)

QUESTION 7.11 (1.50)

- a. What are two (2) actions required of the operator if there is an indication that four (4) CEA's have not fully inserted following actuation of the manual reactor trip pushbutton? (0.5)
- b. Per EOP-03 (LOCA), what are four (4) indirect indications or alarms checked by the operator to verify that PORV's and PZR code safeties are not open? (1.0)

ANSWER 7.11 (1.50)

- a. 1. Open CEDM clutch power supply breakers.
- 2. Emergency borate. [0.25 ea.]

- b. 1. Relief header temperature alarms.
- 2. Relief header acoustic flow alarms.
- 3. Quench Tank
 - i. pressure
 - ii. temperature
 - iii. level(any 4 at 0.25 ea.)

REFERENCE

EOP-01, P. 2 & EOP-03, P. 6

000029K309 000029K310 000029K311 000029K312 ... (KA'S)

QUESTION 7.12 (1.50)

- a. The STEAM GENERATOR TUBE RUPTURE Procedure (EOP-04) cautions the operator early on to avoid use of HCV-1040 and FW-10. State the reason for this caution. (0.5)

- b. The operator is directed to determine which Steam Generator has the tube rupture by monitoring or checking four (4) items. What are these four (4) items? (1.0)

ANSWER 7.12 (1.50)

- a. Avoid unmonitored release of activity to the environment. [0.5]

- b. 1. S/G activity
- 2. Steam line radiation
- 3. S/G Blowdown radiation
- 4. S/G levels [0.25 ea.]

REFERENCE

EOP-04, P. 5

000009A202 000037K305 ... (KA'S)

QUESTION 7.13 (2.00)

According to EOP-01:

- a. How is the operator directed to confirm the diagnosis of an uncomplicated reactor trip? (1.0)
- b. If plant conditions indicate that MORE than an uncomplicated trip has occurred, what are the two (2) subsequent action paths available, one of which the operator must take? (1.0)

ANSWER 7.13 (2.00)

- a. Verify that Safety Function Status Check acceptance criteria is satisfied. (1.0)
- b. 1. (Attempt event diagnosis) and go to the appropriate EOP. [0.5]
2. (If event is not diagnosed), then go to Functional Recovery Procedure (EOP-20). [0.5]

REFERENCE

EOP-01, Pp. 15-17

000011A201 000011E312 ... (KA'S)

QUESTION 7.14 (1.00)

What are the two (2) requirements to be met before the operator implements the LONG TERM ACTIONS of the Emergency Operating Procedures? (1.0)

ANSWER 7.14 (1.00)

Appropriate operator actions for all success paths in use have been performed [0.5] and ALL safety function acceptance criteria are being satisfied. [0.5]

REFERENCE

EOP-20, P.4

000011G011 000011G012 ... (KA'S)

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

QUESTION 8.01 (.00)

- a. How should mistakes in the official control room log be corrected?(.5)
- b. Who is responsible for maintaining the official control room log?(0.5)

ANSWER 8.01 (1.00)

- a. Mistakes are lined out and initialed. (0.5)
- b. The Reactor Operator (assisted by the ARO), (0.5)
OR
The Licensed Senior Operator (LSO) or Licensed Operator (LO)

REFERENCE

FCS Standing Order Q-24, p. 1-4
194001A106 ... (KA'S)

QUESTION 8.02 (2.00)

The following relate to Hold and Caution Tag requirements.

- a. Who will request the hanging and clearing of "Hold Order" tags? (0.5)
- b. According to Standing Order Q-20, in what two (2) situations will "Temporary Clearance" tags be used? (1.0)
- c. Describe a general situation/condition in which the use of "Caution" tags is warranted. (0.5)

ANSWER 8.02 (2.00)

- a. System operator (system operations/906 personnel) (0.5)
- b. 1. When equipment is to be operated in a test position or mode (such as trip checks, motor rotation checks, ~~limitorque operator settings, etc.~~) (0.5)
2. When necessary to allow system/equipment usage for unusual circumstances. (0.5)
- c. 1. When special instructions in the operation of components must be exercised. (0.5)
- OR
2. During system turnover to specify components and systems under OPPD control. (0.5)

REFERENCE

FCS LP 7-15-3 EO 1.1, 5.1, S.O. 0-20, rev 19, p 3.
194001K102 ... (KA'S)

QUESTION 8.03 (1.50)

- a. For a procedure change that is required immediately (On-the-Spot), what two (2) signatures are required on the FC-68 (Setpoint/Procedure Change)? (1.0)
- b. How many times can a specific Temporary (On-the-Spot) Procedure Change be used? (0.5)

ANSWER 8.03 (1.50)

- a. NPC Senior Licensed PRC member
Shift Supervisor
PRC member (any 2 at 0.5 ea)
- b. Once (0.5)

REFERENCE

FCS Standing Order G-30, rev. 19, pgs. 3,4.
194001A101 ... (KA'S)

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

QUESTION 8.04 (1.50)

During the performance of a valve lineup, it is discovered that a valve identification label(tag) is missing from a valve.

- a. What corrective actions should be taken? (1.0)
- b. What are the Shift Supervisor's administrative responsibilities? (0.5)

ANSWER 8.04 (1.50)

- a. A temporary tag should be filled out (0.5), the top half of the tag hung on the valve in question (0.25), the bottom half of the tag given to the Shift Supervisor (0.25).
- b. Log the valve in the Temporarily Tagged Equipment Log (0.25) and forward bottom half of the temporary tag to the Operations Engineer (0.25).

REFERENCE

FCS Standing Order G-48, rev. 2, p 1.
194001K101 ... (KA'S)

QUESTION 8.05 (1.50)

- a. What members of the Plant Fire Brigade report immediately to the fire area? (0.75)
- b. What is the minimum number of Fire Brigade members that must be onsite at all times and how long may there be less than the required minimum onsite? (0.75)

ANSWER 8.05 (1.50)

- a. Fire Brigade Leader (LO*) (0.25)
Two other operators (equipment/aux operators) (0.25)
Two security force personnel (0.25)
- b. 5 (.25) No more than two hours. (0.5)

REFERENCE

FCS Standing Order G-28, rev 11, p 6; T.S. 5.2.2
194001K116 ... (KA'S)

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

QUESTION 8.06 (1.50)

- a. Which shift's Shift Supervisor is required to conduct the daily review of the Key Log for the Operations Key Depository? (0.5)
- b. In reviewing the Key Log Sheet, the Shift Supervisor discovers that a key from the Operations Key Depository has been lost. What action(s) must he take? (1.0)

ANSWER 8.06 (1.50)

- a. The afternoon Shift Supervisor. (0.5)
- b. Notify the Supervisor - Operations(0.5) and the Supervisor - Administrative Services and Security.(0.5)

REFERENCE

FCS Standing Order 0-26, rev 15, pgs 2,3.
194001K105 ... (KA'S)

QUESTION 8.07 (2.00)

- a. What are the two (2) purposes of the checklist items on the "Flame Cutting and Welding Permit" (Form FC-18)? (0.75)
- b. Once a "Flame cutting and Welding Permit" is issued, how often must it be renewed and when does it expire? (0.75)
- c. Where are each of the two "Flame Cutting and Welding Permit" copies maintained? (0.5)

ANSWER 8.07 (2.00)

- a. 1. Prevent fires due to cutting and welding.(0.5)
2. Provide instructions to assigned firewatches.(0.25)
- b. Each shift (0.25)
When the work described in the Maintenance Order or Design Change Order is complete (0.25), but not more than 2 weeks from the date issued (0.25).
- c. One in the Control Room(.25), the other posted at the job sight(.25).

*REFERENCE

FCS Standing Order M-9, rev 11, pg 1.

REFERENCE

FCS SO M-9, REV 11, pg 1
194001K116 ... (KA'S)

QUESTION 8.08 (1.00)

What is the basis for the limit on steam generator coolant radioactivity?

ANSWER 8.08 (1.00)

Ensure that the resultant off-site doses will be well within the limits (of 10 CFR) (0.5) in the event of a steam line break(.25) and a concurrent loss of off-site power(.25).

REFERENCE

FCS TS 2.20
035000SG6 ... (KA'S)

QUESTION 8.09 (1.50)

Protection against low temperature overpressurization requires disabling of the HPSI pumps. What three (3) conditions mitigate the requirement to disable the pumps with the plant in cold shutdown?

ANSWER 8.09 (1.50)

Not required if:

1. a pressurizer safety removed
 2. a pressurizer PORV removed
 3. the reactor vessel head is removed
 4. no charging pump available to borate.
- [any three at 0.5 ea.]

REFERENCE

TS 2.3

006050A201 006050K402 ... (KA'S)

QUESTION 8.10 (1.50)

- a. What is the purpose of the Safety Limits and what three (3) plant parameters are used to determine if a Safety Limit has been exceeded? (1.0)
- b. What action must be taken regarding facility operation in the event a Safety Limit is violated? (Include any applicable time limits). (0.5)

ANSWER 8.10 (1.50)

- a. Maintain the integrity of the fuel cladding.(0.25)
Pressurizer pressure(.25), cold leg temperature(.25), reactor power level(.25)
- b. Place the unit in hot shutdown(.25) within one hour(.25).

REFERENCE

T.S. 1.1, T.S. 5.7.1

000027A204 002000SG5 002000SG6 ... (KA'S)

QUESTION 8.11 (2.00)

- a. What is the basis for the CEA Transient Insertion Limits? (Three (3) elements required for full credit.) (1.0)
- b. What two (2) options are available if the regulating CEA groups are inserted beyond the Transient Insertion Limits? (1.0)

ANSWER 8.11 (2.00)

- a. Ensure that:
1. acceptable power peaking factors are maintained
 2. the minimum available shutdown margin is maintained
 3. the potential consequences of a CEA ejection accident are limited to acceptable levels.
- (0.333 each)
- b.
1. Restore the regulating CEA group to above the Transient Insertion Limits.(0.5)
 2. Reduce reactor power to the allowed level (0.25) which permits continued operation above the Transient Insertion Limit using the existing CEA group position.(.25)

REFERENCE

T.S. 2.10.2 ,p 2-52, 2-50c.
001000K504 ... (KA'S)

QUESTION 8.12 (1.50)

- a. What is the Technical Specification limit for primary-to-secondary leakage? (0.5)
- b. List two (2) of three (3) means of detecting primary-to-secondary leakage per Technical Specifications, one of which must be operable at all times. (1.0)

ANSWER 8.12 (1.50)

- a. 1 gpm total for both steam generators.(0.5)
- b.
1. Steam Generator Blowdown Radiation Sample Instrument
 2. Condenser Off Gas Radiation Monitor
 3. Periodic Secondary Samples Analyzed for Activity
- (any two at 0.5 each)

REFERENCE

TECHNICAL SPECIFICATION 2.1.4
000037SG3 000037SG4 ... (KA'S)

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

QUESTION 8.13 (1.50)

- a. What type of Technical Specification instrument surveillance will include the adjustment of any alarm, interlock, or trip setpoints? (0.5)
- b. Why do the Technical Specifications state that at rated power the minimum operable high power level channels is three (3) and what must be done immediately if the number of operable becomes two (2)? Explain the reason for the required action. (1.0)

ANSWER 8.13 (1.50)

- a. Channel calibration (0.5)
- b. 1. To provide adequate power tilt detection. [0.5]
2. Reduce power to 70% [0.25] to prevent undetected flux tilt from exceeding design peaking factors. [0.25]
- OR
- Place 1 channel in trip within 1 hour [0.25] to provide minimum degree of redundancy. [0.25]

REFERENCE

FCS TS DEFINITIONS, 2.15
015000SG6 ... (KA'S)

QUESTION 8.14 (2.00)

During operations at full reactor power, the emergency feedwater storage tank is declared inoperable and repairs are expected to be completed in about three days. What are the Technical Specification requirements concerning operation of the plant? The Technical Specification for Steam and Feedwater Systems has been provided.

ANSWER 8.14 (2.00)

The "motherhood" tech spec, 2.0.1(1) applies to this situation. The plant must be in hot shutdown in 6 hours (1.0) and subcritical and < 300oF in the next six hours (1.0). (There is no need to go to cold shutdown since the tech spec does not apply below 300oF. If the candidate says that the plant must be in cold shutdown in an additional 30 hours deduct 0.5 pt.)

REFERENCE

TS 2.0.1(1), 2.5
061000SG5 ... (KA'S)

QUESTION 8.15 (3.00)

While the plant is operating at 100% reactor power, your reactor operator computes a total Steam Generator leak rate of 1.5 gpm. At the same time you receive the radiochemistry report for the RCS which shows RCS activity to be 365 uCi/gm DOSE EQUIVALENT I-131. Before you can decide on a course of action, multiple lightning strikes from a severe electrical storm hit in the switchyard causing a loss of off-site power. While verifying the automatic actions for a reactor trip an operator notices that Steam Generator Isolation has actuated but S/G pressure is continuing to decrease. The other operator reports that pressurizer level, which had been recovering, is now dropping rapidly.

- a. Using only the information available, identify each event which by itself requires declaration of an emergency classification. (1.5)
- b. Using EPIP-OSC-1, determine a single classification for your current condition and justify your selection fully. (1.5)

ANSWER 8.15 (3.00)

- a.
 1. Fuel clad damage indicated by high RCS activity ($>300\text{uCi/gm}$) \rightarrow loss of fission product barrier. (alert)
 2. Loss of all offsite power for >15 min. (NOUE)
 3. Uncontrolled rapid secondary depressurization during hot shutdown. (NOUE)(0.5 each)
- b. A Site Area Emergency should be declared (0.75) on the basis of the shift supervisor's application of NOTES 1.a-c. of EPIP-OSC-1. Any one of the three guidelines or the barrier criteria may be used as justification as long as the logic used supports the selection (0.75). Under the barrier criteria that is sufficient information to conclude that the RCS pressure boundary is being challenged or has failed leading to failure or challenge of two barriers.
(If the candidate uses incorrect logic to support his selection of guidelines deduct 0.5 pt.)

REFERENCE

EPIP-OSC-1, TS 2.1.3, 2.1.4
194001A116 ... (KA'S)

U. S. NUCLEAR REGULATORY COMMISSION
 REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: ET. CALHOUN
 REACTOR TYPE: BWR-CE
 DATE ADMINISTERED: 88/07/26
 EXAMINER: MCCRORY, S.
 CANDIDATE: _____

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

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

 Candidate's Signature

QUESTION 1.01 (1.00)

During a reactor startup, an initial reactivity addition causes power to increase from 20 to 40 CPS. A second reactivity addition causes power to change to 80 CPS. Which of the following statements is correct?

- a. The first reactivity addition was smaller.
- b. The second reactivity addition was smaller.
- c. The first and second reactivity additions were equal.
- d. There is insufficient data to determine a relationship between the reactivity additions. (1.0)

ANSWER 1.01 (1.00)

- b. The second reactivity addition was smaller. (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.13.1
001010K536 015000K506 ... (KA'S)

QUESTION 1.02 (1.00)

With the reactor critical at 5000 CPS, CEA withdrawal is used to increase power to 10000 CPS. Select the statement below that correctly describes the position of the CEA's after power is stabilized at 10000 CPS. (1.0)

- a. The rod position will be higher than previous as more fuel must be exposed to the neutron flux to maintain the higher power level.
- b. Rods will be further withdrawn to compensate for the temperature defect at the higher power.
- c. The rod position will be the same because the outward motion needed to attain a given startup rate equals the inward motion necessary to kill the startup rate.
- d. The final position will be lower due to the increasing delayed neutron population associated with the higher power level.

ANSWER 1.02 (1.00)

c. Rod position will be the same. (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.4.3
001000K510 ... (KA'S)

QUESTION 1.03 (1.00)

The moderator temperature coefficient (MTC) varies with certain plant conditions. The MTC: [choose one correct answer]

- a. Becomes more negative as boron concentration is increased.
- b. Varies due to temperature (T_{avg}) because of the non-linear density changes of water as temperature changes.
- c. Causes axial flux distribution to be tilted toward the top of the core at the beginning of life.
- d. Would be expected to introduce a large negative reactivity in the event of a major steam line break.

ANSWER 1.03 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.6.8
192004K103 ... (KA'S)

QUESTION 1.04 (1.00)

In the event of a rod ejection accident, which one will be the first reactivity coefficient to insert negative reactivity?

- a. Doppler coefficient.
- b. Pressure coefficient.
- c. Void coefficient.
- d. Moderator temperature coefficient.

ANSWER 1.04 (1.00)

A (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.7.5
192004K107 ... (KA'S)

QUESTION 1.05 (1.00)

It takes less reactivity to go prompt critical at:

- a. BOL because of the higher value of beta effective.
- b. BOL because of the lower value of beta effective.
- c. EOL because of the higher value of beta effective.
- d. EOL because of the lower value of beta effective.

ANSWER 1.05 (1.00)

D (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 4.5
192003K106 192003K107 192003K108 ... (KA'S)

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

QUESTION 1.06 (1.00)

Which one of the following statements is correct concerning the change in differential boron worth ($\Delta k/k$) with RCS boron concentration (range of 0 to 1600 ppm) and Tave (range of 532 degF to 580 degF)?

- a. It increases as Tave and RCS boron concentration increase.
- b. It decreases as RCS boron concentration increases but is constant as Tave increases.
- c. It decreases as Tave and RCS boron concentration increase.
- d. It increases as Tave increases but is constant as RCS boron concentration increases.

ANSWER 1.06 (1.00)

C (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR

FCS LP 7-5-3. LO 3.5.4

192004K109 192004K110 ... (KA'S)

QUESTION 1.07 (1.00)

Voiding has occurred in the RCS, in the vicinity of the reactor vessel during a natural circulation cooldown. Which of the following CORRECTLY characterizes the process of collapsing the void?

- a. The void will superheat if an attempt is made to collapse it too fast. The rate of collapse will be governed largely by ambient heat loss from the void.
- b. The void will collapse at a rate equivalent to the rate of HPSI flow; therefore, full HPSI should be run until the void is fully collapsed.
- c. The void will be composed largely of hydrogen gas, and will therefore require degasifying of the RCS in order to begin collapsing it.
- d. The void will collapse immediately upon increasing the pressure above the local saturation pressure; the main concern is water hammer.

ANSWER 1.07 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
SECY 82-475
193007K104 ... (KA'S)

QUESTION 1.08 (1.00)

The ratio of Pu-239 and Pu-240 atoms to U-235 atoms changes over core life. Which one of the pairs of parameters below is most affected by this change?

- a. doppler coefficient and beta
- b. moderator temperature coefficient and doppler coefficient
- c. beta and moderator temperature coefficient
- d. moderator temperature coefficient and neutron generation time

ANSWER 1.08 (1.00)

A (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.7.5
192004K107 ... (KA'S)

QUESTION 1.09 (1.00)

A general rule is often stated "doubling the count rate halves the margin to criticality". This is mathematically stated by the equation:

$$CR1/CR2 = (1 - K_{eff2}) / (1 - K_{eff1})$$

Which one of the following statements is CORRECT concerning the above statement and equation?

- a. Equal changes in K_{eff} result in equal changes in subcritical multiplication level.
- b. Both K_{eff1} and K_{eff2} have to be less than 1.0.
- c. The equation only approximates the instantaneous change in count rate; once the equilibrium value is reached, the count rate will be higher.
- d. A second doubling of the count rate will result in the reactor becoming critical or supercritical.

ANSWER 1.09 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 5.1
001010K516 192003K101 ... (KA'S)

QUESTION 1.10 (1.00)

Which one of the following correctly describes the response of core delta T if the RCS coolant flow rate is reduced while the steam system is controlling to maintain 80% electrical output? The plant has been at 80% of full power, steady state, for 10 days. All control rods are fully withdrawn (ARO).

- a. Delta T will increase but nuclear power remains the same to provide the same megawatt thermal output.
- b. Delta T will remain the same but nuclear power will increase to provide the same megawatt thermal output.
- c. Delta T will remain the same since the turbine/generator output power has not changed.
- d. Delta T will increase and nuclear power must increase to provide more steam flow to the turbine.

ANSWER 1.10 (1.00)

A (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-22, LO 7.2-2
193007K108 ... (KA'S)

QUESTION 1.11 (1.00)

The reactor is critical at $10E-3$ % power when a S/G Atmospheric dump valve fails open. Assuming BOL conditions, no rod motion, and no reactor trip, choose the answer below that best describes the values of λ_{avg} and nuclear power for the resulting new steady state. (POAH = point of adding heat).

- a. Final λ_{avg} greater than initial λ_{avg} , Final power above POAH.
- b. Final λ_{avg} greater than initial λ_{avg} , Final power at POAH.
- c. Final λ_{avg} less than initial λ_{avg} , Final power above POAH.
- d. Final λ_{avg} less than initial λ_{avg} , Final power at POAH.

ANSWER 1.11 (1.00)

C (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-4, LO 1.3
192008115 ... (KA'S)

QUESTION 1.12 (1.00)

Which one of the following best supports the reason why Xenon reactivity increases sharply after a trip following 1000 hrs. of operation at 100% power?

- a. Iodine half-life is much shorter than Xenon half-life.
- b. Xenon decays less rapidly due to a reduction in the neutron flux.
- c. Iodine production is greatly reduced and Xenon production is greatly increased due to the reduction in neutron flux.
- d. Due to reduced neutron absorption, Iodine concentration increases, and Xenon decays directly from Iodine, thus Xenon increases.

ANSWER 1.12 (1.00)

A (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.12.6
192006K107 ... (KA'S)

QUESTION 1.13 (1.00)

Select the most correct statement from the following.

- a. If two centrifugal pumps are in parallel, the combined pump head will be approximately the sum of the individual pump heads.
- b. If two centrifugal pumps are in series, the combined power requirements will be approximately equal to the cube of the individual pump power.
- c. If two centrifugal pumps are in series, the flow from each pump will be approximately equal to the square of the individual pump speed.
- d. If two centrifugal pumps are in parallel, the combined flow will be approximately equal to the sum of the individual pump flows.

ANSWER 1.13 (1.00)

D (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS 7-7-21, LN 6.3-5
191004K109 191004K110 ... (KA/9)

QUESTION 1.14 (1.00)

Which one of the following will cause plant efficiency to increase?

- a. Total S/G blowdown is changed from 30 gpm to 40 gpm.
- b. Level increase to higher than normal in a feedwater heater.
- c. Steam quality changes from 99.7% to 99.9%.
- d. Absolute condenser PRESSURE changes from 1.0 psi to 1.5 psi.

ANSWER 1.14 (1.00)

C (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-11-20, LO 3.0
002000K501 ... (KA'S)

QUESTION 1.15 (1.00)

Which one of the below requires the most heat removal during condensation?
(assume steam is of equal quality)

- a. two pounds of steam at 1200 psia.
- b. two pounds of steam at 600 psia.
- c. one pound of steam at 300 psia.
- d. one pound of steam at 0 psia.

ANSWER 1.15 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
steam tables
FCS LP 7-7-16, LO 1.6-1
193003K125 ... (KA'S)

QUESTION 1.16 (1.00)

As core age increases during a cycle, the integral rod worth at 100% full
power of a regulating CEA located near the center of the core:

- a. increases due to the fact that temperature of the CEA is higher.
- b. increases due to the fact that the CEA is operating in a region of
higher neutron flux.
- c. decreases due to the fact that the temperature of the CEA is higher.
- d. decreases due to the fact that the boric-acid concentration in the
core is less.

ANSWER 1.16 (1.00)

B (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.4.6
192005K107 ... (KA'S)

QUESTION 1.17 (1.00)

The term "critical heat flux" refers to that heat flux between a fuel pin and the bulk of the primary coolant:

- a. at which the heat-transfer mechanism changes between natural convection and nucleate boiling.
- b. at which DNBR would equal 1.3.
- c. at which the heat-transfer mechanism changes between nucleate boiling and partial film boiling.
- d. which is 77% of that which would cause clad failure.

ANSWER 1.17 (1.00)

C (1.0)

REFERENCE
EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-18, LO 3.3-2
193008K106 ... (KA'S)

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

QUESTION 1.18 (1.00)

A relief valve on a pipe opens at 885 psig. The temperature of the steam exhausted to the atmosphere is 320 deg. F. The fluid within the pipe is saturated steam. Using the steam tables provided, what is the approximate temperature of the fluid within the pipe, in the immediate vicinity of the relief valve? (Select one response from below.)

- a. 530 deg. F
- b. 400 deg. F
- c. 320 deg. F
- d. 212 deg. F

ANSWER 1.18 (1.00)

A (Saturated steam at 885 + 15 psia.) (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
CE Steam Tables
FCS LP 7-7-17, LO 2.3-1
193004K115 ... (KA'S)

QUESTION 1.19 (1.00)

Which of the following statements concerning power defect is correct?

- a. The power defect is the difference between the measured power coefficient and the predicted power coefficient.
- b. The power defect increases the rod worth requirements necessary to maintain the desired shutdown margin following a reactor trip.
- c. Because of higher boron concentration, the power defect is more negative at the beginning of core life.
- d. The power defect necessitates the use of a ramped Tavg program to maintain an adequate subcooling margin.

ANSWER 1.19 (1.00)

B (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS 7-5-3, LO 3.11.3
001000K549 ... (KA'S)

QUESTION 1.20 (1.00)

With RCS pressure at 2100 psia, one of the seals in a RCP assembly fails. Assume original leakoff flow was 1.0 gpm and leakoff backpressure is 50 psia. Which ONE of the following is correct concerning both the pressure drop across each operable seal and leakoff flow?

- a. 1050 psid and 1.5 gpm
- b. 1050 psid and 1.2 gpm
- c. 1025 psid and 1.2 gpm
- d. 1025 psid and 1.5 gpm

ANSWER 1.20 (1.00)

C 1025 psid and 1.2 gpm (1.0)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-11-20, LO 1.7d
003000A201 ... (KA'S)

QUESTION 1.21 (1.00)

Which of the following statements about burnable poisons is NOT true?

- a. As core age increases burnable poison effects partially compensate for fission product buildup effects.
- b. Including burnable poison in the fuel affects the moderator temperature coefficient.
- c. As core age increases burnable poison effects partially compensate for depletion of the fuel due to fission.
- d. Including burnable poison in the fuel affects the doppler coefficient.

ANSWER 1.21 (1.00)

D (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-3, LO 3.3.2
192007K101 ... (KA'S)

QUESTION 1.22 (1.00)

The reactor trips from full power, equilibrium xenon conditions. Six (6) hours later the reactor is brought critical at $5 \times 10^{-4}\%$. If power level is maintained at $5 \times 10^{-4}\%$, which of the following statements is CORRECT concerning control rod motion?

- a. Rods will have to be withdrawn since xenon will closely follow its normal build-in rate.
- b. Rods will approximately remain as is as the xenon establishes its equilibrium value for this power level.
- c. Rods will have to be inserted since the critical reactor will burnout xenon.
- d. Rods will approximately remain as is since the xenon concentration is independent of time.

ANSWER 1.22 (1.00)

A (1.0)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-5-5, LO 5.3.11
192006K114 ... (KA'S)

QUESTION 1.23 (1.50)

For each of the following events, describe HOW and WHY RCP 'A' motor amperage will vary from its initial magnitude prior to the event.

- a. It is running with two (2) other RCPs and the fourth RCP is started.
- b. Its pump becomes mechanically uncoupled from the motor.
- c. Bearing degradation in the pump results in partial binding.

ANSWER 1.23 (1.50)

- a. The amps will decrease (0.2) because the flow through the pump decreases due to the increased backpressure from starting the fourth pump (0.3)
- b. Amps will decrease (0.2) because the motor no longer has a load (0.3).
- c. Amps will increase (0.2) because friction is increasing the load on the motor (0.3).

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR
FCS LP 7-7-21, LO 6.1.3
191004K107 ... (KA'S)

QUESTION 1.24 (1.00)

Assume the plant is operating at 100% power, with all systems normal, and the backup pressurizer heaters are energized.

- a. How and why will pressurizer pressure change? (0.5)
- b. How and why will pressurizer level change? (0.5)

ANSWER 1.24 (1.00)

- a. Pressure will increase (0.2) due to the water phase change (0.3).
- b. There will be no significant level change (0.5).
OR
Level will decrease (0.2) due to the removal of liquid mass from the pressurizer and the reduced volume of the remaining mass at higher pressure (0.3)

REFERENCE

EQB GENERIC FUNDAMENTALS FOR CE PWR
FCS 01-RC-7, p. 4;
010000A105 ... (KA'S)

QUESTION 1.25 (.50)

As K_{eff} approaches unity, for the same increase in K_{eff} , a greater length of time is required to reach the new equilibrium level. This is a characteristic of:

- a. Moderator effects on neutron leakage.
- b. Increasing population of delayed neutrons.
- c. Reactivity change on power increases.
- d. Subcritical multiplication.

ANSWER 1.25 (.50)

D (0.5)

REFERENCE

EOB GENERIC FUNDAMENTALS FOR CE PWR

FCS LP 7-5-4, LO 5.1

192003K101 ... (KA'S)

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

QUESTION 2.01 (2.50)

Technical Specification 2.2 on the Chemical and Volume Control System requires that there be at least one flow path to the core for boric acid injection whenever fuel is in the reactor. Describe two of the three flow paths which meet this requirement per Tech Specs. (2.5)

ANSWER 2.01 (2.50)

1. The boric acid pumps (0.5) can deliver boric acid tank (0.25) contents to the charging pumps (0.5).
2. The safety injection pumps (0.5) can take suction from the SIRW (0.25) and inject into the core (0.5).
3. The charging pumps (0.5) can take suction by gravity from the SIRW tank (0.75).
4. The charging pumps (0.5) can take suction by gravity from the boric acid tanks (0.75).

(Any 2/4 at point values shown)

REFERENCE

FCS TS 2.2 Basis, p. 2-18, 19
000024SG8 ... (KA'S)

QUESTION 2.02 (1.50)

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

- a. How many condensate pumps must be operating? (0.5)
- b. How many consecutive starts may be attempted? (0.25)
- c. How should the temperature of the seal water lines change when the feed pump goes from standby to normal operation? (0.25)
- d. What should be the status of the warmup valves before starting the feed pump? (0.5)

ANSWER 2.02 (1.50)

- a. 1 (0.5)
- b. 2 (0.25)
- c. Temperature difference (in-out) should disappear. (0.25)
- d. Isolated. (0.5)

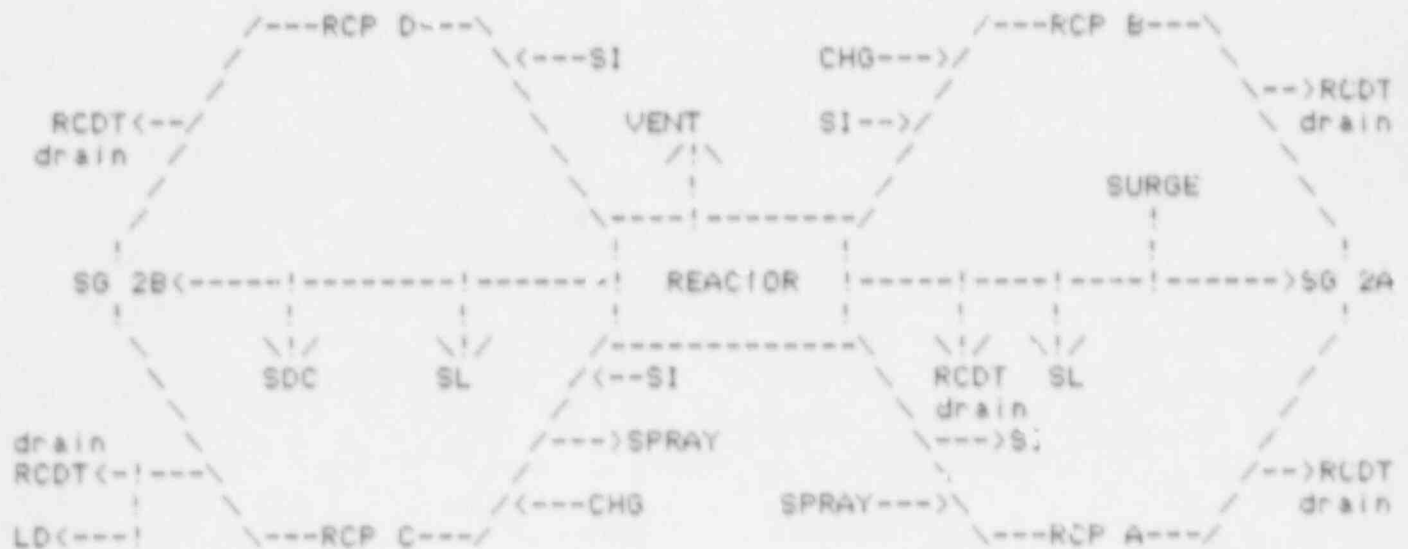
REFERENCE
 FCS LP 7-11-11, p. 47-53

REFERENCE
 C59000SG13 ... (KA'S)

QUESTION 2.03 (3.00)

Using figure 2-1, show and label all major penetrations into the Reactor Coolant System. DO NOT include instrument or test penetrations. (Eighteen properly placed and labelled penetrations are required for full credit.)

ANSWER 2.03 (3.00)



(EIGHTEEN PENETRATIONS AT 0.166 EA)

REFERENCE
 FCS LP 7-11-20, OBJ. 1.2
 002000K10^ ... (KA'S)

QUESTION 2.04 (1.75)

- a. Following a RPS trip initiated by automatic RPS trip modules, WHAT conditions must be satisfied to allow the RPS "M" coil to be re-energized and HOW is it re-energized? (1.0)
- b. How is the RPS "M" coil re-energized following a manual trip from AI-337? (0.75)

ANSWER 2.04 (1.75)

- a. Once the initiating trip has cleared (0.1), the operator must wait for KTD1 and KTD2 relays to time out. (0.4) The "M" coil is then re-energized by pressing the trip reset pushbutton. (0.5)
- b. Manually close the trip breakers (0.5), press the trip reset pushbutton (0.25)

REFERENCE

FCS LP 7-12-25 EO 1.16
001000K603 ... (KA'S)

QUESTION 2.05 (1.25)

- a. What provides backup cooling capability to bring the plant to a safe shutdown condition if Component Cooling Water is not operable? (0.5)
- b. What is the potential public hazard associated with the use of this CCW backup system even if there is no loss of RCS integrity? (0.75)

ANSWER 2.05 (1.25)

- a. Raw Water (0.5) (supplied to various CCW cooled components individually)
- b. Failure to properly isolate the CCW system prior to initiating RW would release toxic chemicals into the river. (0.75)

REFERENCE

FCS LP 7-11-6 EO 5.3
000026A103 ... (KA'S)

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

QUESTION 2.06 (1.25)

- a. HOW is the operation of the RM61 affected by placing it in the "Inversion" mode? (0.5)
- b. WHEN and WHY is the "Inversion" position selected on the RM61? (0.75)

ANSWER 2.06 (1.25)

- a. Placing the switch in INVERSION increases both the alert and alarm setpoints by a fixed amount. (0.5)
- b. It is used when a radon inversion (temperature inversion) has been confirmed (0.5) since the radon will add to the background level increasing the possibility of erroneous alarms and component activation. (0.25)

REFERENCE

FCS LP 7-12-3 EO 6.2
073000K10: ... (KA'S)

QUESTION 2.07 (2.00)

- a. What two (2) conditions will generate a "Containment Vent Fan Off Normal"? (0.5)
- b. What is the failed position for the face dampers and bypass dampers on the containment cooling and filtering units? (0.5)
- c. When the handswitches for the dampers in part b are placed in the UNFILTERED position, what provides the motive force to position the dampers? (0.5)
- d. Why is it important to maintain charcoal bed temperatures below 360 deg.F even after containment air temperatures are returned to normal following a large break LOCA? (0.5)

ANSWER 2.07 (2.00)

- a. control switch in PULL-OUT
69 permissive switch not in AFTER CLOSE position
fan breaker not racked in
(any 2 at 0.25 ea)
- b. face dampers fail open (0.25)
bypass dampers fail shut (0.25)
- c. Control air (instrument air) (operates an air-p to position the dampers for unfiltered operation.) (0.5)
- d. Prevent the release of contaminants absorbed by the charcoal. (0.5)

REFERENCE

FCS LP 7-14-2, LO 1.2, 1.6, 1.8
022000SG10 022000SG7 103000A40) ...(KA'S)

QUESTION 2.08 (2.50)

- a. List three (3) locations from which AFW pump FW-6 may be started manually. (0.75)
- b. With the plant in hot shutdown and SG level being maintained by FW-6 via normal feed regulator valves, describe the response of AFW components to a prolonged loss of instrument air header pressure. Include the impact on SG level. (Assume NO operator action.) (1.75)

(clarification made during exam: normal=bypass)

ANSWER 2.08 (2.50)

- a.
1. CB-10 (Control Room)
 2. AI-66A (Control Room)
 3. Local station at the pump
 4. 4160 VAC switchgear bus 1A3 (pump motor breaker)
(any 3 at 0.25 ea)
- b.
1. The recirc valves (FCV 1368 & 1369) fail open. (0.25)
 2. The AFW control valves (HCV 1107A,B & 1108A,B) fail open. (0.5)
 3. The FW-10 Steam stop valves (YCV-1045 & 1045A/B) eventually open causing FW-10 to start and go on governor control. (0.5)
 4. SG level will increase until the SG is full (because the valves will not respond to the AFWAS reset signal at 60% level). (0.5)

REFERENCE

FCS LP 7-11-1, LO 1.0, 1.8
061000A207 061000SG9 ...(KA'S)

QUESTION 2.09 (2.50)

On the figure representing AI-41A, indicate the expected meter reading and light indications for a normal DC system line up and operation. Use arrows to mark the meter scales and indicate light status as ON, OFF, BRIGHT, or DIM.

ANSWER 2.09 (2.50)

SEE FIGURE AI-41A

Give full credit for voltages indicated between 130 - 140 VDC.

Give 1/2 credit for voltages indicated between 125 - 130 VDC.

Charger current must indicate between 130 - 230 amps.

Battery current should read 0 or slightly to the left of 0.

Both ground indication lights must be labelled as DIM

Both the power available lights (just below the ground lights) must be labelled as ON.

The "Normal Source" light above the selector push button must be labelled as ON and the adjacent "Emer Source" labelled as OFF

REFERENCE

FCS LP 7-13-4, LO 1.4
063000A301 ...(KA'S)

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

QUESTION 2.10 (2.25)

Following a small break LOCA with SI initiation (PPLS and CPHS), automatic Recirculation Actuation occurs. The operator is directed to initiate additional cooling via the shutdown heat exchangers per EOP-03 immediately following the RAS. Assume the following:

1. No manual operation of any SI component has occurred since SI actuation and the subsequent Recirculation actuation.
 2. RCS pressure is 750 psia.
- a. Identify all components that must be manipulated by the operator to establish the desired cooling flow path with the given plant conditions. (0.5)
 - b. Describe the complete SI flow path established as a result of this action. (1.75)

ANSWER 2.10 (2.25)

- a. Open HCV's 349 & 350 (SDHX outlet to HPSI suction) (0.25 ea)
- b. Containment Sump > Containment Spray Pumps > SDHX > HPSI > Loop Safety Injection Nozzles. (0.25 for ea component, 0.5 for sequence)

REFERENCE

FCS LP 7-11-22, LO 1.4, EOP-03
000009A100 ... (KA'S)

QUESTION 2.11 (1.50)

A malfunction in the pressure sensor pressure measurement "A" channel (A/PIA-102Y) causes the output to go to minimum.

- a. List two (2) RPS trip units which receive a signal from this channel and HOW each is affected by the malfunction. (0.75)
- b. Explain why the reactor will or will not trip. (0.75)

ANSWER 2.11 (1.50)

- a. High Pressure and TM/LP (0.25)
The high pressure trip unit will not be affected (since minimum output equates to a low pressure condition). (0.25) The TM/LP trip unit will go to the trip condition initiating a channel "A" trip and a pre-trip alarm. (0.25)
- b. A reactor trip will not occur (0.25) since the 2/4 logic is not satisfied by the single channel trip. (0.5)

REFERENCE

FCS LP 7-12-25, LO 1.03, 007-12-26-H-25-1.03-0001
000027A216 012000A202 ... (KA'S)

QUESTION 2.12 (3.00)

Using the CVCS line diagram provided, circle each component which receives a control signal as a result of a PPLS and indicate the expected response of the component to the control signal.

ANSWER 2.12 (3.00)

The following valves shut:

HCV 204
HCV 241
HCV 206
LCV 218-2
HCV 264
HCV 257
FCV 269
TCV 202
(0.2 ea)

The following valves open:

HCV 258
HCV 265
HCV 268
(0.2 ea)

All 3 charging pumps start (0.4)
Boric acid pumps A & B start (0.2 ea)

REFERENCE

FCS LP 7-12-2, LO 1.4
000009A104 004000A202 ... (KA'S)

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

QUESTION 3.01 (2.00)

Pressurizer pressure is 2270 psig decreasing and pressurizer level is -3.0% from program level and decreasing. Indicate the status of each item below with OPEN, CLOSED, ON, OFF, MINIMUM, or MID (> minimum but < maximum) as appropriate. Assume that the reactor is operating at 100% and the charging pump Standby Switch is selected to CH-1B-1C. NOTE: Other terms may be used to describe component status if desired.

- a. Spray valves
- b. Proportional heaters
- c. Backup heaters
- d. Letdown flow control valves
- e. Charging pumps B and C (answer for each)

ANSWER 3.01 (2.00)

- a. Open
 - b. Off
 - c. Off
 - d. Minimum
 - e. B - On
C - Off
- (6 at 0.333 each)

REFERENCE

FCS LP 7-11-2, LO 4.1
010000K603 011000A102 ... (KA'S)

QUESTION 3.02 (2.50)

The NR NIS power level provides indication at the RPS and CB-4 plus actuation of the Level 1 and rod trip bistable on the drawer front. List six (6) other uses of the power signal from the NR NIS.

ANSWER 3.02 (2.50)

(ANY 6 AT 0.416 EA)

1. Q power auctioneer
2. APD calculator
3. Comparator averager
4. Deviation comparison and alarm
5. Azimuthal tilt (Tq)
6. Reactor Reg
7. UDPT (HI PWR)
8. Plant computer
9. TM/LP calculator

REFERENCE

FCS LP 7-12-19, LO 1.04
015000K100 ... (KA'S)

QUESTION 3.03 (2.00)

What signals, including power levels, type of channels, and number of channels, produce each of the following?

- a. Bypass of the "High Startup Rate" reactor trip. (1.0)
- b. Removal of voltage from the unshielded startup detectors. (0.5)
- c. Bypass of the "Loss of Load" reactor trip. (0.5)

ANSWER 3.03 (2.00)

- a. Below 10E -4% power (0.25) on 2 wide range channels (0.25)
Above 15% power (0.25) on 3 of 4 power range safety channels (0.25)
- b. Above 10E-5% power (0.25) on (that wide range channel) 2 wide range channels (0.25)
- c. Below 15% power (0.25) on 3 of 4 power range safety channels (0.25)

REFERENCE

FCS LP 7-12-18, LO 1.0
012000K406 ... (KA'S)

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

QUESTION 3.04 (2.00)

The qualified safety parameter display system (QSPDS) calculates and displays three (3) saturation margin monitoring (SMM) values.

- a. List the three (3) saturation margins and the temperature sensors (inputs) used to calculate each. If redundant sensors are available, state the criteria which determines the input used by the SMM (1.5)
- b. What signal is used to provide the saturation temperature? (0.5)

ANSWER 3.04 (2.00)

- a. RCS saturation margin - max of RTDs in the hot and cold legs (1.5)
Upper head saturation margin - max of the top three UHJTCs
CET saturation margin - representative CET
- b. Pressurizer pressure (0.5)

REFERENCE

FCS LP 2-12-23, LO 1.7, OI-QSPDS-1-9, REV 0
194001A115 ... (KA'S)

QUESTION 3.05 (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)

ANSWER 3.05 (2.50)

- a. 1. Turbine trip
2. Feedwater Regulating system in automatic (0.625 ea)
- b. 1. Reset the turbine trip (0.25)
2. Place auto/inhibit switch in the inhibit position (0.25)
3. Put the controller in manual (0.25)
- c. Controller in auto (0.25) with valve approximately 8% open (0.25)

REFERENCE

FCS LP 7-12-15, rev. 1, p. 34-36
059000K418 ... (KA'S)

QUESTION 3.06 (2.50)

Three (3) level transmitters (LT-903X, LT-903Y, & LT-903Y-1) supply 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)

ANSWER 3.06 (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 e.; 1.5)
- c. Indication (on AI-179) (0.5)

REFERENCE

FCS LP 7-12-28, rev. 1, p. 19, 20
035010K401 035010K402 ... (KA'S)

QUESTION 3.07 (2.00)

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

ANSWER 3.07 (2.00)

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

(0.5 ea.)

REFERENCE

FCS QC#: 007-013-06-C-05-1.09-0002
064000K402 ... (KA'S)

QUESTION 3.08 (2.50)

- a. What three (3) conditions can cause a Rod Block?
- b. How can the operator reposition CEDMs as necessary to clear a Rod Block?
- c. What two (2) conditions/signals can cause a Rod Withdrawal Prohibit?

ANSWER 3.08 (2.50)

- a. PDIL, Deviation, or Out of Sequence/Overlap. (0.25 ea)
- b. By controlling the affected CEDMs in manual individual while holding the Rod Block Bypass Switch in "bypass". (0.75)
- c. Hi power pre-trip (0.5)
Hi SUR pre-trip (0.5)

REFERENCE

FCS LP 7-12-26 EO 1.3
001050K401 ... (KA'S)

QUESTION 3.09 (2.00)

- a. What is the function of the Diverse Scram System (DSS)? (0.75)
- b. What plant parameter (include setpoint value and logic) will actuate the DSS? (1.25)

ANSWER 3.09 (2.00)

- a. Generate a reactor/turbine trip signal independent of the RPS under ATWS (failure of RPS to generate a trip signal) conditions. (0.75)
- b. Pressurizer pressure (0.5) at 2450 μ sia (0.25) on 2/4 detectors (0.25) tripping 1/2 channels (0.25).

REFERENCE

FCS LP 7-12-25, LO 5.1, 5.2
000029A209 10CFR50.62 ... (KA'S)

QUESTION 3.10 (2.00)

- a. At what power level is the extended range operation of the Wide Range Log Power Channels enabled AND what operator action is necessary to permit extended range operation? (0.5)
- b. How does extended range operation differ from normal operation of a Wide Range Log Power Channel? (0.5)
- c. When audio monitoring of count rate is required, what two (2) switches must be positioned to activate the audio circuit? (0.5)
- d. Aside from possible alarms, what is the control room indication of a non-functioning Campbell circuit for a particular Wide Range Log Power Channel as power is raised from 10E-6% to 10E+1%? (0.5)

ANSWER 3.10 (2.00)

- a. Extended range operation is enabled below 4×10^{-7} % power. (0.25) The operator must take the extended range cutout switch to OFF (0.25) (at about 10 cps control room indication).
- b. Both chambers provide signals that are summed to the channel in extended range with one detector's output disconnected when above approximately 10^{-5} % power. (0.5)
- c. The selector switch on the audio amp must be set to the desired channel (0.25) and the toggle switch for the selected channel must be in the proper position (0.25).
- d. The indication from the affected channel will stop at about 10^{-2} % power. (0.5) (The remaining channels will continue to show normal power increase.)

REFERENCE

FCS LP 7-12-18, LO 1.3, 1.5, 1.7, 1.9
 015000A202 015000K401 ... (KA'S)

QUESTION 3.11 (3.00)

Fill in the numbered blocks on the simplified ESC logic diagram with the proper initiation and actuation signals.

ANSWER 3.11 (3.00)

- | | |
|---------|----------|
| 1. CRHS | 8. SGIS |
| 2. SGLS | 9. CSAS |
| 3. PPLS | 10. RAS |
| 4. STLS | 11. SIAS |
| 5. SGLL | 12. CIAS |
| 6. SGLP | 13. VIAS |
| 7. SGDP | 14. OPLS |
- (0.214 EACH)

REFERENCE

FCS LP 7-12-14, LO 1.1
 013000A301 ... (KA'S)

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

QUESTION 4.01 (1.00)

Choose the correct answer below:

- a. During a reactor startup, CEA motion inhibit due to a rod block is cleared by using the Manual Group Mode.
- b. Manual Individual is used to return a group of CEAs to the proper sequence or overlap.
- c. It is not necessary to use the "Rod Block Bypass Switch" when inserting CEAs whose motion is inhibited by an inoperable CEA.
- d. "Bypass" operation is not necessary when the Rod Drive Power Interrupt alarm is in.

ANSWER 4.01 (1.00)

"b."

REFERENCE

OI-RR-1, Pp.2,3
FCS LP 7-12-26, LO 1.3, 2.1
001000K401 ... (KA'S)

QUESTION 4.02 (1.00)

Choose the letter which corresponds to the best answer.

The purpose of OPERATING INSTRUCTIONS (OI's) is to:

- a. Provide general guidelines for the operation of specific equipment.
- b. Provide detailed instruction for the integrated operation of the plant.
- c. Provide general guidelines for operation of a particular system.
- d. Provide detailed instructions for the operation of plant systems and equipment.

ANSWER 4.02 (1.00)

"d."

REFERENCE

Standing Order 0-17, Section 1.1 & Question Bank
001000G013 ...(KA'S)

QUESTION 4.03 (1.00)

From the following possible combinations of parameters, select the one combination that most correctly describes characteristics of natural circulation cooling.

	RCS Subcooling	SG Pressure	T _{hot}	Core Exit Thermocouples	T _{cold}
a.	20 F	Decreasing	Stable	Decreasing	T _{sat} for SG Press
b.	20 F	Stable	T _{sat} for RCS Press	Decreasing	Stable
c.	30 F	Decreasing	Decreasing	Stable	Stable
d.	40 F	Stable	Decreasing	Increasing	T _{sat} for SG Press

ANSWER 4.03 (1.00)

"a."

REFERENCE

EOP-20, P. 97
000038K103 193008K122 ...(KA'S)

QUESTION 4.04 (1.00)

An area where localized radiation levels are 5 times higher than the 2.5 mrem/hr general area, should be posted as:

- a. Restricted area
- b. Hot spot
- c. Radiation Area
- d. High Radiation Area

ANSWER 4.04 (1.00)

"c"

REFERENCE

Radiation Protection Manual, P. VII-3-2
194001K103 ... (KA'S)

QUESTION 4.05 (2.50)

During a plant heatup from cold shutdown in accordance with OI-RC-3:

- a. What are the two (2) conditions, one of which must be met in order to preclude an RCS pressure surge prior to starting a Reactor Coolant Pump (RCP)? (1.0)
- b. What are the reasons for the upper and lower pressure limits for RCS pressure maintained at 250 deg's RCS temperature? (1.0)
- c. What are the two (2) specific indications to the operator that a steam bubble has been formed in the pressurizer even though level indication is still at maximum? (0.5)

ANSWER 4.05 (2.50)

- a. 1. A pressurizer bubble exists.
2. S/G secondary is less than 50 deg's above RCS temp. [0.5 ea.]
- b. Pressure is maintained so as not to lift PORVs OR to ensure pressure/temperature limits are not exceeded (low temperature over-pressurization) (0.5) and to be sufficient for RCP operation (NPSH). (0.5)
- c. Letdown flow > charging flow, [0.25] and pressure stable. [0.25]

REFERENCE

OI-RC-3, Pp. 2-7

OI-RC-9, P. 1

FCS LP 7-11-23, LO 1.2

005000K104 010000G005 010000G004 011000A101 ... (KA'S)

QUESTION 4.06 (2.00)

During power changes:

- a. What are the two (2) documents referenced by OP-4 that place limits on rate of power change and CEA movement? (1.0)
- b. What must be done if it becomes necessary to change boron concentration to reposition CEAs during a load increase? (0.5)
- c. What are two (2) conditions that may restrict the operators choice to insert CEAs? (0.5)

ANSWER 4.06 (2.00)

- a. Technical Data Book [0.5] and Post Refueling Core Physics Testing and Power Ascension Procedure (SP-PRCPT-1) or OI-RR-1. (any 2 at 0.5 ea)
- b. The load change must be stopped. [0.5]
- c. PDIL or ASI limits [0.25 ea.]

REFERENCE

TDB, P. III-22

OP-4, Pp. 1,2

001000G005 ... (KA'S)

QUESTION 4.07 (1.50)

A stamp is placed on the front of a procedure, requiring a signature and date, prior to using the procedure.

- a. What are the stamp and signature for? (1.0)
- b. Whose signature is required on the stamped area? (0.5)

ANSWER 4.07 (1.50)

- a. The stamp and signature indicate that the latest revision of the procedure is being used. [1.0]
- b. The individual using the procedure. [0.5]

REFERENCE

Standing Order G-7
194001A101 ... (KA'S)

QUESTION 4.08 (1.50)

According to the Radiation Protection Manual, what are your four (4) specific immediate responsibilities should you observe a large spill of radioactive liquid material, WITHOUT trained HP personnel present?

ANSWER 4.08 (1.50)

1. Warn others in the area.
2. Notify the control room.
3. Notify RP
4. Attempt to contain (prevent the spread of) the spill. [0.375 ea]

REFERENCE

Radiation Protection Manual, P. VII-8-1-1
194001K103 ... (KA'S)

QUESTION 4.09 (2.00)

According to AOP-19, Loss of Shutdown Cooling, what are the "LAST RESORT" methods (Flow Paths) for residual heat removal for each of the following conditions. For each case, describe the complete open/closed loop path.

- a. The reactor head installed. (1.0)
- b. The reactor head removed, transfer canal open. (1.0)

ANSWER 4.09 (2.00)

- a. SIRWT > HPSI Pumps into primary system > PORV's OR, Loop Drains > RCDT > RCDT drain pump back to SIRWT. [0.15 for each component in flow path and 0.05 for each manipulation to attain correct order.]
- b. Align Fuel Transfer Canal Drain Pump to take suction from SIRWT and discharge to Spent Fuel Pool. [0.5] Align SFP pumps to transfer water from SFP to SIRWT. [0.5]

REFERENCE

AOP-19, P. 3
LP 2-1-41, L.O. 1.0, 1.2
000025K101 000025K301 ... (KA'S)

QUESTION 4.10 (1.50)

- a. Describe the action (system manipulation) an operator would perform if a head bubble was suspected during natural circulation cooldown. (0.75)
- b. What action is then taken to confirm the existence of a bubble in the head? (0.75)

ANSWER 4.10 (1.50)

- a.
 1. verify letdown isolated
 2. Stop depressurization and, if required, repressurize RCS to greater than or equal to 20deg.F subcooling
 3. Pressurize and depressurize RCS within the limits of Fig. 4-2
 4. If necessary, operate PZR vent and/or reactor vessel head vent to clear trapped non-condensable gases.
(0.1875 ea)
- b. Monitor PZR level and/or RULMS (.5) for trending of RCS inventory(.25)

REFERENCE

LP 7-11-20, LO 3.7d, P. 62
002000A403 ... (KA'S)

QUESTION 4.11 (1.50)

OI-VA-2 gives the operator guidelines on how to IDENTIFY and ISOLATE a leak in the Auxiliary Building which causes a Stack High Radiation Alarm. State these guidelines. (1.5)

ANSWER 4.11 (1.50)

Shut down supply and exhaust fans. [0.5] Isolate all rooms. [0.5] Start one exhaust fan and open dampers one at a time while observing monitor until leak is found. [0.5] (Area monitors may be of some help.)

REFERENCE

FCS EQB
000060A202 ... (KA'S)

QUESTION 4.12 (1.50)

- a. Name the three (3) items that should be removed by control room personnel if the control room is evacuated due to a fire. (0.75)
- b. What three (3) immediate actions should be performed by operators prior to leaving the control room if it is evacuated due to toxic gas? (0.75)

ANSWER 4.12 (1.50)

- a. Key for ASP, Key for east swgr. room and transceiver. [0.25 ea.]
- b.
 - 1. Trip the reactor
 - 2. Trip the turbine
 - 3. Start the turning gear oil and lift pumps. [0.25 ea.]

REFERENCE

AOP-6, Pp2-4 & AOP-7, P. 1
000068G006 000068G011 ... (KA'S)

QUESTION 4.13 (1.25)

The reactor has experienced a Reactor Trip. An early step of EOP-01 has you trip the turbine.

- a. How do you verify that the turbine tripped? (0.5)
- b. What are the two (2) methods specified to trip or stop the turbine if it did not manually trip and is causing continued cooldown? (0.75)

ANSWER 4.13 (1.25)

- a. Verify all turbine intercept and stop valves closed. [0.5]
- b.
 - 1. Control fluid Pumps to Pull-to-lock.
 - 2. Close MSIV's (and Bypasses) [0.375 ea.]

REFERENCE

EOP-01, P. 4
000007A101 000007A107 ... (KA'S)

QUESTION 4.14 (1.75)

- a. What are two (2) actions required of the operator if there is an indication that four (4) CEA's have not fully inserted following actuation of the manual reactor trip pushbutton? (0.75)
- b. Per EOP-03 (LOCA), what are four (4) indirect indications or alarms checked by the operator to verify that PORV's and PZR code safeties are not open? (1.0)

ANSWER 4.14 (1.75)

- a. 1. Open CEDM clutch power supply breakers.
- 2. Emergency borate. [0.375 ea.]

- b. 1. Relief header temperature alarms.
- 2. Relief header acoustic flow alarms.
- 3. Quench Tank
 - i. pressure
 - ii. temperature
 - iii. level(any 4 at 0.25 ea)

REFERENCE

EOP-01, P. 2 & EOP-03, P. 6
000029K309 000029K310 000029K311 000029K312 ... (KA'S)

QUESTION 4.15 (1.50)

- a. The STEAM GENERATOR TUBE RUPTURE Procedure (EOP-04) cautions the operator early on to avoid use of HCV-1040 and FW-10. State the reason for this caution. (0.5)

- b. The operator is directed to determine which Steam Generator has the tube rupture by monitoring or checking four (4) items. What are these four (4) items? (1.0)

ANSWER 4.15 (1.50)

- a. Avoid unmonitored release of activity to the environment. [0.5]

- b. 1. S/G activity
- 2. Steam line radiation
- 3. S/G Blowdown radiation
- 4. S/G levels [0.25 ea.]

REFERENCE

EOP-04, P. 5
000009A202 000037K305 ... (KA'S)

QUESTION 4.16 (1.00)

What are the two (2) requirements to be met before the operator implements the LONG TERM ACTIONS of the Emergency Operating Procedures?

ANSWER 4.16 (1.00)

Appropriate operator actions for all success paths in use have been performed (0.5) and ALL safety function acceptance criteria are being satisfied. (0.5)

REFERENCE

EOP-20, P.4

000011G011 000011G012 ...(KA'S)

QUESTION 4.17 (1.50)

a. State whether each of the following operations would tend to INCREASE, DECREASE, or NOT AFFECT the size of a void existing in the reactor vessel head.

1. Pressurizer spray operation.
2. Pressurizer heater operation.
3. Reactor vessel head vent operation. (0.75)

b. Aside from reactor vessel level, what are three (3) criteria to be met before the operator is allowed to throttle or stop Safety Injection flow? (0.75)

ANSWER 4.17 (1.50)

- a.
 1. Increase
 2. Decrease
 3. Decrease [0.25 ea.]
- b.
 1. RCS subcooling > 20 deg's.
 2. PZR level > or = 45% and not decreasing.
 3. At least one S/G available for heat removal. [0.25 ea.]

REFERENCE

EOP-03, Pp. 17, 26

000009A238 000009K324 ...(KA'S)

FORT CALHOUN STATION
REACTOR/SENIOR REACTOR OPERATOR EXAMINATION
ADMINISTERED ON JULY 26, 1988
REVIEW COMMENTS

QUESTION 1.11/5.11

The Fort Calhoun core often has a slightly positive MTC at BOL. To eliminate possible confusion, it is recommended using MOL instead of BOL for future use of this question.

QUESTION 1.18/5.16

For future use it is recommended clarifying the question as follows:

A relief valve on a pipe opens at 885 psig. The temperature of the steam downstream of the relief valve, exhausted to the atmosphere, is 320° F. The fluid within the pipe upstream of the relief valve is saturated steam. Using the steam tables provided, what is the approximate temperature of the fluid within the pipe, immediately upstream of the relief valve?

QUESTION 5.22

During nominal 100% power operation, the four reactor coolant pumps draw a total of approximately eight megawatts of power. Rated core power is 1500 megawatts. The power contributed by the reactor coolant pumps as compared to the power produced by the reactor core could be considered insignificant ($8\text{MW}/1500\text{MW}=0.5\%$). Since choice c. addresses "normal operating temperature," which implies 100% power conditions, choice c. is a valid response. The answer key should be revised to accept either response c. or d. for full credit.

Reference: SP-CTPC-1, revision 3 for calculation of NSSS calorimetric

QUESTION 5.23

At the Fort Calhoun Station, the Emergency Operating Procedures consider adequate subcooling margin to be 20° F. The RCP NPSH curve is more restrictive than the 20° F. A loss of subcooling margin also means that RCP NPSH requirements have not been met, therefore pump cavitation (that is, two phase conditions) and pump damage could occur. The answer key should be revised to accept either response a. or b. for full credit.

Reference: TDB page III, 25 and Figure 4-2 of the Emergency Operating Procedures

QUESTION 2.03/6.01

The drawing provided for the answer incorrectly shows the relative location of a few penetrations. Full credit should be allowed for responding as indicated on the attached drawing.

Reference: Marked-up copy of answer 6.01 and P&ID E-23866-210-110

QUESTION 2.07/6.02

Instrument air, not service air, provides the motive force to position the dampers (HCV-724A/B and HCV-725A/B). The question does not ask what type of operating mechanism is provided or how it functions. For part c., it is suggested that full credit be given for stating that control air (instrument air) provides the motive force to position the dampers.

Reference: P&ID 11475 M-254, Sh. 5 of 5

QUESTION 2.08/6.01

Part b.3. of the answer identifies FY-10 steam stop valves YCV-1145 & 1145A/B. The answer should be corrected to reflect the correct valve numbers, YCV-1045 & 1045A/B.

Reference: P&ID 11405-M-202

QUESTION 2.09/6.05

Battery charger current is variable, depending on 125 VDC bus loading. The battery chargers are rated for maximum current of 400 amps each. LP 7-13-4 states that normal battery charger current output is approximately 170 - 200 amps. Battery charger current on AI-41A indicated approximately 140 amps on 7/27/88. On 8/1/88, battery charger current on AI-41B indicated approximately 225 amps. It is recommended accepting 130 - 230 amps for battery charger current.

Reference: LP 7-13-4, page 22, rev.2

QUESTION 3.01/6.07

The suggested responses provided in the question do not include "Full Open"; therefore, "Open" should be considered a correct answer for part a.

QUESTION 3.02

The question states rod trip bistable. It should say rod drop bistable. This comment is provided for future use of this question.

QUESTION 3.03

The correct answers should be:

- a. Each RPS High SUR trip channel is bypassed below 10E-4% power on the respective wide range channel or above 15% power on the respective power range safety channel. SUR trip must be bypassed on 3 of 4 RPS channels to prevent High SUR reactor trip (since the RPS employs 2/4 logic).
- b. Above approximately 10E-5% power on that wide range channel.

- c. Each RPS Loss of Load trip channel is bypassed below 15% power on the respective power range safety channel. Loss of Load trip must be bypassed on 3 of 4 RPS channels to prevent reactor trip (since the RPS employs 2/4 logic).

Reference: LP 7-12-25, rev. 2, pages 39 & 61; LP 7-12-18, rev. 1, page 31

QUESTION 3.05

The Feedwater Regulating System was modified during the previous refueling outage. There are now only two (2) conditions that must be met to initiate rampdown and there is not a ramp stop button on the man/auto station.

The correct answers should be:

- a. 1. Turbine trip
2. Feedwater Regulating System in automatic
- b. 1. Reset the turbine trip
2. Place auto/inhibit switch in the inhibit position
3. Put the controller in manual
- c. Controller in auto with the valve approximately 8% open.

Reference: LP 7-12-15, rev. 2, pages 12, 13, & 39

QUESTION 3.09/6.09

Portions of the Diverse Scram System were installed during the previous refueling outage; however, the system is not yet operational. The lesson plans were revised to reflect the installation of the system so the operators could be made aware of its purpose.

Part b. of the question asks for the setpoint value and logic for the parameter that actuates the DSS; it does not solicit how many DSS channels are required to cause a reactor trip.

It is recommended that part b. of the question be deleted since the DSS is not yet operable. However, should it be decided to retain part b., the answer should read as follows:

- b. Pressurizer pressure (0.5) at 2450 psia (2435 psig) (0.25) on 2/4 detectors (0.5). (The correct setpoint is 2450 psia, not 2385 psia.)

Reference: LP 7-12-25, rev. 2, page 87

QUESTION 3.10.a/6.10.a

The extended range is enabled at approximately 10^{-7} power. The EXT RNG C/O switch (toggle ON/OFF) must be OFF for the channel to go into extended range - administratively $10^{-6}/10^{-7}$ which could correspond to 10 to 100 CPS.

It is recommended that the answer be revised as follows:

- a. Extended range operation is enabled at approximately $10^{-7}\%$ power (0.25).
The operator must take the extended range cutout switch to OFF (0.25).

Reference: LP 7-12-18, rev. 1, pages 31-34 & 51

QUESTION 3.10.b/6.10.b

It is recommended that the answer be revised as follows:

- b. Both chambers provide signals that are summed to the channel in extended range with one detector's output disconnected when above approximately $10^{-9}\%$ power (the high voltage is never removed from the dual fission chambers.)

Reference: LP 7-12-18, rev. 1, pages 31-34

QUESTION 3.10.d/6.10.d

The correct answer to this question depends on the definition of "non-functioning". If the Campbell leg of the circuitry is putting out zero signal above $10^{-2}\%$ power, the answer is correct. "Non-functioning" can also be interpreted as signals generated above or below normal which will cause the channel to deviate from the remaining channels in indication.

It is recommended that the candidate's stated assumptions be considered when evaluating his response.

QUESTION 4.03

An indication of natural circulation cooling is no abnormal difference between CET's and RCS T_H . Since answer a. indicates T_{hot} is stable but core exit thermocouples are decreasing, it shows an abnormal difference between CET's and RCS T_H and, therefore, cannot be a correct answer.

It is recommended that this question be deleted from the examination since there is no correct response.

Reference: EOP-20, page 97

QUESTION 4.05/7.01

It is recommended that the answer for part b. be revised as follows:

- b. Pressure is maintained so as not to lift PORV's OR to ensure pressure/temperature limits are not exceeded (low temperature over-pressurization) (either answer is correct) (0.5) and to be sufficient for RCP operation (NPSH). (0.5)

Reference: OI-RC-3, CAUTION after step III.A., rev. 33

QUESTION 4.06.a/7.02.a

It is recommended that the answer be revised to accept any two of the following responses for full credit:

1. Technical Data Book
2. Post Refueling Core Physics Testing and Power Ascension Procedure (SP-PRCPT-1)
3. OI-RR-1

Reference: OP-4, IV.A.2.f., rev. 26

QUESTION 4.06.c/7.02.c

This question does not directly refer to OP-4. Therefore, the answer should be revised to accept any two of the following responses:

1. PDIL limits (or shutdown margin requirements)
2. ASI limits
3. Meet MTC values as prescribed by the Reactor Engineer

Reference: OP-3, III.1, rev. 23

QUESTION 4.10/7.08

It is recommended that the answer be revised as follows:

- a.
 1. Verify letdown isolated
 2. Stop depressurization and, if required, repressurize RCS to greater than or equal to 20°F subcooling.
 3. Pressurize and depressurize RCS within the limits of Figure 4-2.
 4. If necessary, operate PZR vent and/or reactor vessel head vent to clear trapped non-condensable gases.
- b. Monitor PZR level and/or RVLMS for trending of RCS inventory.

Reference: EOP-02, 3.37 page 22, rev. 2

QUESTION 7.10

The following change is recommended for the answer to part c.:

- c. Once-through cooling (HR-4), found in the RCS and Core Heat Removal FRP (found in EOP-20). (Identifying the appropriate procedure, either by number or title, should be acceptable.)

Reference: EOP-20, rev. 2

QUESTION 4.12

Answer b.3. should state "Start the turning gear oil pump and lift pumps.

Reference: AOP-6

QUESTION 4.14/7.11

Each parameter listed as a correct response for part b. is equipped with indication and alarm. Specifying either alarm or indication should be considered correct.

QUESTION 7.13

Part a. solicits specifically operator actions for confirming the diagnosis of an uncomplicated reactor trip. The Shift Technical Advisor performs the safety function status check and informs the Shift Supervisor of the results. It is recommended that the answer be revised as follows, to require only operator actions:

a. Verify that the safety function status check criteria are satisfied.

Reference: EOP-01, page 17, rev. 1

QUESTION 8.01

The control room crew composition and titles have recently been changed. The answer to part b. should be revised as follows:

b. The Reactor Operator (assisted by the ARO)

OR

The Licensed Senior Operator (LSO) or Licensed Operator (LO) (accept either response for full credit)

Reference: FCS Exam Bank Question 007-015-48-H-07-4.04-0001

QUESTION 8.03

Part a. of the question asks "...what two (2) signatures are required...", when in reality three (3) signatures are required for approval of an On-the-Spot procedure change. The answer key should be revised to accept any two of the following responses:

1. PRC member
2. Senior Licensed PRC member
3. Shift Supervisor

Reference: Standing Order G-30, Section 3.3.1, rev. 21

QUESTION 8.05

The answer for part a. should be revised to reflect the current revision of Standing Order G-28. The following members of the Plant Fire Brigade report to the fire area:

Fire Brigade Leader (LO*)
Two other operators (Equipment/Auxiliary Operators)
Two security force personnel

Reference: Standing Order G-28, sect. 3.2.5.1.g-j and 3.2.5.2.b-f, rev. 12,
June 13, 1988