ENCLOSURE 1

EXAMINATION REPORT - 50-395/OL-88-01

Facility Licensee: South Carolina Electric and Gas Company
P. O. Box 88
Jenkinsville, SC 29065

Facility Name: V. C. Summer Nuclear Station

Facility Docket No.: 50-395

Written examinations and operating tests were administered at V. C. Summer Nuclear Station near Jenkinsville, South Carolina.

Chief Examiner: William M. Dean — William M. Dean — 4/15/88 Date Signed

Approved by: John F. Munro — John F. Munro, Chief, Operator Licensing Section 1 — 4/15/88 Date Signed

Summary:

Examinations on March 7-10, 1988.

Operating and written examinations were administered to six initial senior reactor operator (SRO) and two reactor operator (RO) retake candidates. All of the candidates passed the operating and written exams.

Four of the 14 changes (29%) made to the written examinations were a result of inadequate or incomplete reference material provided to the NRC for examination item development.

REPORT DETAILS

1. Facility Employees Contacted:

   *Ken Woodward, Manager, Training
   *Gene Soult, OPS Manager
   *Randy Ruff, Supervisor, Training
   *Victor Kelley, Senior Instructor

   *Attended Exit Meeting

2. Examiners:

   *William Dean
   Richard Baldwin
   Ron Aiello
   Pete Isaksen, INEL

   (Perry Hopkins, RI, attended exit)

   *Chief Examiner

3. Examination Review Meeting

   At the conclusion of the written examinations, the examiners provided your training staff, with a copy of the written examination and answer key for review. The NRC Resolutions to facility comments are listed below.

   a. SRO Exam (Applicable RO questions are in parentheses)

   (1) Question 5.07 (b)

   Disagree with facility comment. Due to the fact that a power level was not specified, there is no ONE correct answer for part "b". Therefore, part "b" has been deleted from the exam. For future reference, the question will, specify a power level which will, in turn, define the fuel centerline temperature, thus making the question NON ambiguous.

   (2) Question 5.15(b)

   Facility comment accepted. 5.15(b) has been deleted from the exam.

   (3) Question 6.01 (2.21)

   Facility comment accepted. Suggested additional answer (choice "c") will be accepted as one of the responses.

(4) Question 6.07

Facility comment accepted. The answer key has been changed to the recommended response.

(5) Question 6.10

Facility comment accepted. The answer key has been changed to the recommended response.

(6) Question 6.14 (3.04)

Facility comment accepted. The answer key has been changed to the recommended response.

(7) Question 6.15

Facility comment accepted. "High level alarm at 70%" will be deleted from the answer key.

(8) Question 6.19 (1.15)

Facility comment accepted. Suggested answers 1 & 2 paraphrase the existing answers in the key. However, the answer key will be expanded to include the facility's suggested answer number three. The training material should be modified to reflect this information.

(9) Question 7.11

Facility comment accepted. Due to the lack of specific procedural guidance, the facility's suggested answer will also be accepted.

(10) Question 7.13

Facility comment accepted. Note, however, that ARP-001, XCP-636, P-12 specifically addresses this failure. Although operators should be familiar with what actions to be taken for a casualty of this nature, the question was not adequately worded to elicit the desired information. The question will be deleted from the exam.

(11) Question 7.17

Facility comment accepted. Number one of the answer key will be changed as recommended.

(12) Question 7.23

Facility comment accepted. The answer key will be changed as recommended.

(13) Question 8.22

Disagree with facility comment. It is clea: that taking "B" EDG OOS renders both RHR pumps inoperable, thereby placing one in an action statement. Furthermore, the RHR loop may be removed from operation for up to one hour per eight hour period only during the performance of core alterations in the vicinity of the reactor pressure vessel hot legs. The answer key remains unchanged.

b. RO Exam

(1) Question 2.08 (a)

Facility comment noted. For exam grading consistency, (.75) will be allotted for the protective feature and (.25) for the set point.

(2) Question 2.13 (a)

Facility comment noted. For exam grading consistency, (.56) will be allotted for the automatic action and (.19) for the set point.

(3) Question 2.17

Facility comment accepted. Note that the information supporting this answer was not made available to the author prior to the exam.

(4) Question 3.06 (b)

Facility's recommended answer is equivalent to existing answer key. No change required.

(5) Question 3.18 (a)

Facili:, comment accepted. The answer key has been changed to accept the recommended answer for full credit.

(6) Question 4.17 (a)

Facility comment accepted. The yearly administrative limit is clearly stated in the reference utilized for question development. No change to answer key.

c. Post-Exam Review Changes

A detailed review of the examinations and associated answer keys resulted in the following additional changes:

(1) Question 2.12 (b)

The TS basis for minimum spent fuel pool water level relative to removal of iodine gap activity was added as an additional correct answer. The facility reference material should be updated to reflect this information.

(2) Question 7.15

Tripping the turbine locally from the front standard was added as an additional correct answer as the question was not specific enough to elicit control room actions exclusively.

4. Exit Meeting

At the conclusion of the site visit the examiners met with representatives of the plant staff to discuss the results of the examination.

There were no generic weaknesses noted during the oral examination.

The examiners did note that there may be some inconsistent training on requirements to restart condensate pumps after a loss of condensate flow. It was also noted that the facility's ongoing effort to update both their lesson plan learning objectives and simulator exercise guides has greatly improved these training documents and once fully implemented should be much more closely related to their job task analysis.

The cooperation given to the examiners and the effort to ensure an atmosphere in the control room conducive to oral examinations was also noted and appreciated.

The licensee did not identify as proprietary any of the material provided to or reviewed by the examiners.

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

MASTER COPY

FACILITY: SUMMER

REACTOR TYPE: PWR-WEC3

DATE ADMINSTERED: 88/03/07

EXAMINER: ISAKSEN, P.

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
30.00	25.00	________	________	1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
30.00	25.00	________	________	2. PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
30.00	25.00	________	________	3. INSTRUMENTS AND CONTROLS
30.00	25.00	________	________	4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
120.0		________ Final Grade	________%	Totals

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

____
Candidate's Signature

MASTER COPY

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.
2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.
3. Use black ink or dark pencil only to facilitate legible reproductions.
4. Print your name in the blank provided on the cover sheet of the examination.
5. Fill in the date on the cover sheet of the examination (if necessary).
6. Use only the paper provided for answers.
7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.
8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only on one side of the paper, and write "Last Page" on the last answer sheet.
9. Number each answer as to category and number, for example, 1.4, 6.3.
10. Skip at least three lines between each answer.
11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.
12. Use abbreviations only if they are commonly used in facility literature.
13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.
14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.
15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.
16. If parts of the examination are not clear as to intent, ask questions of the examiner only.
17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

    a. Assemble your examination as follows:

        (1) Exam questions on top.

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

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

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

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

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

QUESTION 1.01 (1.00)

Increasing the boron concentration at low temperature has little effect on the Moderator Temperature Coefficient as compared to higher operating temperatures because: (choose the correct answer)

a. water density does not change as much at low temperature.

b. water density is greater at lower temperatures so neutron leakage is less.

c. water density is greater at lower temperatures so parasitic neutron absorption is greater.

d. boric acid is less soluble at lower temperatures.

QUESTION 1.02 (1.00)

Which one of the following statements concerning Xenon-135 production and removal is correct?

a. At full power, equilibrium conditions, about half of the Xenon is produced by Iodine decay and the other half is produced as a direct fission product.

b. Following a reactor trip from equilibrium conditions, Xenon peaks because delayed neutron precursors continue to decay to Xenon while neutron absorption (burnout) has ceased.

c. Xenon production and removal increases linearly as power level increases; i.e., the value of 100% equilibrium Xenon is twice that of 50% equilibrium Xenon.

d. At low power levels, Xenon decay is the major removal method. At high power levels, burnout is the major removal method.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.03 (1.00)

As the core ages, the ratio of PU239 atoms to U235 atoms increases. This changing ratio causes the: (Choose the correct answer)

a. reactor startup rate (SUR) to increase, for the same reactivity addition.

b. Void Coefficient to become less negative.

c. Moderator Temperature Coefficient to become less negative.

d. delayed neutron fraction to increase.

QUESTION 1.04 (1.00)

Which one of the following statements concerning Shutdown Margin (SDM) is correct?

a. The maximum SDM requirement occurs at EOL and is based on a rod ejection accident.

b. The maximum SDM requirement occurs at EOL and is based on a steam line break accident.

c. The maximum SDM requirement occurs at BOL and is based on having a positive moderator temperature coefficient.

d. The maximum SDM requirement occurs at BOL and is based on a rod withdrawal accident while in the source range.

QUESTION 1.05 (1.00)

The reactor is critical at 10,000 cps when a S/G PORV fails open. Assuming EOL conditions, no rod motion, and no reactor trip, choose the answer below that best describes the values of Tavg and nuclear power for the resulting new steady state. (POAH = point of adding heat).

a. Final Tavg greater than initial Tavg, Final power above POAH.

b. Final Tavg greater than initial Tavg, Final power at POAH.

c. Final Tavg less than initial Tavg, Final power at POAH.

d. Final Tavg less than initial Tavg, Final power above POAH.

QUESTION 1.06 (1.50)

The reactor is taken critical with Xenon concentration at zero. Power is raised to 50% at 5%/hr.

Use one of the following choices to describe how Xenon concentration will be trending for each of the following situations (a,b, and c).

Increasing
Decreasing
At equilibrium

a. One hour after a trip occurs as power reaches 50%.

b. Four hours after the trip occurs the reactor is taken critical and power raised back to 50%.

c. If reactor operation continues and power level is maintained at 50% for one hour.

QUESTION 1.07 (2.00)

a. How is Shutdown Margin (SDM) affected (Increase, Decrease, or No change) by a 50 ppm boron addition while operating at 50% power? (0.5)

b. List FIVE factors, other than RCS boron concentration and rod position, which will affect SDM and are used in the SDM calculation. (1.5)

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.08 (1.00)

Which one of the following conditions would cause a 1/M plot to be NON-conservative during fuel loading?

a. Fuel being loaded closer to the neutron source than to the source range detector.

b. Loading fuel in the order of high reactivity worth to low reactivity worth.

c. Loading poison rods between the source range detectors and spaces to be filled by fuel assemblies.

d. Increasing the boron concentration in the moderator.

QUESTION 1.09 (1.00)

During a Xenon-free reactor startup, critical data was inadvertently taken two decades below the required Intermediate Range (IR) level (1 E-10 amps). The critical data was then taken at the proper IR level (1 E-08 amps). Assuming RCS temperature and boron concentration did not change, which one of the following statements is correct?

a. The critical rod position taken at the proper IR level is LESS THAN the critical rod position taken two decades below the proper IR level.

b. The critical rod position taken at the proper IR level is THE SAME AS the critical rod position taken two decades below the proper IR level.

c. The critical rod position taken at the proper IR level is GREATER THAN the critical rod position taken two decades below the proper IR level.

d. There is not enough information given to determine the relationship between the critical rod position taken at the proper IR level and the critical rod position taken two decades below the proper IR level.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.10 (1.50)

Match the parameter change in Column A to the direction it will change the Moderator Temperature Coefficient (MTC) in Column B. Consider each case separately.

COLUMN A	COLUMN B
1. Moderator temperature increases	a. More Negative
2. Boron concentration increases	b. Less Negative
3. All rods in vs. all rods out	c. No Effect

QUESTION 1.11 (2.00)

If the Source Range (SR) instruments indicate 50 cps with Keff equal to 0.9, what would the SR instrument indicate if rods were withdrawn to bring Keff equal to 0.95? Assume BOL conditions.

a. 1. 50 cps

2. 75 cps

3. 100 cps

4. 200 cps (1.0)

b. How much reactivity was added?

1. 0.0347

2. 0.0500

3. .0526

4. 0.0585 (1.0)

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.12 (1.50)

Compare the calculated Estimated Critical Position (ECP) for a startup 15 hours after a trip from 100% power operation equilibrium conditions to the Actual Critical Rod Position (ACP) if the following events/conditions occurred. Consider each independently. Limit your answer to:

a. ACP higher than ECP.

b. ACP lower than ECP.

c. ACP would not be significantly different than ECP.

1. One Reactor Coolant Pump is stopped one minute prior to criticality.

2. The steam dump pressure setpoint is increased to a value just below the code safties setpoints.

3. The startup is delayed 2 more hours.

QUESTION 1.13 (1.00)

Which one of the followi correctly describes the observed reactor response for the same smal addition of reactivity, one positive and one negative?

a. The response will be faster for the negative addition at all times in core life.

b. The response will be faster for the negative addition at BOL but faster for the positive addition at EOL.

c. The response will be faster for the positive addition at all times in core life.

d. The response will be faster for the positive addition at BOL but faster for the negative addition at EOL.

e. The response will be the same for both the positive and negative addition.

QUESTION 1.14 (1.00)

Which one 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 the higher boron concentration, the power defect is more negative at beginning of core life.

d. The power defect necessitates the use of a ramped Tavg program to maintain an adequate Reactor Coolant System subcooling margin.

QUESTION 1.15 (1.00)

State TWO reasons for establishing Rod Insertion limits.

QUESTION 1.16 (1.00)

A centrifugal pump is operating at rated flow when the discharge valve is throttled towards the shut direction. For each of the following indicate whether the parameter will increase, decrease or remain the same, after the valve is throttled in the shut direction.

a. NPSH

b. motor amperage

QUESTION 1.17 (1.00)

TRUE or FALSE

a. During a RCS heatup, as temperature gets higher, it will take a smaller letdown flow rate to maintain a constant pressurizer level.

b. Increasing condensate depression (subcooling) will cause BOTH a decrease in plant efficiency AND an increase in condensate (hotwell) pump available NPSH.

QUESTION 1.18 (1.50)

Assume the plant is operating at 85% power with normal/automatic system lineup. Indicate how the following changes in plant conditions would affect DNBR (increase, decrease, remain the same). Consider each case separately.

1. AFD changes from 0% to +5%.

2. Steam Generator PORV fails open.

3. Pressurizer heaters are inadvertantly left on and pressure increases 50 psig.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.19 (2.50)

a. What is the subcooling margin (SCM) of the RCS if the following conditions exist?

Th =580 F Pressurizer pressure =2185 psig
Tc =520 F Steam Generator Pressure =850 psig (1.0)

b. If power is raised from 50 to 100%, how AND why will SCM change (increase, decrease, stay the same)? (0.75)

c. Which one of the following would result in the smal. st SCM? Briefly explain your choice. Assume identical RCS pressures. (0.75)

1. SCM during a controlled natural circulation cooldown following a reactor trip from loss of flow.

2. SCM during continued operation at 5% power.

3. SCM produced when all RCP's are operated at normal no-load temperature after extended shutdown.

QUESTION 1.20 (1.50)

At each of the following leak locations, indicate the state of the exiting fluid (subcooled, saturated, or superheated). Assume normal 100% power initial operating plant conditions.

a. PZR steam space to CTMT atmosphere.

b. Steam Dump to the condenser.

c. Main steam header to turbine building atmosphere.

QUESTION 1.21 (2.00)

The reactor is operating at 30% power when one RCP trips. Assuming no reactor trip or turbine load change occur, indicate whether the following parameters will INCREASE, DECREASE, or REMAIN THE SAME.

a. Flow in operating reactor coolant loops

b. Core delta T

c. Reactor vessel delta P

d. Operating loop steam generator pressure

QUESTION 1.22 (1.00)

Primary system flow rate is many times greater than secondary system flow rate while the heat transferred by the two systems is essentially the same. Explain how this is possible.

QUESTION 1.23 (1.00)

List all of the conditions that must be present in order for natural circulation to exist.

(***** END OF CATEGORY 1 *****)

QUESTION 2.01 (1.50)

What signal(s) must be present for an AUTOMATIC switchover of the suction of the RHR system from the RWST to the reactor building recirculation sumps to occur? Give setpoint(s) and coincidence(s) if applicable.

QUESTION 2.02 (2.00)

Which components of the Reactor Building Spray system are affected by a:

a. Phase A Containment Isolation Signal?

b. Spray Actuation Signal?

QUESTION 2.03 (1.50)

The following questions are associated with the normal service gas decay tanks.

a. How many normal service gas decay tanks are there?

b. Normally, how often is the in-service tank switched?

c. Why is the waste gas distributed among all normal service gas decay tanks instead of filling one tank at a time?

QUESTION 2.04 (1.50)

List THREE systems for which the Acoustic Leak Monitoring System provides indications of a leak.

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.05 (1.00)

Which one of the following statements describing the design of the fuel transfer tube is correct?

a. A blind flange is used to close the transfer tube on BOTH the containment side and the spent fuel side.

b. A blind flange is used to close the transfer tube on the containment side and a valve is used on the spent fuel side.

c. A valve is used to close the transfer tube on the containment side and a blind flange is used on the spent fuel side.

d. A valve is used to close the transfer tube on BOTH the containment side and the spent fuel side.

QUESTION 2.06 (1.00)

The #3 RC pump seal leakoff is normally collected in which one of the following?

a. Containment Sump

b. Pressurizer Relief Tank

c. Volume Control Tank

d. Reactor Coolant Drain Tank

QUESTION 2.07 (2.00)

The following questions concern the RHR System.

a. What THREE interlocks must be met prior to opening the RHR inlet line isolation valves (8701A or 8702A)? (1.0)

b. What interlock will automatically close the RHR inlet line isolation valves? (include setpoint) (0.5)

c. What is the bases of the RHR inlet line relief valve capacity? (0.5)

QUESTION 2.08 (2.00)

a. Other than the thermal barrier heat exchanger, list THREE reactor building loads supplied by the Component Cooling Water System.

b. Other than relief valves, what feature prevents overpressurization of the CCW System if a thermal barrier heat exchanger tube ruptures? (Include setpoint, if applicable)

QUESTION 2.09 (1.50)

Match the RCP seal flow paths in Column A to the appropriate design flow rate in Column B.

COLUMN A	COLUMN B
a. Down shaft into the RCS	1. 10 cc/hr
	2. 100 cc/hr
b. #2 seal leakage	3. 3 gph
	4. 5 gph
c. #3 seal leakage	5. 3 gpm
	6. 5 gpm

QUESTION 2.10 (1.00)

List TWO relief valves that discharge into the Volume Control Tank.

QUESTION 2.11 (1.50)

The following questions concern the Emergency Feed Pumps.

a. What is their normal source of water?

b. What is their backup source of water?

c. What signal shifts the supply from the normal source to the backup source? Setpoints and coincidence NOT required.

QUESTION 2.12 (2.00)

a. State THREE of the four places that flow from the Spent Fuel Cooling and Transfer pump can be directed to.

b. What are the TWO reasons for establishing the design low water level of the Spent Fuel Pit (SFP)?

QUESTION 2.13 (2.00)

a. Describe TWO automatic actions associated with the instrument air system which serve to mitigate a loss of air pressure. Include any associated setpoints. (1.5)

b. Assume the plant is operating at 100% power and NO operator action is taken. What will initially cause a reactor trip on a continued loss of instrument air pressure? (0.5)

QUESTION 2.14 (2.00)

a. What TWO conditions will energize a lockout (86 relay) for an ESF transformer?

b. List FOUR of the abnormal conditions which will cause an ESF transformer trouble alarm, but will NOT cause the transformer to be deenergized. (Setpoints not required)

QUESTION 2.15 (1.50)

State the purpose AND operation of the interlocks between the Letdown isolation valves and the orifice isolation valves.

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.16 (1.00)

Which one of the following statements is NOT true concerning the operation of "C" CVCS pump, if a blackout occurs on the ESF bus with "C" pump aligned to it.

a. The "C" pump would be tripped and locked out provided the A/B pump on that train was racked in and running.

b. The "C" pump would continue to run if it was the running pump on that train.

c. If the A/B pump on that train is manually started the "C" pump would continue to run.

d. If the A/B pump on that train starts on an SI signal the "C" pump will trip and be locked out.

QUESTION 2.17 (1.00)

What automatic action(s) should occur to the Reactor Building Cooling Units upon receipt of an SIAS signal? Assume an initial normal at power lineup.

QUESTION 2.18 (1.00)

The S/G PORV's maximum capacity is limited by design to approximately 6% of rated steam flow. What is the reason for this limitation?

QUESTION 2.19 (1.00)

An undervoltage on a 7.2 kV safeguards bus occurs 20 seconds after the receipt of a Safety Injection signal. Which of the following statements regarding sequencing of loads onto the safeguards bus is correct?

a. All loads except Load Block #1 are stripped and the ESF Loading Sequence is reinitiated once the DG output breaker is closed.

b. Sequencing stops until the DG output breaker is closed at which time it continues from the point at which the undervoltage occurs.

c. Sequencing stops until the DG output breaker is closed at which time only the ECCS-related equipment sequence will be reinitiated.

d. All loads except the ECCS-related equipment are stripped and only the ECCS-related equipment sequence will be continued once the DG output breaker is closed.

QUESTION 2.20 (1.00)

What is the main design purpose of the flow restricting nozzle in the Main Steam Lines?

QUESTION 2.21 (1.00)

Which statement below regarding the Main Generator Protection System is NOT CORRECT.

a) Opening the generator output breakers ALWAYS results in a turbine trip when the generator is loaded.

b) Once the generator is loaded, a turbine trip ALWAYS results in a generator trip.

c) A turbine trip above the protection interlock P-7 (10% power) ALWAYS results in a Reactor trip.

d) A reactor trip ALWAYS results in a turbine trip.

(***** END OF CATEGORY 2 *****)

QUESTION 3.01 (2.00)

Indicate whether the Over Power Delta Temperature trip setpoint will INCREASE, DECREASE, or REMAIN THE SAME for each of the following parameter changes. Consider each separately.

a. Increasing Tavg

b. Tavg less than rated power Tavg

c. Delta I becoming more negative

d. Pressurizer Pressure decreasing

QUESTION 3.02 (1.00)

Which one of the following flowpaths describing how power is normally supplied to a typical vital instrument bus is correct?

a. 125 VDC from battery, supplied to battery bus, inverted to 120 VAC, and supplied to instrument bus.

b. 480 VAC from vital bus, transformed to 120 VAC, and supplied to instrument bus.

c. 480 VAC from vital bus, rectified to 125 VDC, inverted to 120 VAC, and supplied to instrument bus.

d. 480 VAC from vital bus, rectified to 120 VDC, and supplied to instrument bus.

QUESTION 3.03 (1.00)

List FIVE outputs of the Pressurizer Pressure master controller. NOTE: Redundant outputs count as one, i.e., Pump A and Pump B.

QUESTION 3.04 (1.00)

The Cold Overpressure Protection System (COPS) provides an alarm to warn the operator that overpressure protection is isolated. What plant conditions will cause this alarm?

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.05 (1.50)

With the pressurizer level control switch in Position 2, describe the response for a high failure of LT-459, including components affected, alarms received, and the effect on actual pressurizer level. Assume normal charging and letdown system lineups and no operator actions are taken. Continue the description until pressurizer level is constant or a reactor trip occurs. Include setpoints were applicable.

QUESTION 3.06 (1.50)

a. What TWO interlocks must be satisfied prior to manually resetting a safety injection signal? (1.0)

b. After resetting safety injection, automatic actuation is inhibited until what signal is cleared? (0.5)

QUESTION 3.07 (1.00)

Describe the interlock associated with the reactor trip bypass breakers.

QUESTION 3.08 (1.50)

Provide the expected RVLIS indications for all THREE ranges (Upper, Narrow, and Wide) for a full vessel at 100% AND 0% flow.

QUESTION 3.09 (1.00)

Which one of the following malfunctions will result in both a low Tavg indication and a low delta T indication?

a. Hot leg RTD failed high

b. Hot leg RTD failed low

c. Cold leg RTD failed high

d. Cold leg RTD failed low

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.10 (1.50)

Describe what each of the following Steam Dump System status lights indicate.

a. "PERMISV C-9" status light dims.

b. "STEAM DUMP CONTROL" status light illuminates.

c. "PERMISV C-7B PB-447B" status light brightens.

QUESTION 3.11 (1.00)

Indicate whether the following conditions will cause the Steam Dump System to ARM ONLY, ARM & DUMP, or HAVE NO EFFECT.

a. Tavg Mode, Tavg channel fails high during a 3% per minute load reduction.

b. Tavg Mode, first stage pressure (PT-447) fails low with Tavg 1.5 degrees F greater than Tref.

QUESTION 3.12 (1.00)

Indicate whether the following malfunctions in the SGWLC System will result in a LOW, HIGH, or NO S/G level trip signal. Assume initially the reactor is at 75% power with S/G levels at program.

a. Steam pressure (density compensation signal) fails high.

b. N-44 fails low.

QUESTION 3.13 (1.50)

The following questions are associated with the Reactor Control Unit of the Rod Control System.

a. What signals are used to generate the temperature error signal?

b. What signals are used to generate the power error signal?

c. What is the purpose of the variable gain applied to the power error signal?

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.14 (1.50)

List SIX rod control interlocks. Setpoints are NOT required. Redundant interlocks only count once, i.e., Channel A high voltage and Channel B high voltage.

QUESTION 3.15 (1.50)

List ALL input parameters used to calculate the Over Temperature Delta T trip setpoint.

QUESTION 3.16 (1.50)

What THREE signals will cause a feedwater isolation? (Setpoints NOT required)

QUESTION 3.17 (2.00)

Which of the following radiation monitor channels have automatic actions (other than indication and alarm) associated with them. Briefly describe the automatic actions, if any.

a. Reactor Building Manipulator crane (RM-G17A)

b. Component Cooling Water (RM-L2A)

c. Nuclear Blowdown Waste Effluent (RM-L7)

d. Main Plant Vent Exhaust (RM-A3)

QUESTION 3.18 (3.00)

Answer the following concerning the Core Cooling Monitor (CCM).

a. What are the FIVE inputs to the CCM? Be specific. (1.25)

b. For each of the THREE CCM status lights, state the color AND briefly describe what is meant when each of the status lights are lit. (0.75)

c. What does it mean if the status lights are flashing? If all the status lights are off? (1.0)

QUESTION 3.19 (2.50)

The following concern the Rod Position Indication (RPI) system.

a. What is the effect of taking the "accuracy mode" switch out of its "normal" A + B position? (1.0)

b. State TWO conditions which will cause a DRPI urgent alarm. (1.0)

c. How are the affected rods displayed when a RPI urgent alarm signal is received? (0.5)

QUESTION 3.20 (1.50)

State the purpose/function for each of the following permissive signals. Include which instrument is used to develop the signal, setpoints are NOT required.

a. P-6
b. P-8
c. p-9

(***** END OF CATEGORY 3 *****)

QUESTION 4.01 (2.50)

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

b. Assume the plant is operating at full power and the AFD has been outside the target band for the last 5 minutes. What are the TWO different actions specified which may be used to meet the TS requirements? Include time limitations, if any. (1.0)

c. Assume that it is 0310 on 03/07/88 and the plant is presently at 45% power. Considering the AFD penalty history below, at what date and time may power be increased above 50%? Explain and show all work. Assume no deviation outside the band after 0310 on 03/07/88.

DATE	TIME WENT OUT OF BAND	TIME BACK IN BAND	% POWER
03/06/88	0310	0318	85
03/06/88	1557	1637	65
03/07/88	0148	0310	45

(1.0)

QUESTION 4.02 (2.50)

a. What are THREE symptoms/plant conditions which would require the RCS to be emergency borated, according to EOP-11.0, Emergency Boration procedure? (1.5)

b. What TWO operator actions are required to perform Emergency Boration? (1.0)

QUESTION 4.03 (2.00)

According to SAP-200, Conduct of Operations administrative procedure, under what condition may the "operator at the controls" leave the surveillance area of the control room during Mode 1 operation? How does this change during Mode 5 operation?

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.04 (1.00)

What are the Immediate Corrective Action(s) required if the charging flow control valve (FCV-122) fails closed while in automatic control and will not respond to a manual open signal?

QUESTION 4.05 (1.50)

What are the Immediate Corrective Actions if Group 1 and Group 2 step counters of Bank D rods differ by more than 1 step? (Three required)

QUESTION 4.06 (1.00)

Which one of the below statements describe the RCP trip criteria following a SI with normal containment conditions?

a. Less than 30 degrees subcooling AND pzr level less than 4%.

b. Less than 30 degrees subcooling AND SI flow verified.

c. RCS pressure less than 1380 psig AND SI flow verified.

d. RCS pressure less than 1380 psig AND pzr level less than 4%.

QUESTION 4.07 (1.00)

If a void exists in the reactor vessel with all RCPs stopped, which of the following actions is used to collapse the void according to EOP-18.2, "Response to Voids in Reactor Vessel"?

a. Decrease temperature while maintaining system pressure.

b. Start a SI pump to increase system pressure while keeping temperature constant.

c. Increase system pressure using pressurizer heaters while maintaining pressurizer level.

d. Fill pressurizer solid and vent the reactor vessel head.

QUESTION 4.08 (2.00)

List the FOUR possible alternate actions that can be taken if during a response to abnormal power generation (ATWS) the turbine had not automatically tripped.

QUESTION 4.09 (1.00)

What plant condition determines when "ADVERSE" Containment conditions (brackets in EOP) are used in the Emergency Operating Procedures?

QUESTION 4.10 (1.50)

a. What is the Technical Specification Safety Limit for RCS pressure while in Mode 5? (0.5)

b. What are the required actions if this limit is violated? Only include actions required within 1 hour. (1.0)

QUESTION 4.11 (1.00)

Indicate the numerical value(s) associated with the following precautions.

a. Maximum differential pressure between RCS and S/G.

b. Maximum differential temperature between RCS loops.

c. Minimum RCS flowrate prior to and during RCS dilutions.

d. Maximum rate of power increase above 20% reactor power without management approval.

QUESTION 4.12 (1.00)

List the TWO actions required if the actual critical position is above the low-low insertion limit but differs from the estimated critical position by more than 50 steps, and less than the maximum rod withdrawal limit, according to GOP-APPENDIX A, Generic Operating Precautions.

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.13 (1.50)

The following questions concern the requirements associated with performing a reactor startup, according to GOP-3, Reactor Startup from Hot Standby to Startup procedure.

a. When must all Shutdown Bank rods fully withdrawn be verified?

b. How many licensed operators must be present in the Control Room? Be specific as to what licenses are required.

c. If the startup is delayed, when must the Estimated Critical Condition calculation be reviewed?

QUESTION 4.14 (1.50)

a. Indicate the Immediate Corrective Action(s) required, if while operating at 50% power, the following alarms occur simultaneously.

"RCP A #1 SL LKOFF FLO HI/LO" and "RCP A #1 SL dP LO"

b. How much time is allotted to take the above Immediate Corrective Action?

c. For how long may the RCP be operated with a #1 Seal Failure?

QUESTION 4.15 (1.50)

What THREE conditions would require that SI be reinitiated, according to EOP-1.2, Safety Injection Termination procedure? (1.5)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.16 (1.50)

Answer the following according to EOP-10.0, Malfunction of Rod Control System.

a. Other than verifying the reactor is not tripped for a dropped control rod condition with the plant at full power, what are the TWO remaining immediate operator actions? (1.0)

b. TRUE or FALSE?

When commencing recovery of the dropped rod an "URGENT FAILURE" alarm will occur due to the lift coils for the other rods in the group being disconnected. (0.5)

QUESTION 4.17 (1.50)

Answer the following according to VC Summer Radiation Protection Fundamentals (HP Handout).

a. What are the V.C.Summer Nuclear Station Administrative exposure limits for Whole Body, Skin, and extremities for occupational workers? (exclude fertile females) (1.0)

b. (Fill in the blank on your answer sheet)

Any time your dosimeter reads_____ mr or greater when entering the RCA it should be re-zeroed by HP. (0.5)

QUESTION 4.18 (1.50)

Caution III.1 of EOP 15.0 "Response to loss of Secondary Heat Sink" states: If S/G Wide Range levels in any 2 S/G is < 20% OR Pressurizer pressure is > 2335 psig then STOP ALL RCPs and immediately initiate bleed and feed per steps 7 through 14.
Why are the RCPs tripped prior to initiating bleed and feed, aside from the fact that heat input from the pumps will be removed?

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.19 (1.00)

Emergency Operating Procedure EOP-13, "Response to Abnormal Nuclear Power Generation", has the operator trip the turbine as one of the immediate actions. However, one of the major concerns in the ATWS transient response evaluations is the excessive RCS pressure developed due to significant heatup of the primary coolant. Since keeping the turbine on the line would mitigate this temperature rise, why is the turbine tripped?

QUESTION 4.20 (1.00)

With the exception of electrical personnel acting in the capacity of a red tag, what are the TWO required qualifications of the individual responsible for second verification of danger tag placement?

QUESTION 4.21 (1.00)

What, AS A MINIMUM, should the temporary or unexpected relief turnover include?

(***** END OF CATEGORY 4 *****)
(********** END OF EXAMINATION **********)

EQUATION SHEET

$f = ma$

$w = mg$

$E = mC^2$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$W = v\Delta P$

$\Delta E = 931\Delta m$

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

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

$Pwr = W_f \dot{m}$

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

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

$SUR = 26.06/T$

$T = 1.44\ DT$

$SUR = 26\left(\frac{\lambda_{eff}\rho}{\bar{\beta} - \rho}\right)$

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

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

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

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

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

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

$\Sigma = N\sigma$

$v = s/t$

$s = v_o t + \frac{1}{2}at^2$

$a = (v_f - v_o)/t$

$v_f = v_o + at$

$\omega = \theta/t$

Cycle efficiency $= \dfrac{\text{Net Work (out)}}{\text{Energy (in)}}$

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

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

$t_{1/2}(eff) = \dfrac{(t_{1/2})(t_b)}{(t_{1/2} + t_b)}$

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

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

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

$TVL = 1.3/\mu$

$HVL = 0.693/\mu$

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

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

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

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

$M = (1 - K_{eff})_0/(1 - K_{eff})_1$

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

$\ell^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^2 = I_2 d_2^2$

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

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

WATER PARAMETERS

1 gal. = 8.345 lbm

1 gal. = 3.78 liters

1 ft^3 = 7.48 gal.

Density = 62.4 lbm/ft^3

Density = 1 gm/cm^3

Heat of vaporization = 970 Btu/lbm

Heat of fusion = 144 Btu/lbm

1 Atm = 14.7 psi = 29.9 in. Hg

1 ft. H_2O = 0.4333 lbf/in^2

MISCELLANEOUS CONVERSIONS

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^3 BTU/hr

1 Mw = 3.41×10^6 Btu/hr

1 Btu = 778 ft-lbf

1 inch = 2.54 cm

$^oF = 9/5\,^oC + 32$

$^oC = 5/9\,(^oF - 32)$

ANSWER 1.01 (1.00)

a.

REFERENCE

VCS RT-11, p 12-15. EO-5,10

KAI 3.1
192004K106 ..(KA's)

ANSWER 1.02 (1.00)

d.

REFERENCE

VCS RT-12, p 11-23. EO-3

KAI 3.1
192006K105 ..(KA's)

ANSWER 1.03 (1.00)

a.

REFERENCE

VCS RT-10, p 17-20. EO-15

KAI 3.2
192003K106 ..(KA's)

ANSWER 1.04 (1.00)

b.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

REFERENCE

VCS TS, p B 3/4 1-1; RT-15. EO-3,5

KAI 3.8
192002K114 ..(KA's)

ANSWER 1.05 (1.00)

d.

REFERENCE

VCS RT-11. p 24,25. EO-19

KAI 3.1
192008K114 ..(KA's)

ANSWER 1.06 (1.50)

a. Increasing.

b. Decreasing.

c. Increasing. [0.5 each] (1.5)

REFERENCE

VCS RT-12, p 20-24. EO-4,5

KAI 3.4,3.4
192006K106 192006K107 ..(KA's)

ANSWER 1.07 (2.00)

a. SDM is increased. [0.5]

b. [any 5, 0.3 each]

-RCS avg temp
-Fuel burnup
-Xenon concentration
-Samarium
-Power defect
-Power level

REFERENCE

VCS RT-15, p 7-10. EO-6,7

KAI 3.8
192002K114 ..(KA's)

ANSWER 1.08 (1.00)

c

REFERENCE

VCS RT-8, p 21-26. EO-10
VCS, SOP-403, Rod Control and Position Indicating System, p 14.

KAI 3.8,2.9
192008K106 192002K114 ..(KA's)

ANSWER 1.09 (1.00)

b

REFERENCE

VCS RT 17, p 11. EO-2
Westinghouse Reactor Physics, Sect. 3, Neutron Kinetics and Sect. 5, Core Physics

KAI 3.3
001010K505 ..(KA's)

ANSWER 1.10 (1.50)

1. a
2. b
3. a [0.5 each]

REFERENCE

VCS RT-11, p 12-20. EO-5,7,8
Westinghouse Nuclear Training Operations, pp. I-5.6 - 16

KAI 3.1
192004K106 ..(KA's)

ANSWER 1.11 (2.00)

a. 3

b. 4 [1.0 each]

REFERENCE

VCS RT-8, p 15-17. EO-6,7
SHNP, RT-HO-1.6.

KAI 3.8
192008K104 ..(KA's)

ANSWER 1.12 (1.50)

1. c (same)

2. a (ACP higher)

3. b (ACP lower) [0.5 each]

REFERENCE

VCS RT-15. EO-4,7
Cook Theory, Pp. I-36-45.
SHNP, RT-HO-1.14.

KAI 3.6
001010A207 001010K207 ..(KA's)

ANSWER 1.13 (1.00)

c

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

REFERENCE

VCS, RT-10, P 11.
RT-6, LO 13, 16, 21, 26, 29.
KAI 3.3
192008K110 192006K116 192002K114 ..(KA's)

ANSWER 1.14 (1.00)

b

REFERENCE

VCS RT-11, p 24-26. EO-17
Westinghouse Reactor Physics, pp. I-5.26 & 27
SHNPP RT-LP-1.10, p 13-15.

KAI 3.8, 2.9
192004K113 192002K114 ..(KA's)

ANSWER 1.15 (1.00)

1. To insure minimum shutdown margin is maintained.

2. Minimize the reactivity consequences of an ejected rod. or potential effects of rod misalignment on associated accident analysis are limited

3. Maintain acceptable axial flux distribution. (Power distribution limits)
[any 2, 0.5 each]

REFERENCE

VCS RT-14, p 20.; TS p 3/4 1-3. EO-10

KAI 3.4
192005K115 ..(KA's)

ANSWER 1.16 (1.00)

a. Increase

b. Decrease [0.5 each]

REFERENCE

GP HTFF p.328 NEO

KAI 2.9
193006K105 ..(KA's)

ANSWER 1.17 (1.00)

a. FALSE
b. TRUE [0.5 each]

REFERENCE

GP HT&FF, p 155,320 and Subcooled Liquid Density Tables. NEO

KAI 2.5,2.4
193004K111 193005K103 ..(KA's)

ANSWER 1.18 (1.50)

1. DNBR decreases
2. DNBR decreases
3. DNBR increases [0.5 each]

REFERENCE

GP HTFF p 243-259. NEO

KAI 3.4
193008K105 ..(KA's)

ANSWER 1.19 (2.50)

a. From tne C-E Stm Tables,

Tsat for 2200 psia= 649.5 F
SCM= Tsat-Th= 649.5-580= 69.5 F (+/-1 F) [0.5 ea] (1.0)

b. decrease [0.25]
Th increases as unit delta T increases with power [0.5] (0.75)

c. 1 [0.25]
Core delta T during natural circulation cooldown will approach full load delta T. Thot is greater than in the other 2 cases. [0.5] (0.75)

REFERENCE

GP HTFF p 356; Steam Tables NEO

KAI 3.6
193008K115 ..(KA's)

ANSWER 1.20 (1.50)

a. Saturated.

b. Superheated.

c. Superheated.

REFERENCE

Steam Tables, Mollier diagram NEO
GP HTFF p 83,94.

KAI 2.8
193004K115 ..(KA's)

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

ANSWER 1.21 (2.00)

a. INCREASE
b. INCREASE
c. DECREASE
d. DECREASE [0.5 each]

REFERENCE

GP HTFF Section 3 Part B sections 2&3. NEO

KAI 3.3
003000K501 ..(KA's)

ANSWER 1.22 (1.00)

In the secondary system there is a phase change [0.5]. A phase change requires a large delta h. With the larger delta h of the secondary, the same heat can be transferred with a lower flow rate [0.5].

REFERENCE

GP HTFF, Section 3.2 NEO

KAI 2.8
193008K101 ..(KA's)

ANSWER 1.23 (1.00)

1. Density difference (or DELTA T) created by heat addition by the heat source and heat removal by the heat sink. (0.5)

2. The heat sink must be elevated physically above the heat source. (0.5)

REFERENCE

VCS, TH SCI, TS-14, P 27, LO 5.
KAI 3.?.
193008K121 006020K304 ..(KA's)

(***** END OF CATEGORY 1 *****)

ANSWER 2.01 (1.50)

Safety Injection Signal [0.3] AND [0.3] 2/4 [0.3]
RWST level [0.3] less than 18% [0.3] (1.5)

REFERENCE

VCS, AB-7, RHR System, p 16. EO-1.3.1

KAI 4.2
006020K304 005000K402 ..(KA's)

ANSWER 2.02 (2.00)

a. 1. NaOH isolation valves (open)
   2. Spray discharge isolation valves (open)
b. 1. RWST suction valves (open)
   2. Spray pumps (start) [0.5 each]

REFERENCE

VCS, AB-8, RB Spray System, p 15. EO-1.1.4,1.2

KAI 4.2
026000K101 ..(KA's)

ANSWER 2.03 (1.50)

a. 6
b. every 2 days
c. To reduce the site boundary dose that would occur if a single tank ruptured. [0.5 each]

REFERENCE

VCS, AB-12, Waste Gas System, p 16. EO-1.4

KAI 2.5
071000G007 071000K007 ..(KA's)

ANSWER 2.04 (1.50)

(Any 3 at 0.5 pts. each)
a. Rx Vessel Head Vent
b. Main Feedwater
c. Emergency Feedwater
d. Pressurizer Safety Valves

REFERENCE

VCS, IC-14, Acoustic Leak Monitoring, p. 21 and Operation & Maintenance Manual for TEC Model 1414-7-(4) EO-1.2

KAI 3.8
002000K405 ..(KA's)

ANSWER 2.05 (1.00)

b

REFERENCE

VCS, GS-4, Fuel Handling System, p.4 EO-1.2

KAI 2.4
033000K101 ..(KA's)

ANSWER 2.06 (1.00)

d

REFERENCE

VCS, AB-4, Reactor Coolant Pump, Figure AB4.9 EO-1.3

KAI 3.3
003000K103 ..(KA's)

ANSWER 2.07 (2.00)

a. 1. RWST-to-RHR suction valve closed (MVG-8809) (0.33)
   2. RHRS-to-CVCS isolation valve closed (MVG-8706) (0.33)
   3. RCS pressure less than 425 psig (0.33)
b. RCS Pressure greater than 700 psig (0.5)
c. Discharge combined flow of all (three) charging pumps. (0.5)

REFERENCE

VCS, AB-7, RHR System, p 13 & 14 EO-1.1.3

KAI 3.0,3.2,3.2
005000K407 005000K402 005000K401 ..(KA's)

ANSWER 2.08 (2.00)

a. 1. RCP bearing oil coolers (upper and lower) (0.33)
   2. Excess L/D heat exchanger (0.33)
   3. RCDT heat exchanger .75 pts (0.33)
b. Thermal barrier isolation valve automatically closes ~~(0.5 pts.)~~
   when respective downstream flow exceeds 65 gpm ~~(0.5 pts.)~~ .25 pts (1.0)

REFERENCE

VCS, IB-2, CCW System, p 4 & 14. EO-1.1,1.3

KAI 3.3,3.0
003000K112 008000K102 008000K103 008000K301 ..(KA's)

ANSWER 2.09 (1.50)

a. 6
b. 3
c. 2 [0.5 each]

REFERENCE

VCS, AB-4, Reactor Coolant Pump, p 9, 12, & 13. EO-1.2,1.4

KAI 2.7
003000K602 ..(KA's)

ANSWER 2.10 (1.00)

[Any 2 at 0.5 each]
1. L/D Hx (tube side)
2. Seal Water Hx (tube side)
3. Letdown Reheat Hx (shell side)

REFERENCE

VCS, AB-3, CVCS, p 22. EO-1.1

KAI 3.1
004010K403 ..(KA's)

ANSWER 2.11 (1.50)

a. Condensate Storage Tank
b. Service Water System
c. Low suction pressure in Emergency Feep Pump header [0.5 each]

REFERENCE

VCS, IB-3, Emergency Feedwater System, p 9 & 10. EO-1.1

KAI 3.9
061000K401 ..(KA's)

ANSWER 2.12 (2.00)

a. RWST
Cask-loading area
Fuel transfer canal
SFP [any 3, 0.33 each]

b. 1. Minimum water shielding depth (9.5 ft. over fuel assemblies limiting the dose rate to 2.5 mr/hr) ~~[0.5]~~

2. To satisfy the Spent Fuel Shipping cask drop criteria (limit max velocity of a dropped SF cask to 44 ft/sec) ~~[0.5]~~

3. Sufficient water depth available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly.
[any 2, 0.5 each]

REFERENCE

VCS, GS-5, Spent Fuel Pool Cooling System, p 7-10 EO-1.4
TS, PG 3/4 9-2.

KAI 2.7,2.7
033000K404 033000K105 033000K401 ..(KA's)

ANSWER 2.13 (2.00)

a. 1. Service air isolates ~~[0.5]~~ .5625 pm at 90 psig ~~[0.25]~~ .1875 pm (IPV-8324)
2. Standby air compressor starts [0.5] at 70 psig [0.25] (if lead compressor breaker is closed)

b. Low S/G level [0.5] - also accept Low-Low S/G level trip

REFERENCE

VCS, AOP-220.1, p 1. NEO

KAI 3.2,3.4
078000K302 078000K402 ..(KA's)

ANSWER 2.14 (2.00)

a. Electrical [0.5] and Sudden Pressure faults [0.5]

b. Loss voltage
High transformer winding temp
High combustible gas w/in transformer
Low oil level
High N2 pressure
Low N2 pressure
High oil temp
Loss of power to the cooling fans [4 required, 0.25 each]

REFERENCE

VCS, GS-2, Safeguards Power, p 8. EO-1.1,1.3

KAI 2.6,3.1
062000G008 062000K401 ..(KA's)

ANSWER 2.15 (1.50)

Prevents excessive pressure surge damage to the CVCS regenerative heat exchanger. [0.5] The isolation valves will not open unless all three letdown orifice isolation valves are closed and will close only if all orifice valves are closed. (both letdown isolation valves must be open before orifice valves can be opened and orifice isolation valves will close if either letdown isolation valve closes). [1.0]

REFERENCE

VCS, AB-3, CVCS, p 9. EO-1.1

KAI 3.1
004010K403 ..(KA's)

ANSWER 2.16 (1.00)

c

REFERENCE

VCS, AB-3, CVCS, p 25. EO-1.2

KAI 3.3,3.5
062000K301 004000K202 ..(KA's)

ANSWER 2.17 (1.00)

Selected ~~All~~ fans would start/shift to low speed [0.5] and service water system booster pump starts automatically [0.5] ~~CAFE~~ (Industrial cooling water supply to RBCU's isolates)

REFERENCE

VCS, TS 3.6.2.3 and A/B-9~~7~~. NEO

KAI 2.9,3.1
022000K402 022000K301 ..(KA's)

ANSWER 2.18 (1.00)

Limits plant cooldown rate [0.5] if any one PORV sticks open. [0.5]

REFERENCE

VCS, TB-2, Main Steam System, P 16 and OS-8, Accident Analysis, P 28.
LO 1.1.
KAI 3.1.
035010K602 012000K502 ..(KA's)

ANSWER 2.19 (1.00)

a

REFERENCE

VCS, GS-2, SAFEGUARDS POWER SYSTEMS P 36, LO 1.3, 1.4.
KAI 3.1.
064000K410 015000K102 ..(KA's)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

ANSWER 2.20 (1.00)

To limit the rate of S/G blowdown during a main steam line break.

REFERENCE

VCS, TBS, TB-1, P 16, LO 1.1.1.
KAI 2.9.
039000G007 016000K403 ..(KA's)

ANSWER 2.21 (1.00)

a or c

REFERENCE

VCS, I&C, IC-9, P 44,59, LO 1.1.2.
TBS, TB-5, P 87, LO 1.2.1, 1.4.
KAI 3.4.
045010K423 016000K108 ..(KA's)

(***** END OF CATEGORY 2 *****)

ANSWER 3.01 (2.00)

a. DECREASE
b. REMAIN THE SAME
c. REMAIN THE SAME
d. REMAIN THE SAME [0.5 each]

REFERENCE

VCS, IC-9, Reactor Protection and Logic, p 47,48. EO-1.4

KAI 2.9
012000K611 016000K201 ..(KA's)

ANSWER 3.02 (1.00)

c

REFERENCE

VCS, GS-2, Safeguards Power System, p 27 & 28. EO-1.1

KAI 3.4
015000K102 006030K406 ..(KA's)

ANSWER 3.03 (1.00)

ANY FIVE AT 0.2 POINTS EACH
1. PVC-444B (PORV)
2. High Pressure Alarm
3. B/U Heater Control
4. Low Pressure Alarm
5. Proportional Heater Control
6. PCV-444 C (D) (Spray)

REFERENCE

VCS, IC-3, Pzr Pressure and Level Control System, Figure IC3.8 EO-1.2

KAI 2.8,3.8
010000K403 016000K403 012000K401 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.04 (1.00)

Low auctioneered wide range Th or Tc less than ~~325~~ 300 degrees AND any RHR Suction Valve not fully open.

REFERENCE

VCS, IC-3, Pzr Pressure and Level Control System, p 33. EO-1.3,1.4

KAI 3.4
016000K108 016000K302 ..(KA's)

ANSWER 3.05 (1.50)

B/U heaters come on (0.1) and charging flow reduced to minimum (0.1). Level decreases (0.1). At 17% (0.1) level, letdown isolates (0.1), heaters turn off (0.1), and alarm (0.1). Level increases (0.1). High level alarm (0.1) at 70% (0.1). High level trip (0.4) at 92% (0.1).

REFERENCE

VCS, Control System Failure Analysis, p 7;IC-3 PZR Press & Lvl Control system, p 37-39. EO-1.4

KAI 3.4
011000A210 016000K201 ..(KA's)

ANSWER 3.06 (1.50)

a. 1. 60 second time delay (0.5)
   2. Rx Trip Bkrs open (P-4) (0.5)
b. Rx Trip Bkrs closed (P-4) (0.5)

REFERENCE

VCS, IC-9, RPS, p 52. EO-1.3,1.4

KAI 3.7
006030K406 039000K015 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.07 (1.00)

Shutting one sends a trip signal to the other. (Both cannot be shut at the same time.)

REFERENCE

VCS, IC-9, RPS, p 26. EO-1.4

KAI 3.7
012000K401 016000K403 ..(KA's)

ANSWER 3.08 (1.50)

[0.25 POINTS EACH]

	100% FLOW	0% FLOW
UPPER	65 (60-70)	100 (95-105)
NARROW	115 (110-120)	100 (95-105)
WIDE	100 (95-105)	30 (25-35)

REFERENCE

VCS, IC-13, RVLIS, Figure IC13.7 EO-1.2

KAI 3.5
002000K402 016000K303 ..(KA's)

ANSWER 3.09 (1.00)

b

REFERENCE

VCS, SOP-401, Reactor Protection and Control System, p 15. IC-9, EO-1.6

KAI 3.0
016000A201 001010K507 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.10 (1.50)

a. The condenser is not available for steam dump (2/2 condenser pressure and 1/3 Circ Water pump breakers closed).
b. At least one steam dump valve bank trip-open solenoid valve is energized.
c. Load rejection arming signal is present (25%/min). [0.5 each]

REFERENCE

VCS, IC-1, Steam Dumps, p 24,28&32. EO-1.3

KAI 2.8
041020G008 001010K410 ..(KA's)

ANSWER 3.11 (1.00)

a. HAVE NO EFFECT
b. ARM ONLY [0.5 each]

REFERENCE

VCS, Control System Failure Analysis, p 3&4; IC-1, SDS, EO-1.1,1.2

KAI 2.8
041020G007 012000K501 ..(KA's)

ANSWER 3.12 (1.00)

a. HIGH
b. LOW [0.5 each]

REFERENCE

VCS, Control System Failure Analysis, p 8&9; IC-9, EO-1.4

KAI 3.4,3.6
035000K401 035010A203 006000K107 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.13 (1.50)

a. Auctioneered High Tavg [0.25] and Tref (from Pimp) [0.25]
b. N-44 [0.25] and Pimp [0.25]
c. Reduce contribution of power error at high power (where reactor is more responsive). [0.5]

REFERENCE

VCS, IC-5, Rod Control, p 17&18. EO-1.1,1.2

KAI 3.2
001010K507 073000K401 ..(KA's)

ANSWER 3.14 (1.50)

SIX AT 0.25 POINTS EACH
1. IRM High Flux
2. PRM Overpower
3. OT Delta T
4. OP Delta T
5. Turbine Power < 15%
6. Bank D withdrawal limit (220 steps)

REFERENCE

VCS, IC-5, Rod Control, p 37. EO-1.4

KAI 3.2
001010K410 017000G011 017020K401 ..(KA's)

ANSWER 3.15 (1.50)

1. Tavg
2. Pzr Pressure
3. Delta Flux [0.5 each]

REFERENCE

VCS, IC-6, Temperature Indication System, p 20. EO-1.3

KAI 3.3
012000K501 014000G007 014000K403 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.16 (1.50)

a. Hi-Hi S/G Level (P-14) (2/3 on 1 S/G)
b. SI
c. P-4 in coincidence with Low Tavg (2/3) [0.5 each]

REFERENCE

VCS, IC-9, RPS, p 57. EO-1.4

KAI 2.9
006000K107 015000K407 ..(KA's)

ANSWER 3.17 (2.00)

a. Yes [0.2], Closes purge supply and exhaust isolation valves [0.3].

b. Yes [0.2], Closes surge tank vent valve [0.3].

c. Yes [0.2], Diverts flow to nuclear blowdown monitor tank [0.3].

d. Yes [0.2], Closes waste gas decay tank discharge valve [0.3].

REFERENCE

VCS, RMS, p 5,10,11,13,27. NEO

KAI 4.0
073000K401 015000G005 ..(KA's)

ANSWER 3.18 (3.00)

a. Wide range Tc
Wide range Th
Incore TC's
Narrow range PZR press.
Wide range RCS hot leg press. (PT-402A, -403A) [0.25 each] (1.25)

b. Green - margin to saturation greater than alarm or caution setpoints

Yellow - margin to saturation is between caution and alarm setpoints

Red - margin to saturation is less than the alarm setpoint
[0.25 each]

c. The margin to saturation status has changed since the last actuation of the "alarm acknowledge" pushbutton. [0.5] The sensor is disabled or out of range. [0.5]

REFERENCE

VCS, IC-12, CCM, p 4,5,10. EO-1.2,1.4

KAI 3.4,3.8
017000G011 017020K401 000024K302 000024K301 ..(KA's)

ANSWER 3.19 (2.50)

a. The rod position indication is reduced to one half its normal accuracy and/or data is supplied by either the data A or B cabinet. (1.0)

b. 1. DATA A AND DATA B failure (will also accept causes for data failures)
2. Combined rod height data greater than 38 (equivalent to 228 steps)
3. Greater than one bit difference between the data A and B gray codes.
[any 2, 0.5 each]

c. On the bottom. [0.5]

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

REFERENCE

VCS, IC-4, RPI, p 12,13. EO-1.2,1.4

KAI 3.2,2.8
014000G007 014000K403 000068K005 ..(KA's)

ANSWER 3.20 (1.50)

a. IR [0.2] to allow the operator sufficient time to actuate the SR reactor trip block [0.3]

b. PR [0.2] enables the single loop loss of flow reactor trip [0.3]

c. PR [0.2] provides the reactor trip/turbine trip interlock [0.3]

REFERENCE

VCS, IC-8, NIS, p 51. EO-4

KAI 3.7
015000K407 004000K014 ..(KA's)

(***** END OF CATEGORY 3 *****)

ANSWER 4.01 (2.50)

a. 2 [0.5]

b. Within 15 (or next 10) minutes [0.2] either
1. Restore the indicated AFD to within target band [0.4] or
2. Reduce power to <90% of rated thermal power [0.4].

c. Accumulated penalty over the past 24 hrs is 89 min [0.5]
The penalty will be reduced to 60 min at 1618 on 03/07/88
and then power may be increased [0.5]
(OR)

85%	0318-0310 =	8 [0.2]
65%	1637-1557 =	40 [0.2]
45%	0310-0148 = 82/2 =	41 [0.3]
		89 min total

03/07/88, from 1157; 81 min left - 60 = 21 min > 1618 03/07/88 [0.3]

REFERENCE

VCS TS, 3.2.1 NEO

KAI 3.3
015000G005 001050A305 ..(KA's)

ANSWER 4.02 (2.50)

a. 1. Failure of the reactor makeup control system (such that bypass is necessary to accomplish boration.

2. Uncontrolled cooldown NOT requiring SI

3. Any questionable shutdown margin. [0.5 each]

b. Open emerg. borate valve (MVT-8104) [0.75]
Verify flow (on FI-110) [0.25]

REFERENCE

VCS, EOP-11.0, p 1.

KAI 4.1,3.9
000024A117 000024K301 003000K005 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.03 (2.00)

To initiate corrective actions resulting from an emergency condition is the only reason allowed during Mode 1 [1.0]. In Mode 5 may also leave to verify receipt of annunciators [1.0]

REFERENCE

VCS, SAP-200, Conduct of Operations, p 12.

KAI 3.6
000068K005 000074K011 ..(KA's)

ANSWER 4.04 (1.00)

1. Reduce letdown to 45 gpm (0.5)
2. Control pzr level using (local) FCV-122 bypass valve (XVT-8403) (0.5)

REFERENCE

VCS, SOP-102, CVCS, p 37&38.

KAI 3.9
004000G014 000029K312 ..(KA's)

ANSWER 4.05 (1.50)

1. Stop any changes in reactivity
2. Place rod control system in MANUAL
3. Adjust Tavg by adjusting turbine load [0.5 each]

REFERENCE

VCS, SOP-403, Rod Control and Position Indicating System, p 14.

KAI 3.1
014000G014 194001A102 ..(KA's)

ANSWER 4.06 (1.00)

c

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

REFERENCE

VCS, EOP-1.0, p 10.

KA! 3.8
003000G015 010000K005 ..(KA's)

ANSWER 4.07 (1.00)

c

REFERENCE

VCS, EOP-18.2, p 5.

KAI 4.0
000074K311 194001K102 ..(KA's)

ANSWER 4.08 (2.00)

1. Manually trip turbine from MCB
2. Stop (and lock out) both EHC pumps
3. Runback the turbine
4. Close all MSIVs [0.5 each]

REFERENCE

VCS, EOP-13.0, p 2.

KAI 4.4
000029K312 006000K005 ..(KA's)

ANSWER 4.09 (1.00)

"HIGH-1" signal present

REFERENCE

VCS, EOP Lesson Plan, p 4.

KAI 4.1
194001A102 002000K005 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.10 (1.50)

a. 2735 psig (0.5)
b. Reduce pressure to within limit [0.4] within 5 min. [0.3] and notify the NRC [0.3]. (1.0)

REFERENCE

VCS, TS, p. 2-1

KAI 3.6
002000G005 001010A207 ..(KA's)

ANSWER 4.11 (1.00)

[0.25 POINTS EACH]
a. 1600 psid
b. 25 degrees F
c. 3000 gpm
d. 3%/hr

REFERENCE

VCS, GOP-Appendix A, GOP Precautions, p 2,3,&5.

KAI 3.6
002000K005 001000K005 ..(KA's)

ANSWER 4.12 (1.00)

1. Continue with S/U
2. Recalculate ECC (if no error found, notify RE) [0.5 each]

REFERENCE

VCS, GOP-APPENDIX A, p 5.

KAI 3.6
001010A207 003000A201 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.13 (1.50)

a. Within 15 minutes of commencing Control Bank rod withdrawal.
b. Two, one of whom is SRO licensed.
c. Within 4 hours prior to criticality. [0.5 each]

REFERENCE

VCS, GOP-3, p 8,9.

KAI 3.7
001000K005 013000K015 ..(KA's)

ANSWER 4.14 (1.50)

a. Close the RCP A seal leakoff valve (PVT-8141A). [0.5]

b. 5 min. [0.5]

c. 30 min. [0.5]

REFERENCE

VCS, SOP-101, Reactor Coolant System, p 51&52.

KAI 3.5
003000A201 000003K010 ..(KA's)

ANSWER 4.15 (1.50)

1. RCS pressure unstable or decreasing.

2. RCS subcooling (based on core exit TC's) <30-F.

3. PZR level cannot be maintained >4% [39%] [0.5 each]

REFERENCE

VCS EOP-1.2, p 4&5.

KAI 4.1
013000G015 194001K103 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.16 (1.50)

a. 1. Decrease turbine load to match Tavg with Tref (+/- 3 to 5-F)

2. Take manual control control of rods (rotate Rod Cntrl Sel switch to Man) [0.5 each]

b. True [0.5]

REFERENCE

VCS EOP-10.0, p 13&14.

KAI 3.9
000003K010 ..(KA's)

ANSWER 4.17 (1.50)

a. WB 1 rem per qtr [0.25] and 4 rem per year [0.25]
Skin 6 rem per qtr [0.25]
Ex 12 rem per qtr [0.25]

b. 250 (half scale) [0.5]

REFERENCE

VCS Radiation Fundamentals, p 9,10 17.

KAI 2.8
194001K103 ..(KA's)

ANSWER 4.18 (1.50)

The RCPs will keep 2 phase flow mixture (0.75) and the PORVs will not be able to release as much steam (energy). (0.75)

OR

Higher pressure will reduce SI flow (0.75) and increase the inventory flow out of the PORVs. (0.75)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

REFERENCE

VCS, EOP-15.0, P 1. (NO LO AVAIL)
Westinghouse B/G document, ERG-HP, FR-S/C/H, FR-H, P 55.
KAI 4.1
000074K308 ..(KA's)

ANSWER 4.19 (1.00)

The turbine is tripped so that the heat sink will be maintained as long as possible (0.5) on a total loss of feedwater ATWS (0.5).

REFERENCE

ERG-HP, Westinghouse Background Information, FR-S.1, P 75-77.
(NO LO AVAIL)
KAI 4.4
000029K312 ..(KA's)

ANSWER 4.20 (1.00)

1. Qualified Danger Tagger (0.5)
2. (Current) NRC License (0.5)

REFERENCE

VCS, SAP, SAP-201, DANGER TAGGING, P 5, (NO LO AVAILABLE)
KAI 3.7.
194001K102 ..(KA's)

ANSWER 4.21 (1.00)

1. A discussion of existing plant conditions and anticipated evolutions during the relief. (0.5)

2. A review of the main control board controls, instrumentation and annunciators. (0.5)

REFERENCE

VCS, SAP, SAP-200, P 7, (NO LO AVAILABLE)
KAI 2.5.
194001A103 ..(KA's)

(***** END OF CATEGORY 4 *****)
(********** END OF EXAMINATION **********)

SCE&G
A SCANA Company

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Dan A. Nauman
Vice President
Nuclear Operations

March 14, 1988

Mr. Bill Dean
License Examiner
U.S.Nuclear Regulatory Commission
Region II, Suite 2900
101 Marietta Street, N.W.
Atlanta, Georgia 30323

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
License No. NPF-12
Operator License Examinations

Dear Mr. Dean:

Enclosed are the utility comments to the NRC Operator and Senior Operator examinations administered at V.C. Summer on March 7, 1988. Your consideration is appreciated.

Very truly yours,

OSBradham for

D.A. Nauman

GAL:DAN
Enclosures

cc: (without attachment)
O. S. Bradham
M. B. Williams
A. R. Koon
NPCF

(with attachment)
K. W. Woodward
M. Morgan
R. Aiello
P. Isaksen (w/attachment-RO only)
File (814.04)

REACTOR OPERATOR

EXAM QUESTIONS

WITH

NRC RESOLUTION

QUESTION

1.15 List 3 purposes for the Rod Insertion Limits.

ANSWER KEY RESPONSE

1. Adequate SDM upon trip
2. To minimize the amount of positive reactivity inserted during an ejection accident, and
3. To minimize radial flux tilt (peaking)

REFERENCES

VCS, RT BK III, RT-14, P. 20

SUGGESTED CORRECT RESPONSE

Either the above answer, or

To ensure that:

1) Acceptable power distribution limits are maintained,
2) The minimum **SHUTDOWN MARGIN** is maintained, and
3) The potential effects of rod misalignment on associated accident analyses are limited.

REASON:

Although the answer key response lists the "standard" reasons for maintaining rods above the RIL, the alternate answer is found in V.C. Summer Plant Technical Specifications, page B 3/4 1-3 (attached) as the bases for control rod insertion limits.

NRC RESOLUTION:

Comment accepted answer key and references modified to include additional correct answer either accepted for full credit.

Question 1.15

BORATION SYSTEMS (Continued)

MARGIN from expected operating conditions of 1.77% delta k/k or as required by Figure 3.1-3 after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs from full power equilibrium xenon conditions and is satisfied by 12475 gallons of 7000 ppm borated water from the boric acid storage tanks or 64,040 gallons of 2300 ppm borated water from the refueling water storage tank.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The limitation for a maximum of one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all charging pumps except the required OPERABLE pump to be inoperable below 275°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The boron capability required below 200°F is sufficient to provide the required SHUTDOWN MARGIN of 1 percent delta k/k or as required by Figure 3.1-3 after xenon decay and cooldown from 200°F to 140°F. This condition is satisfied by either 2000 gallons of 7000 ppm borated water from the boric acid storage tanks or 9690 gallons of 2300 ppm borated water from the refueling water storage tank.

The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics.

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section ensure that (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential effects of rod misalignment on associated accident analyses. OPERABILITY of the control rod position indicators is required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits.

QUESTION:

2.08(b) Other then relief valves, what feature prevents overpressurization of the CC'' System if a thermal barrier heat exchanger tube ruptures? (Include setpoint, if applicable).

ANSWER KEY RESPONSE:

Thermal barrier isolation valve isolation automatically closed (0.5 points) when respective downstream flow exceeds 65 gpm (0.5 pts.). (1.0)

REFERENCE:

VCS, IB-2, CCW System, p 4 & 14

SUGGESTED RESPONSE:

As given above with 0.8 points for action and 0.2 points for setpoint.

REASON: Knowing that the CCW system is protected from RCS pressure upon thermal barrier failure by the closure of the isolation valve on high flow is far more important than knowing the associated setpoint. Only reactor trip, safety injection, permissive and control interlocks, steam and feedwater isolation signals, RB spray signal, and other SSPS setpoints should carry such high weighting. An 80%/20% split between action and setpoint is more amenable for a feature such as this.

NRC RESOLUTION:

Comment noted. It is also significant to know when an automatic feature should have or have not actuated. To be consistent with other sections of the exam the answer key will be modified to 0.75 for the protective feature and 0.25 for the setpoint.

QUESTION:

2.13 (a) Describe TWO automatic actions associated with the instrument air system which serve to mitigate a loss of air pressure. Include any associated setpoints.

ANSWER KEY RESPONSE

a. 1. Service air isolated (0.5) at 90 psig (0.25) (IPV-8324)
   2. Standby air compressor starts (0.5) at 70 psig (0.25) (if lead compressor breaker is closed).

REFERENCE:

VCS, AOP-220.1, p 1

SUGGESTED ADDITIONAL RESPONSE:

As given above with 0.6 for action and 0.15 for setpoint.

REASON: Knowing that service air isolates is far more significant than knowledge of the setpoint at which the action occurs. Only reactor trip, safety injection, permissive and control interlocks, steam and feedwater isolation signals, RB spray signal, and other SSPS setpoints should carry such high weighting. An 80%/20% split between action and setpoint is more amenable for a feature of this nature.

NRC RESOLUTION:

Comment noted. It is also significant to know when an automatic feature should have or have not performed its protective action. No change to answer key.

QUESTION:

2.17 What automatic action(s) should occur to the Reactor Building Cooling Units upon receipt of an SIAS signal? Assume an initial normal at power lineup.

ANSWER KEY RESPONSE

All fans would start/shift to low speed (0.5) and service water system booster pump starts automatically (0.5)

REFERENCES:

VCS, TS 3.6.2.3 and AB 9

SUGGESTED RESPONSE:

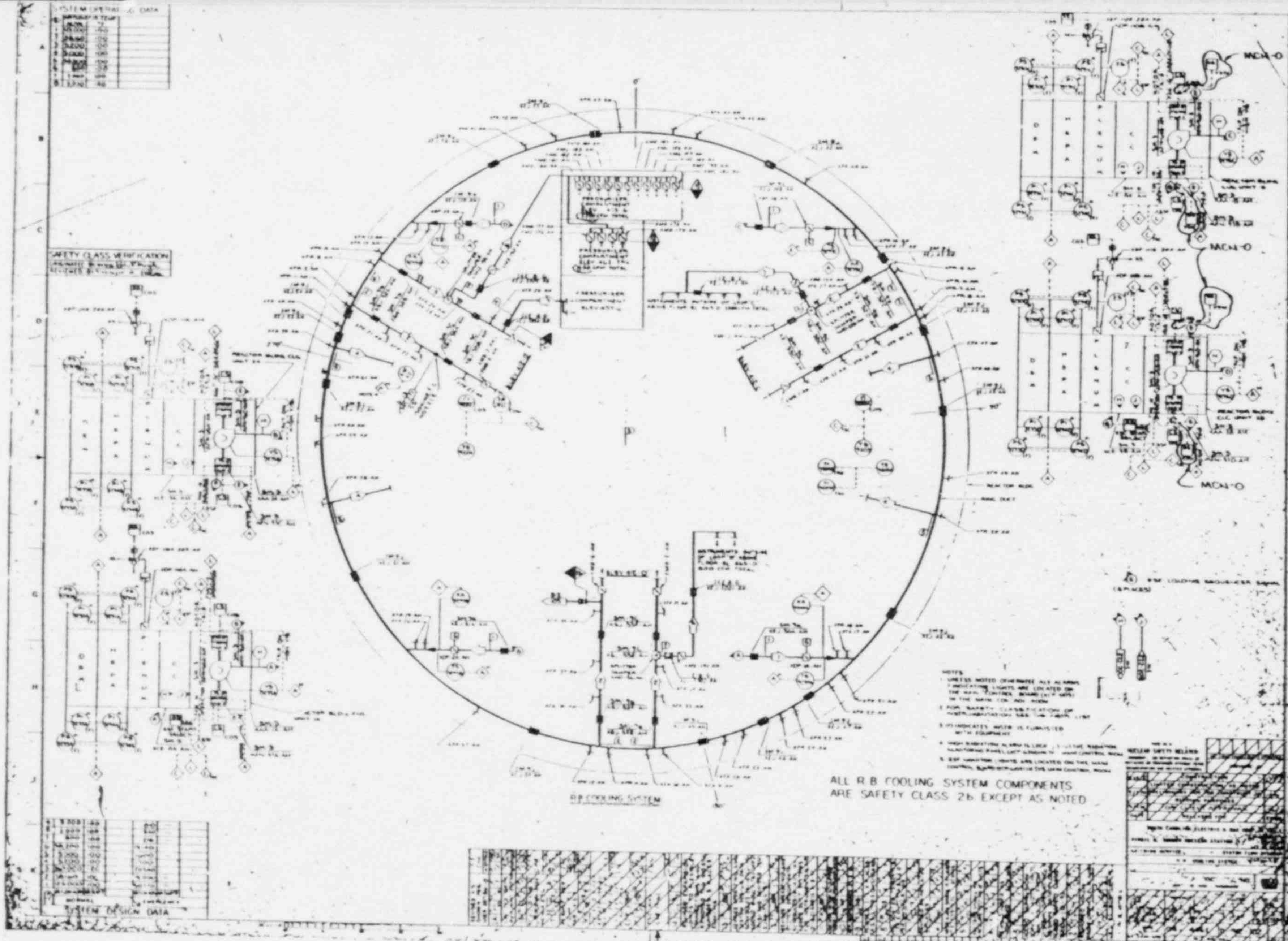
Selected fans (1 in each train) would start/shift to low speed (0.5) and service water system booster pumps start automatically (0.5) (Industrial cooling water supply to RBCU's isolates).

REASON: Main control board selector switches allow the operator to choose one fan in Train A and one in Train B for the RBCU's. Only these fans will shift to slow speed upon a safety injection signal. See attached drawing showing selector switches for each train.

NRC RESOLUTION:

Comment accepted. This was a CAF (Check at Facility) since information was not supplied to prepare the examination. Answer key modified as suggested.

Question 2.17



Note: SS is selector switch

QUESTION:

2.21 Which statement regarding the Main Generator Protection System is **NOT CORRECT.**

a) Opening the generator output breakers **ALWAYS** results in a turbine trip when the generator is loaded.

b) Once the generator is loaded, a turbine trip **ALWAYS** results in a generator trip.

c) A turbine trip above the protection interlock P-7 (10% power) **ALWAYS** results in a reactor trip.

d) A reactor trip **ALWAYS** results in a turbine trip.

ANSWER KEY RESPONSE:

a) Opening the generator output breakers **ALWAYS** results in a turbine trip when the generator is loaded.

REFERENCE:

VCS, IC-9, P. 44, 59 ; TB-5, P. 87

SUGGESTED ADDITIONAL RESPONSE:

(c) A turbine trip above the protection interlock P-7 (10% power) **ALWAYS** results in a reactor trip.

REASON: While choice (a) is certainly a correct answer to the question, choice (c) is also correct. The question asked which choice is **NOT TRUE**. At V.C. Summer, a turbine trip above P-7 will **not** always result in a reactor trip. At one time this was the case. However, now, the **P-9 interlock** (>50% power) enables the reactor trip upon turbine trip. This is documented by the attached references, IC-8, Nuclear Instrumentation, p. 29, and IC-9, Reactor Protection and Logic, p. 45.

NRC RESOLUTION:

Comment accepted answer key modified to accept a or c.

more of the four power range channels exceed the trip setpoint, the bistable will cause a reactor trip and actuate the reactor trip first-out annunciator "PR FLUX HI SETPT HI" on CBP 10. This trip function cannot be blocked.

- o P-8 permissive circuit. When the outputs of two of four power range channels exceed the P-8 setpoint (38 percent power), a loss of flow, as sensed by two of three flow transmitters in any one loop, will cause a reactor trip. Between readings of 38 percent power (P-8) and 10 percent power (P-7), flow must be lost in at least two loops to cause a reactor trip. Below P-7 there are no loss of flow trips. As each power range channel exceeds 38 percent power, the respective "CHAN I (II, III, IV) P8" light on the reactor permissives panel energizes. When two of four channels exceed 38 percent power, the "P8" light on the reactor permissives panel on CBP 9 energizes.

- o P-10 permissive circuit. This permissive is automatically enabled when two of four power range channels exceed 10 percent. Actuation of P-10 allows the manual blocking of the power range low setpoint trip, the intermediate range trip, and the intermediate range rod stop. It also blocks the source range trip and provides a portion of the P-7 signal. As each power range channel exceeds 10 percent power, the respective "CHAN I (II, III, IV) P10" light on the reactor permissives panel energizes. When two of four channels exceed 10 percent power, the "P10" light on the reactor permissives panel on CBP 9 energizes. The "P7" light also energizes because its logic is satisfied when either P-10 or P-13 (1/2 turbine impulse pressure greater than 10 percent) is satisfied.

- o P-9 permissive circuit. As reactor power exceeds 50% indication for two of the four power range channels, a turbine trip will activate a reactor trip. At power levels less than 50% (3/4), the reactor trip resulting from a turbine trip will be blocked.

The differential amplifier provides an output signal proportional to the rate of change of reactor power to two separate bistables.

The first bistable will trip when a sudden increase in neutron flux occurs (+5 percent of full power within 2 seconds). When this bistable trips, it will actuate "CHAN I (II, III, IV) PR FLUX RATE HI" on the reactor bistable

A separate permissive, P-8, will automatically block the trip that occurs when flow is lost in one loop. This occurs when three of four power range channels are below the setpoint of 38 percent. Again, the reacto s adequately protected below the setpoint without the trip. If allowed in the future, it would be possible to continue limited power operation with an inoperable loop. The AND gate of the P-8 permissive logic denoted with a 2 of 4 coincidence actually energizes above the P-8 setpoint and the NOT gate will extinguish the permissive status light. To deenergize the AND bistable, 3 of 4 power range channels must be below the P-8 setpoint. The P-8 permissive status light energizes and the zero input to the AND gate of the low flow logic blocks a reactor trip from a loss of flow in one loop. P-7 works in a similar manner. P-9 will prevent the reactor trip that normally results from a turbine trip. The setpoint for this additional permissive is 50% power with a coincidence of 2 out of 4 power range channels.

Rod Stops (Sh. 4 and Sh. 9)

The C-1 high neutron flux rod stop will block both automatic and manual rod withdrawal. This occurs if the operator does not block the rod stop prior to either a normal or an unexpected power increase. Any out motion is then stopped if one of two intermediate range channels exceeds an amperage output that is equivalent to 20 percent of rated thermal power ($\approx 10^{-5}$ amps). This rod stop is manually blocked at the same time the operator blocks the intermediate range high flux reactor trip. In fact, the same switches that are used to block the trips are also used to prevent the rod stop. Again, attempts to block the C-1 function prior to 2 of 4 power range channels exceeding P-10 will be unsuccessful. The rod stop is automatically reinstated when 3 of 4 power range channels fall below 10 percent.

The C-2 overpower rod stop also blocks automatic and manual control rod withdrawal. The block action occurs when one of four power range channels rises above 103 percent power. This is the only function associated with the Reactor Protection System that actuates on a 1 of 4 coincidence. Because of this, special switches called Rod Stop Bypass Switches are provided on the flux deviation, miscellaneous control and indication drawer of NIS. These switches allow continued normal rod withdrawal if a power range channel should fail high or if a channel should require testing.

QUESTION

3.04 What plant conditions will cause the Cold Overpressure Protection System (COPS) alarm to actuate?

ANSWER KEY RESPONSE

Low auctioneered wide range T or T less than 350°F **AND** any RHR Suction valve not fully open

REFERENCE

VCS, IC-3, PZR PRESSURE AND LEVEL CONTROL SYSTEM, p. 33

SUGGESTED CORRECT RESPONSE

Any wide range T or T <u>less than 300°F</u> **AND** any RHR Suction valve not fully open.

REASON

Annunciator Response Procedure, ARP-001 XCP-610 (attached) clearly specifies the conditions which cause actuation of the alarm. This is backed up by Technical Specification 3.4.9.3 (attached), which is the basis for the alarm.

NRC RESOLUTION:

The answer key response was 325°F (not 350°F) and will be modified to 300°F and "Low Auctioneered" will be placed in parenthesis.

PANEL XCP-0610 (NSSS)

ANNUNCIATOR POINT 2-4

RCS TEMP LO AND RHR SUCT VLVS NOT OPN

SETPOINT:

RCS temp <300°F and any RHR suction valve not fully open

ORIGIN

TY/410J
TY/413K
33X-RH04
33X-RH06

PROBABLE CAUSE:

1. Failed low temperature instrument.
2. RHR suction valve (8701A, 8701B, 8702A, 8702B) not fully open.

AUTOMATIC ACTIONS

None

IMMEDIATE ACTIONS:

1. Verify RCS temperature < 300°F as read on ITI-410 and ITI-413.
2. Verify RHR suction valves 8701A, 8701B, 8702A, and 8702B fully open.

SUPPLEMENTAL ACTION:

1. Ensure at least one train Cold Overpressure Protection being provided by an onservice RHR suction relief valve.
2. Refer to Technical Specification 3.4.9.3.

REFERENCES:

1. GAI DWG. B-208-082, sh. 73
2. GAI DWG. B-208-084, RH-03
3. GAI DWG. B-208-084, RH-04
4. GAI DWG. B-208-084, RH-05
5. GAI DWG. B-208-084, RH-06
6. V.C. Summer Technical Specifications
7. SOP-115

REACTOR COOLANT SYSTEM

OVERPRESSURE PROTECTION SYSTEMS

LIMITING CONDITION FOR OPERATION

3.4.9.3 At least one of the following overpressure protection systems shall be OPERABLE:

a. Two RHR relief valves with:

1. A lift setting of less than or equal to 450 psig, and

2. The associated RHR relief valve isolation valves open; or

b. The Reactor Coolant System (RCS) depressurized with an RCS vent of greater than or equal to 2.7 square inches.

APPLICABILITY:

MODE 4 when the temperature of any RCS cold leg is less than or equal to 300°F, MODE 5, and MODE 6 with the reactor vessel head on.

ACTION:

a. With one RHR relief valve inoperable, restore the inoperable valve to OPERABLE status within 7 days or depressurize and vent the RCS through a greater than or equal to 2.7 square inch vent within the next 8 hours.

b. With both RHR relief valves inoperable, within 8 hours either:

1. Restore at least one RHR relief valve to OPERABLE status, or

2. Depressurize and vent the RCS through a greater than or equal to 2.7 square inch vent.

c. In the event an RHR relief valve or RCS vent is used to mitigate an RCS pressure transient, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 30 days. The report shall describe the circumstances initiating the transient, the effect of the RHR relief valves or vent on the transient and any corrective action necessary to prevent recurrence.

d. The provisions of Specification 3.0.4 are not applicable.

QUESTION:

3.06(b) After resetting safety injection, automatic actuation is inhibited until what signal is cleared? (0.5)

ANSWER KEY RESPONSE:

b. Rx Trip Bkrs closed (P-4)

REFERENCES:

VCS, IC-9, RPS, p 52. EOP-1.2, 1.4

SUGGESTED RESPONSE:

b. P-4 must be cleared. (It is cleared by closing the reactor trip breakers).

REASON: The intent of the answer key appears to be correct. The question asked only "what signal must be cleared". However, to provide clarification, a logic drawing is attached showing that the P-4 signal must be removed in order to enable a subsequent auto SI signal. The P-4 signal is cleared by closing the reactor trip breakers.

NRC RESOLUTION:

Comment noted. Either response will be given full credit since the action to clear P-4 is to close the reactor trip breakers. No change to the answer key is required.

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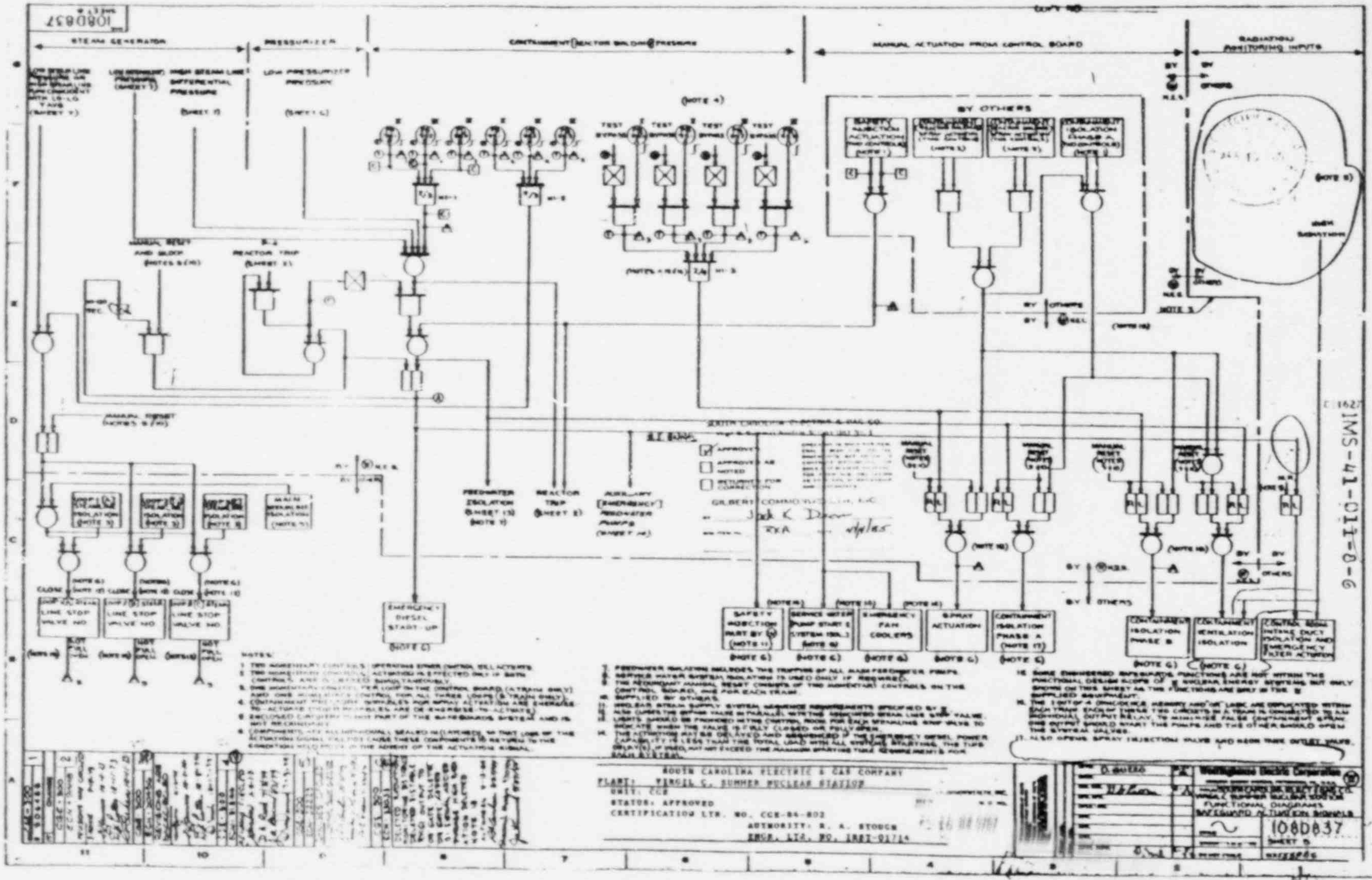

South Carolina Electric & Gas Co.
NUCLEAR OPERATIONS DEPT.
ONLY

Question 3.06(b)

QUESTION

3.18 a. What are the FIVE inputs to the CCM? Be specific.

ANSWER KEY RESPONSE

Wide range Tc
Wide range Th
Incore TC's
Narrow range PZR press.
Wide range RCS hot leg press. (0.25 each)

REFERENCES

VCS, IC-12, CCM, p 4,5,10. EOP-1.2, 1.4

SUGGESTED CORRECT RESPONSE

Wide range Tc
Wide range Th
Incore TC's
Narrow range PZR press.
Wide range RCS press. (0.25 each)

REASON

The only wide range pressure transmitters on the RCS (PT-402A, PT-403A) are located on the Loop A and C RCS hot legs (see attached drawings). Therefore, requiring the words "hot leg" in conjunction with the wide range pressure instruments is both redundant and unnecessary.

NRC RESOLUTION:

Comment noted. The reference uses the terms wide range and hot log pressure in several places. The answer key will be modified to place "hot leg" in parenthesis and include PT-402A, -403A in parenthesis and wide range RCS pressure will be accepted for full credit.

QUESTION:

4.17 a. What are the V.C. Summer Nuclear Station Administrative exposure limits for Whole Body, Skin, and extremities for occupational workers? (exclude fertile females)

ANSWER KEY RESPONSE

a. WB 1 rem per qtr (0.25) and 4 rem per year (0.25)
Skin 6 rem per qtr (0.25)
Ex 12 rem per qtr (0.25)

REFERENCES:

VCS Radiation Fundamentals, p. 9,10 17

SUGGESTED CORRECT RESPONSE:

WB 1 rem per qtr. (0.33)
Skin 6 rem per qtr. (0.33)
Ex 12 rem per qtr. (0.33)

REASON: Plant limits are expressed in terms of maximum quarterly exposure. Requiring 4 rem per year as well as 1 rem per qtr. is redundant. Neither the skin or extremities limits were extrapolated to yearly values. Quarterly limits are more restrictive and should be all that is required. Deletion of this item and reassignment of points to one-third point for each limit is requested.

NRC RESOLUTION:

Comment not accepted. The reference specifically addresses both quarterly and whole body limits and no additional supportive reference material supplied with these utility comments justifies any change to the answer key.

Additional changes made to answer key:

2.12b Also accepted TS basis for water level concerning removal of 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly and reference added.

2.13b Clarified answer to accept Low-Low S/G level trip in addition to low S/G level.

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

FACILITY: SUMMER

REACTOR TYPE: PWR-WEC3

DATE ADMINISTERED: 88/03/07

EXAMINER: AIELLO, R F

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 que·····. The passing grade requires at least 70% in each category and a final ·rade of at least 80%. Examination papers will be picked up six (6) h··urs after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
26.5 X ~~27.50~~	22.6 ~~22.96~~	________	________	5.	THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
31.0 X ~~30.75~~	26.4 ~~25.69~~	________	________	6.	PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
30.25 X ~~31.75~~	25.7 ~~26.51~~	________	________	7.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
29.75	25.3 X ~~24.84~~	________	________	8.	ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
117.5 X ~~119.75~~		________ Final Grade	________%		Totals

X RA 04/13/88

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

____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.
2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.
3. Use black ink or dark pencil <u>only</u> to facilitate legible reproductions.
4. Print your name in the blank provided on the cover sheet of the examination.
5. Fill in the date on the cover sheet of the examination (if necessary).
6. Use only the paper provided for answers.
7. Print your name in the upper right-hand corner of the first page of <u>each</u> section of the answer sheet.
8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a <u>new</u> page, write <u>only on one side</u> of the paper, and write "Last Page" on the last answer sheet.
9. Number each answer as to category and number, for example, 1.4, 6.3.
10. Skip at least <u>three</u> lines between each answer.
11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.
12. Use abbreviations only if they are commonly used in facility <u>literature</u>.
13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.
14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.
15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.
16. If parts of the examination are not clear as to intent, ask questions of the <u>examiner</u> only.
17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

10. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

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

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

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

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

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

QUESTION 5.01 (1.00)

Given: 3 reactor coolant (RCP) pumps operating in parallel, each with a flow rate "m" and a combined flow rate "M". Which one of the following best describes the system response to securing one RCP?

a. The resulting core flow (M) will decrease as individual operating RCP flows (m) decrease.

b. The resulting core flow (M) will increase along with individual operating RCP flows (m).

c. The resulting core flow (M) will decrease as individual operating RCP flows (m) increase.

d. The resulting core flow (M) will not change due to decrease in RCP back pressure.

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

QUESTION 5.02 (1.00)

Which one of the following statements BEST describes Xenon behavior, over the first few hours, on a power decrease following 100 hours at 100% power?
NOTE: [Xe] denotes xenon concentration

a. Direct [Xe] increases, indirect [Xe] decreases, total [Xe] decreases.

b. Direct [Xe] increases, indirect [Xe] increases, total [Xe] increases.

c. Direct [Xe] decreases, indirect [Xe] decreases, total [Xe] decreases.

d. Direct [Xe] decreases, indirect [Xe] increases, total [Xe] increases.

e. Direct [Xe] decreases, indirect [Xe] increases, total [Xe] decreases.

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

QUESTION 5.03 (1.00)

Which ONE of the following expresses the relationship between differential rod worth (DRW) and integral rod worth (IRW)?

a. DRW is the slope of the IRW curve at that location.

b. DRW is the area under the IRW curve at that location.

c. DRW is the square root of the IRW at that location.

d. There is no relationship between DRW and IRW.

QUESTION 5.04 (1.00)

The reactor trips from full power, equilibrium xenon conditions. Six hours later the reactor is brought critical at 10E-8 amps on the intermediate range. If power level is maintained at 10E-8 amps, which ONE of the following statements, concerning rod motion requirements for the next two hours, is correct?

a. Rods will have to be withdrawn since xenon will closely follow its normal build-in rate following a trip.

b. Rods will have to be inserted since xenon will closely follow its normal decay rate following a trip.

c. Rods will have to be rapidly inserted since the critical reactor will cause a high rate of burnout.

d. Rods will have to be rapidly withdrawn since the critical reactor will cause a higher than normal rate of build-in.

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

QUESTION 5.05 (1.00)

Which ONE of the following correctly describes the observed reactor response for the same small addition of reactivity, one positive and one negative?

a. The response will be faster for the negative addition at all times in core life.

b. The response will be faster for the negative addition at BOL but faster for the positive addition at EOL.

c. The response will be faster for the positive addition at all times in core life.

d. The response will be faster for the positive addition at BOL but faster for the negative addition at EOL.

e. The response will be the same for both the positive and negative addition.

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

QUESTION 5.06 (1.00)

Indicate whether each of the following will make the moderator temperature coefficient LESS NEGATIVE, MORE NEGATIVE, or have NO EFFECT.

a. INCREASE moderator temperature

b. DECREASE boron concentration

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

QUESTION 5.07 ~~(1.50)~~ 1.0 RFA 03/24/88

State the change (INCREASES , DECREASES or REMAIN THE SAME) in the magnitude of the fuel temperature coefficient (FTC) for each of the following:

A. An increase in power.

~~B. Aging of the core.~~ DELETED RFA 03/24/88

C. A decrease in magnitude of the moderator temperature coefficient (MTC).

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

QUESTION 5.08 (1.00)

A centrifugal pump is started up with its discharge valve open. How would the following parameters differ(HIGHER, LOWER, THE SAME) if the pump had been started with its discharge valve shut?

a. Motor current

b. Discharge pressure

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

QUESTION 5.09 (1.50)

Indicate whether the following will INCREASE, DECREASE, or have NO EFFECT on the available NPSH of a centrifugal pump:

a. Throttle shut on the pump discharge valve.

b. Increase the temperature of the suction side fluid.

c. Increase the pressure of the N2 blanket on the suction side supply tank.

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

QUESTION 5.10 (2.00)

For steam (at 1000 psia) going through a throttling process, indicate how the following parameters change as the steam passes through the valve (INCREASE, DECREASE, or REMAIN THE SAME).

(NOTE: assume ideal conditions)

a. Enthalpy

b. Pressure

c. Entropy

d. Temperature

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

QUESTION 5.11 (1.50)

With respect to reactor start up, indicate whether each of the following statements are TRUE or FALSE:

A. The purpose of fully withdrawing the shut down rods is to provide adequate negative reactivity which may be inserted should a problem occur.

B. Counts doubling indicates that the margin to criticality has been halved.

C. If counts have doubled, adding the same amount of reactivity will cause the reactor to go supercritical.

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

QUESTION 5.12 (2.00)

The reactor is operating at 30% power when one RCP trips. Assuming no reactor trip or turbine load change occurs, indicate whether the following parameters will INCREASE, DECREASE, or REMAIN THE SAME.

a. Flow in operating reactor coolant loops (0.5)

b. Core delta T (0.5)

c. Reactor vessel delta P (0.5)

d. Operating loop steam generator pressure (0.5)

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

QUESTION 5.13 (1.00)

List all of the conditions that must be present in order for natural circulation to exist.

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

QUESTION 5.14 (1.00)

State TWO (2) reasons why 10 exp -3% powar (1x10exp-8 amps) is chosen as a standard reference for critical rod height data.

NOTE: "standard reference" is NOT an acceptable answer

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

QUESTION 5.15 2.5 ~~(3.00)~~ RFR 03/24/88

a. When in MODE 2 with keff < 1, the Shutdown Margin (SDM) must be verified within 4 hours prior to criticality. How is this verification accomplished without performing a SDM calculation? (1.0)

~~b. What is the SDM limit with Tave < 350 degrees?~~ DELETED (0.5)

c. Name SIX factors that go into a SDM calculation. RFR 03/24/88 (1.5)

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

QUESTION 5.16 (2.00)

List the FOUR bases for the minimum temperature for criticality.

QUESTION 5.17 (1.50)

a. With reactor power greater than 50%, what is the maximum Quadrant Power Tilt Ratio (QPTR) that can exist without putting limitations on plant operations? (0.5)

b. The Technical Specifications allow operations for a 2 hour time period with a QPTR of greater than that in part a. What is the reason for this allowance? (1.0)

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

QUESTION 5.18 (1.50)

The enthalpy of the reactor coolant entering the steam generator is 650 Btu/lbm; its enthalpy leaving is 580 Btu/lbm. The enthalpy of the feedwater is 400 Btu/lbm. What is the enthalpy of the steam produced if the reactor coolant flow is 6 x 10exp 7 lbm/hr and the feedwater flow is 6 x 10exp 6 lbm/hr? (SHOW ALL WORK!)

QUESTION 5.19 (1.00)

Calculate the condensate depression in a condenser operating at 1 psia with a condensate temperature of 95 deg F
(SHOW ALL WORK!)

QUESTION 5.20 (1.00)

Define subcritical multiplication.

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

QUESTION 6.01 (1.00)

Which statement below regarding the Main Generator Protection System is NOT CORRECT.

a) Opening the generator output breakers ALWAYS results in a turbine trip when the generator is loaded.

b) Once the generator is loaded, a turbine trip ALWAYS results in a generator trip.

c) A turbine trip above the protection interlock P-7 (10% power)* ALWAYS results in a Reactor trip.

d) A reactor trip ALWAYS results in a turbine trip.

* CHANGE EQC TO P-9 (50% POWER)

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

QUESTION 6.02 (1.00)

An undervoltage on a 7.2 kV safeguards bus occurs 20 seconds after the receipt of a Safety Injection signal. Which of the following statements regarding sequencing of loads onto the safeguards bus is correct?

a. All loads except Load Block #1 are stripped and the ESF Loading Sequence is reinitiated once the DG output breaker is closed.

b. Sequencing stops until the DG output breaker is closed at which time it continues from the point at which the undervoltage occurs.

c. Sequencing stops until the DG output breaker is closed at which time only the ECCS-related equipment sequence will be reinitiated.

d. All loads except the ECCS-related equipment are stripped and only the ECCS-related equipment sequence will be continued once the DG output breaker is closed.

QUESTION 6. 3 (1.00)

What set of signals below is sent to the Reactor Protection System to indicate a Turbine Trip?

a. Stop valves closed & Auto Stop Oil pressure low

b. Stop valves closed & EHC pressure low

c. Governor valves closed & Auto Stop Oil pressure low

d. Governor valves closed & EHC pressure low

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

QUESTION 6.04 (1.00)

Which valve listed below is used to throttle auxiliary spray flow?

a) FCV-122 (Charging Flow Control Valve)
b) PVT-8145 (Aux Spray Valve)
c) PCV-444C (Loop C Spray Valve)
d) PCV-444D (Loop A Spray Valve)
e) You cannot throttle auxiliary spray

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

QUESTION 6.05 (1.50)

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

a. Increasing Tavg (0.5)

b. Tavg less than rated power Tavg (0.5)

c. Delta I becoming more negative (0.5)

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

QUESTION 6.06 (2.50)

Concerning the Rod Control System:

a) Using a one line diagram, show the inter-relationships of the following components.

1) DC hold cabinet
2) Power cabinet
3) Motor generator set
4) Reactor Trip Breaker(s)
5) Automatic Rod Control Unit
6) Logic Cabinet

b) For the components in Part a), above, STATE the number of each present in the system.

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

QUESTION 6.07 (1.50)

Match the RCS penetrations in Column A with the appropriate RCS loop segment listed in Column B. (Answers may be used more than once)

Column A	Column B
a) Normal Letdown	1) Loop A cold leg
b) PZR Surge Line	2) Loop A hot leg
c) CVCS Normal Charging	3) Loop A intermediate leg
d) PZR Spray Line	4) Loop B cold leg
e) RHR Suction	5) Loop B hot leg
	6) Loop B intermediate leg
	7) Loop C cold leg
	8) Loop C hot leg
	9) Loop C intermediate leg

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

QUESTION 6.08 (1.00)

What is the main design purpose of the flow restricting nozzle in the Main Steam Lines?

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

QUESTION 6.09 (1.00)

The S/G PORV's maximum capacity is limited by design to approximately 6% of rated steam flow. What is the reason for this limitation?

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

QUESTION 6.10 (1.50) RFR 03/24/87

What signal(s) OTHER THAN AN SI SIGNAL, must be present to initiate an AUTOMATIC switchover of the suction of the RHR system from the RWST to the reactor building recirculation sumps? Give setpoint(s) and coincidence(s) if applicable.

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

QUESTION 6.11 (2.00)

For each of the following, list the components of the Reactor Building Spray system which are affected.

a. Phase A Containment Isolation Signal (1.0)

b. Spray Actuation Signal (1.0)

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

QUESTION 6.12 (1.50)

The following questions are associated with the normal service gas decay tanks:

a. How many normal service gas decay tanks are there? (0.5)

b. Normally, how often is the in-service tank switched? (0.5)

c. Why is the waste gas distributed among all normal service gas decay tanks instead of filling one tank at a time? (0.5)

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

QUESTION 6.13 (1.00)

List FIVE outputs of the Pressurizer Pressure master controller.
NOTE: Redundant outputs count as one, i.e., Pump A and Pump B.

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

QUESTION 6.14 (1.00)

What plant conditions will cause the Cold Overpressure Protection System (COPS) alarm to actuate?

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

QUESTION 6.15 (1.25)

With the pressurizer level control switch in Position 2, describe how a high failure of LT-459 will affect actual pressurizer level. Assume normal charginr and letdown system lineups exists and no operator actions are taken. Continue the description until pressurizer level is constant or a reactor trip occurs. Include setpoints* where applicable.

* CHANGE KEY TO INCLUDE ALARMS

R/A 03/22/88

QUESTION 6.16 (1.00)

List 2 reasons for providing a void volume in a new fuel rod.

QUESTION 6.17 (1.00)

Aside from a loose printed circuit board card, list 4 distinct causes of an "URGENT FAILURE" in the Power Cabinets of the Rod Control System.

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

QUESTION 6.18 (2.00)

LIST 4 of the 5 Design bases for the ECCS Cooling Performance following a LOCA, as stated in 10CFR50.46.

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

QUESTION 6.19 (1.50)

List 3 purposes for the Rod Insertion Limits.

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

QUESTION 6.20 (1.50)

Describe what causes a "Hard Bubble" in the pressurizer during normal plant operations and how this affects the reactor on plant transients.

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

QUESTION 6.21 (3.00)

All reactor controls are in automatic with Bank D rods at 210 steps and reactor power at 70%. The output of the Auctioneered Tavg circuit fails LOW. Describe the effect this would have on ALL the plant control systems supplied with this signal until a stable condition is reached or a reactor trip occurs. (assume no operator action)

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

QUESTION 6.22 (1.00)

How are the inputs to the Detector Current Comparator compared, and what conditions are needed to automatically defeat the circuitry while at power?

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

QUESTION 7.01 (1.00)

Which ONE of the following is NOT an input into determining conformance with the reactor core Safety Limits?

a. Pressurizer Pressure

b. Lowest Operating Loop Flow

c. Thermal Power

d. Highest Operating Loop Tavg

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

QUESTION 7.02 (1.00)

If the Subcriticality Critical Safety Function indicates a dashed path, which ONE of the following actions is required?

a. Go immediately to the referenced procedure.

b. Go to the referenced procedure as time permits.

c. Monitor other status trees and if no higher priority condition exists, then go to referenced procedure.

d. Monitor other status trees and if no higher priority condition exists, then go to referenced procedure as time permits.

QUESTION 7.03 (1.00)

While performing steps in EOP 6.0, "Loss of All A/C Power", an SI signal may be generated when power is restored. If an SI signal is generated, which action below is required by the procedure?

a. Reset the SI to permit the EDG's to energize the emergency buses.

b. Place SI in test to prevent an overpressurization of the RCS.

c. No action is necessary as it has no effect.

d. Reset the SI to permit MANUAL loading of equipment on an A/C emergency bus.

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

QUESTION 7.04 (1.50)

In accordance with EOP 12, Monitoring of Critical Safety Functions, list the Critical Safety Functions (CSF) in descending order of priority?

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

QUESTION 7.05 (1.00)

Which ONE of the following statements is correct concerning the status of the Nuclear Instrumentation Recorder prior to withdrawing control bank rods for a reactor startup?

a. The highest reading source range channel and the highest reading intermediate range channel are selected.

b. Only the highest reading source range channel is selected.

c The highest reading source range channel and the lowest reading intermediate range channel are selected.

d. The highest reading source range channel and either intermediate range channel are selected.

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

QUESTION 7.06 (1.00)

Which ONE of the following reasons correctly describes the basis for allowing RCP restart in EOP 14.0 (ERG-FR-C.1) "Response to Inadequate Core Cooling"?

a. Helps to mix the SI flow to protect the reactor vessel from cold water.

b. Once subcooling is established, restarting the RCPs helps to collapse voids that may have formed in the reactor vessel head.

c. Allows restoration of PZR pressure control using normal sprays.

d. Provides for cooling of the core when secondary depressurization does not alleviate inadequate core cooling.

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

QUESTION 7.07 (1.00)

With respect to Emergency Plan Procedure EPP-003, In Plant Radiological Surveying, indicate whether each of the following statements are TRUE or FALSE.

1. A Standing RWP must be used for an entry into an area with a severe or unknown exposure potential.

2. Entries into areas where a severe or unknown potential for radiation exposure exists should be limited to Rescue attempts to preserve human life.

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

QUESTION 7.08 (1.50)

The reactor has been operating for 1 week at 100% power. RCS pressure and temperature are in their normal bands. Indicate whether EACH of the following conditions would be a symptom of a loss of containment integrity as listed in the TS for primary containment integrity? Answer YES or NO.

a. Primary containment air temperatures for elevations 412', 436' and 463' are 114, 116, and 118 degrees F respectively.

b. One air lock door is inoperable for more than 24 hours with the operable door closed and the inoperable door locked.

c. A section of the containment ventilation ducting exiting the containment is removed and a thin metal plate has been taped over the opening thus keeping air from leaking out.

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

QUESTION 7.09 (1.00)

FILL IN THE BLANKS:

A loss of flow signal is sent to the solid state protection system (SSPS). A Reactor Trip will occur only if _____ of _____ (0.5) Power Range Channels exceeds _____ percent (0.5)

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

QUESTION 7.10 (1.25)

Indicate the numerical values associated with the following precautions:

a. Maximum differential pressure between RCS and S/G.

b. Maximum differential temperature between RCS loops.

c. Minimum RCS flowrate prior to and during RCS dilutions.

d. Maximum rate of power increase above 20% reactor power without management approval.

e. Maximum RCS temperature during RHR operations.

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

QUESTION 7.11 (1.00)

What are the 2 Immediate Corrective Actions required if the charging flow control valve (FCV-122) fails closed while in automatic control and will not respond to a manual open signal?

DELETE THIS QUESTION FROM BAB

RAA 03/24/88

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

QUESTION 7.12 (1.50)

What are the plant load limitations with the following number of feedwater booster pumps in service?

a. 3

b. 2

c. 1

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

~~QUESTION 7.13 (1.50)~~ DELETED RAA 03/24/88

Other than identifying and correcting the malfunction, what are the 3 Immediate Corrective Actions for a diesel generator trip following an emergency start?

DELETE PER AGR RAA 03/24/88

QUESTION 7.14 (1.00)

What method is used to collapse the void, according to EOP-18.2, "Response to Voids in the Reactor Vessel", if a void exists in the reactor vessel with all RCPs stopped?

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

QUESTION 7.15 (2.00)

List the FOUR possible alternate actions that can be taken if, during a response to abnormal power generation (ATWS), the turbine had not automatically tripped.

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

QUESTION 7.16 (1.00)

What plant conditions determine when adverse containment conditions are used in the Emergency Operating Procedures?

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

QUESTION 7.17 (2.00)

In accordance with EOP-1.3, "Natural Circulation Cooldown", what are the five (5) parameters (conditions) that support or indicate natural circulation flow during cooldown? Which way should they be trending?

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

QUESTION 7.18 (2.00)

List the 4 conditions, including appropriate setpoints, that must be met prior to opening a Reactor Coolant Pump (RCP) seal water bypass valve.

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

QUESTION 7.19 (2.00)

List all the immediate actions for a loss of all AC, as stated in EOP 6.0, Loss Of All AC.

NOTE: It is NOT necessary to list the Alternative Action.

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

QUESTION 7.20 (2.00)

LIST the 4 SI Termination Criteria as stated in EOP 1.2, Safety Injection Termination.

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

QUESTION 7.21 (1.00)

EOP-13.0, "Response to Abnormal Nuclear Power Generation/ATWS", has the operator trip the turbine as one of the immediate actions. However, one of the major concerns in the ATWS transient response evaluations is the excessive RCS pressure developed due to significant heatup of the primary coolant. Since keeping the turbine on the line would mitigate this temperature rise, why is the turbine tripped?

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

QUESTION 7.22 (1.00)

In accordance with EOP 1.3, Natural Circulation, what determines the amount of RCS subcooling required during a natural circulation cooldown following a reactor trip?

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

QUESTION 7.23 (1.00)

How are the trip bistables of a failed power range detector placed in the trip condition?

CHANGE QUESTION IN EQB TO INCLUDE THE PROCEDURE

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

QUESTION 7.24 (1.50)

Caution III.1 of EOP 15.0 "Response to loss of Secondary Heat Sink" states: If S/G Wide Range levels in any 2 S/G is < 20% OR Pressurizer pressure is > 2335 psig then STOP ALL RCPs and immediately initiate bleed and feed per steps 7 through 14.
Why are the RCPs tripped prior to initiating bleed and feed, aside from the fact that heat input from the pumps will be removed?

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

QUESTION 8.01 (2.00)

State WHETHER or NOT the conditions below would meet the safety injection system TS OPERABILITY criteria, assuming all other conditions are normal? Answer YES or NO.

a. "A" RHR pump fails to start and "B" RHR pump mechanical seal fails.

b. One of #2's Accumulator discharge check valves fails to open.

c. "B" charging pump trips and "B" RHR pump seals fail.

d. Two charging pumps fail, one due to a breaker malfunction, the other due to bearing problems.

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

QUESTION 8.02 (1.00)

The following plant conditions have existed for the past twelve (12) hours:

100 percent rated thermal power (RTP)

Normal Operating Temperature/Normal Operating Pressure

Residual Heat Removal Heat Exchanger (RHR Hx) "A" - INOPERABLE

The maintenance supervisor reports that the suction from the containment sump to RHR Pump "B" is INOPERABLE. You concur.

Which one of the following most accurately describes the allowances and/or limitations imposed by the Technical Specifications?

NOTE: Technical Specifications 3.0, 3.4.1.3, 3.4.1.4, 3.5.2 and 3.5.3 are enclosed for reference.

a) No limitations are imposed by the Technical Specifications.

b) Restore the inoperable subsystem to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours.

c) Suspend all operations involving reductions in Reactor Coolant System (RCS) boron concentration and immediately initiate corrective action to return loop to operation.

d) Within 1 hour, action shall be initiated to place the unit in at least HOT STANDBY within the next 6 hours & at least HOT SHUTDOWN in the following 6 hours.

e) Because of the inoperability of either the RHR Hx or RHR pump, restore at least one ECCS subsystem to OPERABLE status or maintain RCS Tavg to less than 350 degrees by use of alternate heat removal methods.

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

QUESTION 8.03 (2.00)

For EACH of the following, indicate WHETHER or NOT the Technical Specifications require action to be taken within one hour.

a. In Mode 1 with one full-length rod immovable but within 12 steps of the group counter demand position.

b. In Mode 5 with one pressurizer code safety valve inoperable.

c. In Mode 2 with one pressurizer PORV block valve inoperable.

d. In Mode 1 with only one operable charging pump.

QUESTION 8.04 (2.00)

With respect to the EDG, state whether a VALID TEST, INVALID TEST, or VALID TEST FAILURE would apply for each of the following:

1. Malfunction of equipment that is not part of the defined generator unit (e.g. ESF Load Sequencer).
2. Successful starts that are intentionally terminated without loading.
3. Any diesel trip that is the result of a valid trip condition.
4. Test performed in the process of maintenance troubleshooting.

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

QUESTION 8.05 (1.50)

With regard to Maintenance Work Requests (MWR), indicate whether EACH of the following are TRUE or FALSE.

a. Emergency maintenance does NOT require the initiation of a MWR.

b. MWRs for corrective maintenance are normally prepared by the person identifying the problem.

c. Priority 1 MWRs can ONLY be approved by the Shift Supervisor.

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

QUESTION 8.06 (2.00)

For each of the following, state whether or not the condition(s) below will place the unit directly into an LCO. (state YES or NO)

a. Loss of ONE (1) seismic monitoring instrument.

b. Loss of ONE (1) meteorological monitoring instrument

c. Loss of a PRNI channel at > 1% power.

d. Loss of BOTH SRNI channels at > 1% power.

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

QUESTION 8.07 (1.25)

Match the RCS leakage types in column A to the TS limits in column B. (Assume plant is in mode 1)

COLUMN A	COLUMN B
a. Through PZR PORV to PRT	1. 0 gpm
b. From RCS into steam generators	2. 1 gpm
c. From unknown location	3. 10 gpm
d. To RCP seal supply	4. 31 gpm
e. Nonisolable fault on RTD bypass line	5. 33 gpm
	6. 21 gpm

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

QUESTION 8.08 (1.00)

What is the minimum boron concentration requirements that must exist in the RCS prior to unbolting the reactor vessel head?

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

QUESTION 8.09 (1.00)

What is the following a Technical Specification definition of:

The process of determining an instrument's accuracy by visually comparing the indication to other independent instrument channels measuring the same parameter.

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

QUESTION 8.10 (1.00)

What is the basis for the high pressurizer water level reactor trip?

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

QUESTION 8.11 (1.00)

What is the basis for the upper containment temperature limit?

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

QUESTION 8.12 (1.00)

The most limiting condition for SDM requirements occurs at EOL with Tavg at no load operating temperature and is based on a steam line break accident.

a. Why is EOL more limiting than BOL? (0.5)

b. Why is no load temperature more limiting than full load temperature? (0.5)

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

QUESTION 8.13 (1.50)

a. What is the Technical Specification Safety Limit for RCS pressure while in Mode 1? (0.5)

b. What are the 2 required actions that must be taken within 1 hour if this limit is violated? (1.0)

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

QUESTION 8.14 (1.00)

Once a piece of equipment is danger tagged for a particular maintenance work request, no other work can be performed on the isolated equipment unless either of two requirements are met. What are these TWO requirements?

QUESTION 8.15 (1.00)

With the exception of electrical personnel acting in the capacity of a red tag, what are the TWO required qualifications of the individual responsible for second verification of danger tag placement?

QUESTION 8.16 (2.00)

According to EPP-001, for each of the following indicate the LOWEST Emergency Action Level (EAL) that requires the action to be taken:

a. Notify Fairfield Pump Storage Facility

b. Emergency Log Established

c. Sound Radiation Emergency Alarm

d. Activate EOF

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

QUESTION 8.17 (1.00)

List the SCE&G employees allowable planned emergency exposure limit for each of the following:

a. Save human life

b. Mitigate damage to vital equipment

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

QUESTION 8.18 (1.00)

What, AS A MINIMUM, should the temporary or unexpected relief turnover include?

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

QUESTION 8.19 (2.00)

a. What are the Bases of the Undervoltage (UV) and Underfrequency (UF) RCP Bus Trip as well as the bases for their setpoints?

b. What is the significance of the time delay incorporated in the trips linked in part "a"?

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

QUESTION 8.20 (1.00)

What is meant by the statement in TS 3.4.4, action C, attached, that says "the provisions of specification 3.0.4 are not applicable"?

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

QUESTION 8.21 (1.00)

What is the definition 'or the Heat Flux Hot Channel Factor?

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

QUESTION 8.22 (1.50)

Using the attached Technical Specifications (TS), answer the question stated in the situation presented below:

The reactor is being refueled (> 23 ft above Rx Vessel Flange), loop "C" is isolated for maintenance and RCPs "A" and "B" are out of service for breaker repairs. "B" RHR pump and its Heat Exchanger are being used to circulate reactor coolant, with "A" RHR pump INOPERABLE for routine maintenance. A request to take the "B" EDG out of service for about 30 minutes to do a surveillance on the generator is made by the electrical supervisor. Can this surveillance be performed? Support your answer by referring to the applicable TS.

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

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

ANSWER 5.01 (1.00)

c (1.0)

REFERENCE
VCS, TH SCI, TS-10, P 17-20, LO 4,5,8,10,11,14.
KAI 2.5.
191004K109 ...(KA'S)

ANSWER 5.02 (1.00)

d (1.0)

REFERENCE
VCS, RT BK III, RT-12, P 17-23, LO 9.
KAI 3.4.
192006K106 ...(KA'S)

ANSWER 5.03 (1.00)

a

REFERENCE
BK III, REACTOR THEORY, CH-14, CURVES FND-RF-46/47, LO 7.
KAI 3.1, 3.4.
001000K502 192005K105 ...(KA'S)

ANSWER 5.04 (1.00)

a

REFERENCE
VCS, BK III, REACTOR THEORY, CH-14, CORE CONDITIONS AFFECTING ROD WORTH, P-16, LO 9.
KAI 3.4.
192006K106 ...(KA'S)

ANSWER 5.05 (1.00)

c

REFERENCE
VCS, RT-10, P 11.
RT-6, LO 13, 16, 21, 26, 29.
KAI 3.4
192008K110 ...(KA'S)

ANSWER 5.06 (1.00)

a. MORE NEGATIVE (0.5)

b. MORE NEGATIVE (0.5)

REFERENCE
VCS, RT BK III, RT-11, MTC & TPD, P 4,5, LO 5,7,8.
KAI 3.1.
192004K106 ...(KA'S)

ANSWER 5.07 ~~(1.50)~~ 1.0 RFA 03/24/88

a. DECREASES (0.5)

~~b. DECREASES (0.5)~~ DELETED RFA 03/24/88

c. DOES NOT CHANGE (0.5)

REFERENCE
VCS, RT BK III, RT-11, P 24, LO 18,19.
KAI 2.9.
192004K107 ...(KA'S)

ANSWER 5.08 (1.00)

a. LOWER (0.5)

b. HIGHER (0.5)

REFERENCE
VCS, TH SCI, TS-10, P 25-30, LO 11.
KAI 2.9, 2.6
191004K107 ...(KA'S)

ANSWER 5.09 (1.50)

a. INCREASE (0.5)

b. DECREASE (0.5)

c. INCREASE (0.5)

REFERENCE
VCS, TH SCI, TS-10, P 16-30, LO 14.
KAI 2.8.
191004K115 ...(KA'S)

ANSWER 5.10 (2.00)

a. REMAIN THE SAME (0.5)

b. DECREASE (0.5)

c. INCREASE (0.5)

d. DECREASE (0.5)

REFERENCE
VCS, TH SCI, TS-8, P 1-14, LO 2,3.
KAI 2.8.
193004K115 ...(KA'S)

ANSWER 5.11 (1.50)

A. TRUE (0.5)
B. TRUE (0.5)
C. TRUE (0.5)

REFERENCE
VCS, I&C BK I, IC-5, P 12, LO 1.4.
VCS, RT BK II, RT-8, P 36, LO 7.
KAI 3.9, 3.8.

ANSWERS -- SUMMER -88/03/07-AIELLO, R F

001010K506 192002K114 ...(KA'S)

ANSWER 5.12 (2.00)

a. INCREASE (0.5)
b. INCREASE (0.5)
c. DECREASE (0.5)
d. DECREASE (0.5)

REFERENCE
VCS, TH SCI, TS-10, FIG FND-FF-45, LO 4,8.
General Physics, HT & FF - Fluid Flow Applications for Systems and Components
KAI 4.0, 3.4.
002000K501 003000K301 ...(KA'S)

ANSWER 5.13 (1.00)

1. Density difference (or DELTA T) created by heat addition by the heat source and heat removal by the heat sink. (0.5)

2. The heat sink must be elevated physically above the heat source.(0.5)

REFERENCE
VCS, TH SCI, TS-14, P 27, LO 5.
KAI 4.2.
193008K121 ...(KA'S)

ANSWER 5.14 (1.00)

1. It is well above the source range.
OR
Source neutrons are negligible. (0.5)

2. It is below the point of adding heat. (0.5)
OR
Doppler effects are not present (0.25)
AND
MTC effects are not present (0.25)

REFERENCE
VCS, I&C BK II, IC-8, P 45.
RT-17, P 1, LO 2.

ANSWERS -- SUMMER -88/03/07-AIELLO, R F

KAI 3.6.
192008K112 ...(KA'S)

ANSWER 5.15 2.5 ~~(3.00)~~ RFA 03/24/88

a. The predicted critical rod position (0.5 pts) is within control rod insertion limits. (0.5 pts)

~~b. 2000 pcm (-30 +0 pcm)~~ DELETED RFA 03/24/88 (0.5)

c. (any 6 at 0.25 pts each)
1. RCS boron concentration
2. Control rod position (stuck rods)
3. RCS Tave
4. Fuel burnup
5. Xenon
6. Samarium
7. Power level

REFERENCE
VCS, TS, P. 3/4 1-1 - 1-3, GOP-3, p-7, RT BK III, CH 13, ECC & SDM P 10, LO 5,6.
KAI 3.6, 3.7, 3.9, 4.4.
001000K508 192002K110 192002K113 192002K114 ...(KA'S)

ANSWER 5.16 (2.00)

1. MTC within analyzed range (0.5)
2. Protective instrumentation within normal operating range (0.5)
3. Pressurizer capable of being operable (0.25 pts.) with a steam bubble (0.25 pts.)
4. Reactor pressure vessel above RT(NDT) (0.5)

REFERENCE
VCS, TS, p. B 3/4 1-2 (NO LO AVAILABLE)
KAI 3.8.
001000G006 ...(KA'S)

ANSWER 5.17 (1.50)

a. 1.02 (0.5)

b. Allow correction (and detection) of a dropped (or misaligned) control rod.

REFERENCE
VCS, TS, P B3/4 2-13, RT BK III, RT-14, CONTL ROD REACTIVITY, P-2, LO 10.

KAI 4.1, 3.8.
001000G005 001000G006 ...(KA'S)

ANSWER 5.18 (1.50)

(from formula H/O)

m1(hout,1 - hin,1) = -m2(hout,2 - hin,2)

m1 = reactor coolant mass flow rate
m2 = feedwater mass flow rate

(hout,2 - hin,2) = -m1/m2 (hout,1 - hin,1)

hout,2 = -m1/m2 (hout,1 -hin,1) + hin,2 (0.5)

hout,2 = -(6 x 10exp 7 lbm/hr) / (6 x 10exp 6 lbm/hr) x
(580 Btu/lbm - 650 Btu/lbm) + 400 Btu/lbm (0.5)

hout,2 = [(-10) x (-70 Btu/lbm)] + 400 Btu/lbm

hout,2 = 700 Btu/lbm + 400 Btu/lbm

hout,2 = 1,100 Btu/lbm (0.5)

Thus, the enthalpy of the steam produced is 1,100 Btu/lbm.

REFERENCE
VCS, TH SCI, TS-5, P 4, LO 8.
KAI 2.4, 3.4.
193003K119 193003K125 ...(KA'S)

ANSWER 5.19 (1.00)

From the steam tables, 1 psia corresponds to a saturation temperature of 101.74 deg F. (0.5)

The difference between the saturation temperature and the condensate temperature is the condensate depression, thus:

101.74 deg F - 95 deg F = 6.74 deg F (0.5)

REFERENCE
VCS, TH SCI, TS-9, P 20, LO 6.
STEAM TABLES
KAI 2.5, 3.4.
193003K125 193004K111 ...(KA'S)

ANSWER 5.20 (1.00)

The process or phenomenon of utilizing source neutrons to sustain the chain reaction for Keff < 1.0. (1.0)

REFERENCE
VCS, RT BK II, RT-8, P 12, LO 4.
KAI 2.8.
192003K101 ...(KA'S)

ANSWER 6.01 (1.00)

a OR c (1.0) RFA 03/24/88

REFERENCE
VCS, I&C, IC-9, P 44,5v, LO 1.1.2.
TBS, TB-5, P 87, LO 1.2.1, 1.4.
KAI 3.6.
045010K423 ...(KA'S)

ANSWER 6.02 (1.00)

a

REFERENCE
VCS, GS-2, SAFEGUARDS POWER SYSTEMS P 36, LO 1.3, 1.4.
KAI 4.0.
064000K410 ...(KA'S)

ANSWER 6.03 (1.00)

b

REFERENCE
VCS, I&C BK II, IC-9, P 58, LO 1.3.2, 1.4.1.
KAI 3.7.
045010K111 ...(KA'S)

ANSWER 6.04 (1.00)

a (1.0)

REFERENCE
VCS, ABS, AB-2, P 34, LO 1.4.
AB-3, P 28, LO 1.1.3.
KAI 3.9.
010000A202 ...(KA'S)

ANSWER 6.05 (1.50)

a. DECREASE (0.5)
b. REMAIN THE SAME (0.5)
c. REMAIN THE SAME (0.5)

REFERENCE
VCS, I&C BK I, IC-6, RCS TEMP IND, LO 1.4.4.
VCS, I&C BK II, IC-9, REACTOR PROTECTION & LOGIC, P-47, LO 1.3.2.
KAI 3.3, 2.9.
012000K502 012000K611 ...(KA'S)

ANSWER 6.06 (2.50)

a) 1. Auto Rod Control---> Logic Cabinet---> Power Cabinet (0.5)
2. MG Set---> Reactor Trip Breakers---> DC Hold Cabinet---> Power Cabinet (0.5)

b)

motor generator set	2
reactor trip breaker(s)	2
power cabinet	4
logic cabinet	1
automatic rod control unit	1
DC hold cabinet	1

RFA 05/24/88

(0.25 ea)

REFERENCE
VCS, I&C BK I, IC-5, FIG IC5.1, IC5.10, LO 1.1.2.
KAI 3.7, 3.1.
001000K202 010000K203 ...(KA'S)

ANSWER 6.07 1.75 ~~(1.50)~~ RFA 03/24/88

a) ~~1~~ 3
b) 2
c) 4 RFA 03/24/88
d) 1,7
e) 2,8

(0.25 ea)

REFERENCE
VCS, P&ID, RCS, DWG F-21.
ABS, AB-2, FIG AB2.3.
AB-2, P 16-17, LO 1.2.3.
KAI 4.0, 4.1, 3.9.
002000K106 002000K109 005000K109 ...(KA'S)

ANSWER 6.08 (1.00)

TO limit the rate of S/G blowdown during a main steam line break (+1.0)

REFERENCE
VCS, TBS, TB-1, P 16, LO 1.1.1.
KAI 2.9.
039000G007 ...(KA'S)

ANSWER 6.09 (1.00)

Limits plant cooldown rate (0.5) if any one PORV sticks open. (0.5)

REFERENCE
VCS, TB-2, Main Steam System, P 16 and OS-8, Accident Analysis, P 28.
LO 1.1.
KAI 3.5.
035010K602 ...(KA'S)

ANSWERS -- SUMMER -88/03/07-AIELLO, R F

ANSWER 6.10 (1.50)

~~Safety Injection Signal (0.3 pts.) AND (0.3 pts.)~~ 2/4 (~~0.3~~ 0.5 pts.)
RWST level (~~0.3~~ 0.5 pts.) less than 18% (~~0.3~~ 0.5 pts.)
RFA 03/24/88

REFERENCE
VCS, AB-7, RHR SYSTEM, P 16, LO 1.2.
KAI 4.3, 3.9.
005000K411 006020A304 ...(KA'S)

ANSWER 6.11 (2.00)

a. 1. NaOH isolation valves (open) (0.5)
 2. Spray discharge isolation valves (open) (0.5)

b. 1. RWST suction valves (open) (0.5)
 2. Spray pumps (start) (0.5)

REFERENCE
VCS, AB-8, RB SPRAY SYSTEM, P 15, LO 1.1.4, 1.2, 1.3, 1.4.
KAI 4.3, 3.6.
026000K401 026000K402 ...(KA'S)

ANSWER 6.12 (1.50)

a. 6 (0.5)

b. every 2 days (0.5)

c. To reduce the site boundary dose that would occur if a single tank ruptured. (0.5)

REFERENCE
VCS, AB-12, Waste Gas System, P 16, LO 1.2, 1.4.
KAI 2.5, 3.3.
071000A203 071000K610 ...(KA'S)

ANSWER 6.13 (1.00)

(Any FIVE at 0.2 points each)

1. PVC-444B (PORV)
2. High Pressure Alarm
3. B/U Heater Control
4. Low Pressure Alarm
5. Proportional Heater Control
6. PCV-444 C (D) (Spray)

REFERENCE
VCS, I&C BK-1, IC-3, PZR PRESSURE AND LEVEL CONTROL SYSTEM, FIGURE IC3.8, LO 1.1.2.
KAI 3.4, 4.1.
010000K402 010000K403 ...(KA'S)

ANSWER 6.14 (1.00)

Low auctioneered wide range OR any Th or Tc less than ~~350~~ 300 degrees AND any RHR Suction Valve not fully open. RA 03/24/88

REFERENCE
VCS, IC-3, PZR PRESSURE AND LEVEL CONTROL SYSTEM, P 33, LO 1.2.2.
KAI 4.1.
010000K403 ...(KA'S)

ANSWER 6.15 (1.25)

(B/U heaters come on). Charging flow reduced to minimum. Level decreases (0.25). At 17% level, letdown isolates (0.25). (Heaters turn off). Level increases. ~~High level alarm at 70%~~ (0.25). High level trip at 92% (0.5). RA 03/24/88
NOTE: setpoints worth 0.1 pt ea.

REFERENCE
VCS, CONTROL SYSTEM FAILURE ANALYSIS, IC-15, P 27, LO B.1.b, B.2.a.
AOP 401.6, P 2.
KAI 3.6.
011000A210 ...(KA'S)

ANSWER 6.16 (1.00)

(0.5 ea for any two)

1) Accommodate release of f.p. gases
2) Differential thermal expansion between clad and fuel pellet
3) Fuel density changes during burnup

REFERENCE
VCS, RT BK II, RT-9, P 14,15, LO 12.

ANSWER 6.17 (1.00)

1) Phase Failure (+.25 ea)
2) Regulation Failure
3) Logic Error
4) Multiplexing Error

REFERENCE
VCS, I&C BK I, IC-5, P 32, LO 1.4.
KAI 3.6.
001000G008 ...(KA'S)

ANSWER 6.18 (2.00)

(any 4 of 5 at 0.5 ea)
1) Max. Fuel Element Claddinq Temp. < 2200 Deg. F
2) Cladding Oxidation < 17% thickness
3) Hydrogen generated by Zirc-Water reaction <1% of max. possible.
4) Core remains in a coolable geometry
5) Provides for long term decay heat removal

REFERENCE
10CFR50.46
KAI 3.8
006000G004 ...(KA'S)

ANSWER 6.19 (1.50)

1) Adequate SDM upon trip
2) To minimize the amount of positive reactivity inserted during a rod ejection accident,* and
3) To minimize radial flux tilt (peaking)

(0.5 ea) * OR THE POTENTIAL EFFECTS OF ROD MISALIGNMENT ON ASSOCIATED ACCIDENT ANALYSIS ARE LIMITED
RFA 03/24/88

REFERENCE
VCS, RT BK III, RT-14, P 20, LO 10.
KAI 4.7.
001000K504 ...(KA'S)

ANSWER 6.20 (1.50)

Gases, particularly Hydrogen from the VCT (and some f.p. gases) come out of solution as they are sprayed into the PZR. (+1.0) this creates larger pressure oscillations during transients (+.5)

REFERENCE
VCS, I&C BK I, IC-3, P 11-13, LO 1.3.
KAI 3.6.
010000G010 ...(KA'S)

ANSWER 6.21 (3.00)

1) Rod control- Due to Tavg < Tref, rods will withdraw until a rod stop is reached (+1.0)

2) Pzr level control- Low Tavg will cause Pzr level control system to shutdown on FCV-122 until level is 25% (+1.0)

3) Steam Dumps- Tavg < Tref, so that even if armed in the Tavg mode, no dump actuation would occur (+1.0)

REFERENCE
VCS, I&C BK I, IC-5, P 17-19, LO 1.4.
IC-3, P 19, LO 1.2.2.
IC-3, P 38, LO 1.2.2.
KAI 3.6, 3.5, 3.1.
016000K301 016000K302 016000K303 ...(KA'S)

ANSWER 6.22 (1.00)

The highest reading upper/lower detector is compared to the average of the upper/lower detectors (0.5). The circuit auto defeats below 50% power on ALL channels (0.5).

REFERENCE
VCS, I&C BK II, IC-8, P 39, LO 4.b, 5.a.
KAI 3.2, 3.9.
015000A303 015000K604 ...(KA'S)

ANSWER 7.01 (1.00)

b

REFERENCE
VCS, TS, 2.1, BK II, I&C-9, REACTOR PROT. & LOGIC, FIG IC9.1, LO 1.2.
KAI 4.1.
002000G005 ...(KA'S)

ANSWER 7.02 (1.00)

c

REFERENCE
VCS, EOP-12.0, P 3. (NO LO AVAIL)
KAI 4.2.
000029G012 ...(KA'S)

ANSWER 7.03 (1.00)

d

REFERENCE
VCS, EOP 6.0, P 13, (NO LO AVAIL)
KAI 4.1.
000055A206 ...(KA'S)

ANSWER 7.04 (1.50)

Subcriticality, Core Cooling, Heat Sink, RCS Integrity, Containment, RCS Inventory.
(0.15 for CSF, 0.10 for correct order)

REFERENCE
VCS, EOP 12, P 1. (NO LO AVAIL)
KAI 4.2, 4.4.
000029G012 000074G012 ...(KA'S)

ANSWER 7.05 (1.00)

d

REFERENCE
VCS, GOP-1, INSTRUCTION 7. (NO LO AVAIL)
KAI 3.6.
015000A401 ...(KA'S)

ANSWER 7.06 (1.00)

d

REFERENCE
ERG-HP, Westinghouse Background Information, RCP Restart", P 4.
(NO LO AVAIL)
KAI 4.4
000074K307 ...(KA'S)

ANSWER 7.07 (1.00)

1. FALSE
2. FALSE

REFERENCE
VCS, EPP-003, In Plant Radiological Surveying, P 1-6. (NO LO AVAIL)
KAI 4.4
194001A116 ...(KA'S)

ANSWER 7.08 (1.50)

a. NO
b. YES
c. YES
(0.5 ea)

REFERENCE
VCS, TS 3.6.1.3, 3.6.1.5, 3.6.1.7. (NO LO AVAIL)
KAI 3.8, 3.9.
000069G003 000069G004 ...(KA'S)

ANSWERS -- SUMMER -88/03/07-AIELLO, R F

ANSWER 7.09 (1.00)

2 of 4, 38

REFERENCE
VCS, I&C, IC-9, P 46, LO 1.4.1, 1.4.2.
KAI 4.2.
015000K101 ...(KA'S)

ANSWER 7.10 (1.25)

(0.25 Points each)

a. 1600 psid
b. 25 degrees F
c. 3000 gpm
d. 3%/hr
e. 350 degrees F

REFERENCE
VCS, GOP-APPENDIX A, GENERIC OPERATING PRECAUTIONS, P 2, 3, 5, & 6.
ABS, AB-2, LO 1.3.1.
KAI 3.9
002000G010 ...(KA'S)

ANSWER 7.11 (1.00)

1. Reduce letdown to 45 gpm (0.5)
2. Control PZR level using (local) FCV-122 bypass valve (XVT-8403) (0.5)

OR

1. ISOLATE LETDOWN
2. PLACE EXCESS LETDOWN IN SERVICE

RFA 03/20/88

REFERENCE
VCS, SOP-102, CVCS.
ABS, AB-3, LO 1.3.
VCS, P&ID, CVCS.
KAI 3.8.
004000G014 ...(KA'S)

ANSWER 7.12 (1.50)

a. No restriction (0.5)
b. 60 +/- 1% (0.5)
c. 38 +/- 1% (0.5)

REFERENCE
VCS, SOP-210, FEEDWATER SYSTEM, P 35,36.
GOP-4, INST 12.
TURB FLD SYS, TB-7, LO 5,6.
KAI 2.9.
059000G010 ...(KA'S)

ANSWER 7.13 ~~(1.50)~~

RFA 03/24/88

1. ~~Reset mechanical overspeed, if applicable~~ (0.5)
2. ~~Momentarily place EXCITER switch in SHUTDOWN~~ (0.5)
3. ~~Depress GEN RELAYS RESET pushbutton~~ (0.5)

DELETED

~~REFERENCE~~
~~VCS, SOP-306, EMERGENCY DIESEL GENERATOR, P 4, 5, 24, 25. (NO LO AVAIL)~~
~~ARP, ARP-001, XCP-636.~~
~~GS-2, P 22.~~
~~KAI 4.3.~~
000055G010 ...(KA'S)

ANSWER 7.14 (1.00)

Increase system pressure using pressurizer heaters while maintaining pressurizer level.

REFERENCE
VCS, EOP-18.2, P 5. (NO LO AVAIL)
KAI 4.8.
000009A201 ...(KA'S)

ANSWER 7.15 (2.00)

(4 of 5 REQ) RA 04/11/88

1. Manually trip turbine from MCB (0.5)
2. Stop (and lock out) both EHC pumps (0.5)
3. Runback the turbine (0.5)
4. Close all MSIVs (0.5)
5. TRIP TURBINE FROM THE FRONT STD. RA 04/11/88

REFERENCE
VCS, EOP-13.0, P 2. (NO LO AVAIL)
KAI 4.5.
000029G010 ...(KA'S)

ANSWER 7.16 (1.00)

"HIGH-1" signal present

OR

Cont Temp CAF
Press CAF
Rad CAF

REFERENCE
VCS, EOPs, BOOK 1 & 2.
AUX BLDG SYS, AB-8, LO 1.2.
KAI 4.1. (P 3.6-27).
103000G015 ...(KA'S)

ANSWERS -- SUMMER -88/03/07-AIELLO, R F

ANSWER 7.17 (2.00)

1. ~~Differential Temperature~~ RCS SUBCOOLING (0.2)	~~25-80% of full power (by WR RTD)~~ BASED ON CORE EXIT TC > 30°F RFA 03/24/88 (0.2)
2. S/G Pressure (0.2)	Stable or decreasing (follow RCS TEMP) (0.2)
3. Hot Leg RTD (0.2)	Stable or decreasing (0.2)
4. Core exit T/C (0.2)	Stable or decreasing (0.2)
5. Cold Leg Temp (0.2)	Near Saturation Temp. for S/G press OR Constant or slowly decreasing (0.2)

REFERENCE
VCS, TH SCI, TS-14, P 14-24, LO 3,5.
GENERAL PHYSICS, HTFF, P 356.
VCS, EOP 1.3.
KAI 4.2.
193008K122 ...(KA'S)

ANSWER 7.18 (2.00)

1. RCS pressure (0.15) is > 100psig (0.5) but < 1000 psig (0.5).

2. RCP seal leakoff valves are open (0.25).

3. RCP No. 1 seal injection flow to each RCP (0.15) is > 6 gpm (0.15).

4. RCP No. 1 seal leakoff flow rate (0.15) is < 1 gpm (0.15).

REFERENCE
VCS, SOP-101, P 6.
ABS, AB-4, LO 1.1.2, 1.4.
KAI 3.6, 3.6.
003000G010 003000K103 ...(KA'S)

ANSWER 7.19 (2.00)

1. Trip the Reactor manually from the Main Control Board.

2. Verify Turbine Trip.

3. Isolate RCS.

4. Verify total EFW flow > 390 gpm.

(0.50 ea)

REFERENCE
VCS, EOP 6.0, LOSS OF ALL AC, P 2,3. (NO LO AVAILABLE)
KAI 3.9.
000056G010 ...(KA'S)

ANSWER 7.20 (2.00)

a) RCS Pressure - Stable or Increasing (0.5)

b) RCS Subcooling - greater than 30 degrees F (0.5)

c) PZR Level - greater than 4 percent (0.5)

4) Either 1 OR 2 below is satisfied (for Heat Sink Criteria):

1) Total Feed Flow to intact S/G's - > 390 gpm (0.25).

OR

2) Narrow Range Level in at least 1 S/G - > 38 percent (0.25).

REFERENCE
VCS, EOP 1.2, SI TERMINATION, P 1. (NO LO AVAILABLE)
KAI 4.3.
006050A401 ...(KA'S)

ANSWER 7.21 (1.00)

The turbine is tripped so that the heat sink will be maintained as long as possible (0.5) on a total loss of feedwater ATWS (0.5).

REFERENCE
ERG-HP, Westinghouse Background Information, FR-S.1, P 75-77.
(NO LO AVAIL)
KAI 4.7
000029K312 ...(KA'S)

ANSWER 7.22 (1.00)

Number of CRDM fans running. (1.0)

REFERENCE
VCS, EOP-1.3, p. 7. (NO LO AVAIL)
KAI 4.5.
000009E326 ...(KA'S)

ANSWER 7.23 (1.00)

Removing the applicable control and instrument power fuses on the power range drawers. OR

PULLING THE CONTROL POWER FUSES ON THE POWER RANGE DRAWER

REFERENCE
VCS, AOP-401.10, POWER RANGE FAILURE, P 2.
I&C, IC-8, LO 8.
KAI 3.2, 3.9.
015000A403 015000K604 ...(KA'S)

RFA 03/24/88

ANSWER 7.24 (1.50)

The RCPs will keep 2 phase flow mixture (0.75) and the PORVs will not be able to release as much steam (energy). (0.75)

OR

Higher pressure will reduce SI flow (0.75) and increase the inventory flow out of the PORVs. (0.75)

REFERENCE
VCS, EOP-15.0, P 1. (NO LO AVAIL)
Westinghouse B/G document, ERG-HP, FR-S/C/H, FR-H, P 55.
KAI 4.2
000074K308 ...(KA'S)

ANSWER 8.01 (2.00)

a. NO
b. NO
c. NO
d. NO
(0.5 ea)

REFERENCE
VCS, ABS, AB-7, P 11, LO 1.3.
AB-10, P 10, LO 1.3.
VCS, TS, LCO 3.5.1 & 3.5.2 and bases for each.
KAI 4.2.
013000G011 ...(KA'S)

ANSWER 8.02 (1.00)

d) (1.0)

REFERENCE
VCS TS, Section 3/4, LCO and SURVEILLANCE REQ. (NO LO AVAIL)
Specifications 3.0, 3.4.1.3, 3.4.1.4, 3.5.2 and 3.5.3.
KAI 4.2, 4.2.
006000G005 006000G011 ...(KA'S)

ANSWER 8.03 (2.00)

a. YES (0.5)
b. NO (0.5)
c. YES (0.5)
d. NO (0.5)

REFERENCE
VCS, TS, pp. 3/4 1-10 & 14 and 3/4 4-7 & 10. (NO LO EXIST)
KAI 3.6, 3.8, 3.8.
000005G003 004000G005 010000G005 ...(KA'S)

ANSWER 8.04 (2.00)

VT-Valid Test, IT-Invalid Test, VTF-Valid Test Failure

1. IT
2. IT
3. VTF
4. IT

(0.5 ea)

REFERENCE
VCS, SAP, SAP-204, P 9. (NO LO AVAIL)
KAI 3.9.
064000G011 ...(KA'S)

ANSWER 8.05 (1.50)

a. TRUE
b. TRUE
c. TRUE
(0.5 ea)

REFERENCE
VCS, SAP, SAP-601, REV 3, P 7, LO: RESPONSIBILITY 5.7.
KAI 3.4.
194001A103 ...(KA'S)

ANSWER 8.06 (2.00)

a. YES
b. YES
c. YES
d. NO

REFERENCE
VCS T.S., LCO 3.3.1, 3.3.3.3, 3.3.3.4. (NO LO AVAIL)
KAI 4.3.
015000K301 ...(KA'S)

ANSWER 8.07 (1.25)

a. 3
b. 2
c. 2
d. 5
e. 1
(0.25 ea)

REFERENCE
VCS, TS 3.4.6.2. (NO LO AVAIL)
KAI 4.1.
002000G005 ...(KA'S)

ANSWER 8.08 (1.00)

2000 ppm OR enough to ensure keff is less than 0.95, whichever is GREATER.

REFERENCE
VCS, TS, P 3/4 9-1. (NO LO AVAIL)
KAI 4.1.
002000G005 ...(KA'S)

ANSWER 8.09 (1.00)

Channel Check (1.0)

REFERENCE
VCS, TS, P 1-1. (NO LO AVAIL)
KAI 3.5.
016000G005 ...(KA'S)

ANSWER 8.10 (1.00)

Protects the pressurizer safety valves against water relief.

REFERENCE
VCS, TS, p. B 2-6, BK II, I&C-9, REACTOR PROTECTION & LOGIC, P-49, LO 1.4.2.
KAI 4.3.
012000K402 ...(KA'S)

ANSWER 8.11 (1.00)

Prevent exceeding design pressure during steam line break.

REFERENCE
VCS, TS, P B 3/4 6-2. (NO LO AVAIL)
KAI 3.6.
022000G006 ...(KA'S)

ANSWER 8.12 (1.00)

a. MTC more negative at EOL (0.5)

b. More mass in S/G at no load temperature (0.5)

REFERENCE
VCS, OS-8, ACCIDENT ANALYSIS, P 31. (NO LO AVAIL)
VCS, TS, P B 3/4 1-1.
KAI 3.8.
001000G006 ... A'S)

ANSWER 8.13 (1.50)

a. 2735 psig (0.5)

b. Be in Hot Standby (0.7 pts.) and notify NRC (0.3 pts.) (1.0)

REFERENCE
VCS, TS, P 2-1. (NO LO AVAIL)
KAI 4.0
002000G011 ...(KA'S)

ANSWER 8.14 (1.00)

1. Another series of tags are issued (0.5)
2. Applicable information is added to (original and yellow copy) Danger Tag Log sheet already in effect. (0.5)

REFERENCE
VCS, SAP, SAP-201, DANGER TAGGING, P 15, (NO LO AVAILABLE)
KAI 4.1.
194001K102 ...(KA'S)

ANSWER 8.15 (1.00)

1. Qualified Danger Tagger (0.5)
2. (Current) NRC License (0.5)

REFERENCE
VCS, SAP, SAP-201, DANGER TAGGING, P 5, (NO LO AVAILABLE)
KAI 4.1.
194001K102 ...(KA'S)

ANSWER 8.16 (2.00)

a. ALERT (0.5)
b. NUE (0.5)
c. ALERT (0.5)
d. SITE EMERGENCY (0.5)

REFERENCE
VCS, EPP-001, ATTACHMENT III. (NO LO AVAIL)
KAI 4.4
194001A116 ...(KA'S)

ANSWER 8.17 (1.00)

1. Life - 75 REM
2. Equip - 25 REM

(0.5 ea)

REFERENCE
VCS, EPP-02C, P 2. (NO LO AVAIL)
KAI 3.4
194001K103 ...(KA'S)

ANSWER 8.18 (1.00)

As a minimum, the temporary or unexpected relief turnover should include the following:

1. A discussion of existing plant conditions and anticipated evolutions during the relief. (0.5)

2. A review of the main control board controls, instrumentation and annunciators. (0.5)

REFERENCE
VCS, SAP, SAP-200, P 7, (NO LO AVAILABLE)
KAI 3.4.
194001A103 ...(KA'S)

ANSWER 8.19 (2.00)

a. The UV & UF RCP Bus Trips provide reactor core protection against DNB as a result of complete loss of forced coolant flow. (0.5) The specific set points assure a reactor trip signal is generated before the low flow trip set point is reached. (0.5)

b. Time delays are incorporated in the UF & UV trips to prevent spurious reactor trips from momentary electrical power transients (1.0)

REFERENCE
VCS, TS BASES, P B2-7.
I&C, IC-9, LO 1.1.2, 1.2, 1.4.1, 1.4.2.
KAI 4.3, 3.8.
003000K501 012000K402 ...(KA'S)

ANSWER 8.20 (1.00)

Entry into an Operational Mode may be made (0.5) even if the conditions for an LCO are not met (0.5).

REFERENCE
VCS, TS 3.0.4.. (NO LO AVAIL)
KAI 3.6
010000G006 ...(KA'S)

ANSWER 8.21 (1.00)

The maximum local heat flux on the surface of a fuel rod at core elevation Z divided by the average fuel rod heat flux.

REFERENCE
VCS, TS, P B 3/4 2-1.
TH SCI, TS-13, LO 2.
KAI 3.3.
193009K107 ...(KA'S)

ANSWER 8.22 (1.50)

Maintenance can not be performed (0.5), TS 3.9.7.1 applies (1.0)

REFERENCE
VCS, TS 3.9.7. (NO LO AVAIL)
KAI 3.8.
005000G005 ...(KA'S)