FCS EXAMINATION REPORT
Number: 50-285/OL-86-01

Docket No: 50-285 License No.: DPR-40

Licensee: Omaha Public Power District
1623 Harney
Omaha, NE 68012

Examinations administered at Fort Calhoun Station

Chief Examiner: S. L. McCrory, Examiner 1/23/86
Date

Approved by: R. A. Cooley, Section Chief 1/23/86
Date

Summary

Examinations conducted on November 12, 1985.

Written and oral license examinations were administered to four (4) Senior Reactor Operators. Two (2) candidates passed these examinations. Written and oral requalification examinations were administered to five (5) Senior Reactor Operators and three (3) Reactor Operators. None of the Senior Reactor Operators passed the written examination and one (1) failed the oral examination. Two (2) of the Reactor Operators passed both examinations and one (1) failed the written examination only.

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No. 50-285/OL-86-01

Report Details

1. Examination Results

SRO Candidates				RO Candidates			
Total	Pass	Fail	%	Total	Pass	Fail	%
4	2	2	50	0	0	0	na

SRO Requalification				RO Requalification			
Total	Pass	Fail	%	Total	Pass	Fail	%
5	0	5	0	3	2	1	67

2. Examiners

S.L. McCrory, Chief Examiner, NRC
J. Whittemore, NRC
J. Pellet, NRC

3. Examination Report

This Examination Report is composed of the sections listed below.

A. Examination Review Comment Resolution

B. Exit Meeting Minutes

C. Generic Comments

D. Requalification Program Evaluation Report

E. FCS Examination Key (SRO/RO Questions and Answers)

Performance results for individual candidates are not included in this report because examination reports are placed in NRC's Public Document Room as a matter of course.

A. Examination Review Comment Resolution

In general, editorial comments or changes made during the examination, the examination review, or subsequent grading reviews are not addressed by this resolution section. This

section reflects resolution of substantive comments made during the examination review. The modifications discussed below are included in the master examination key which is provided elsewhere in this report as are all other changes mentioned above but not discussed herein.

COMMENTS

(1) 5.1/ 5.1*/ 1.1*
Part B as written may imply that conduction is the only mode of heat transfer.
Resp. **REJECT.** No words in the question specify that conduction is to be considered the only means of heat transfer.

(2) 5.3*
Parts C and D should both be true.
Resp. **ACCEPT.**

(3) 5.4*
The range of values for 1* should be 10^{-5} - 10^{-4} as it is in the SRO exam.
Resp. **ACCEPT.**

(4) 5.6/ 5.6*/ 1.3*
The key is correct for a step change in reactivity. If the candidate assumes a constant SUR, then the time to change K_{eff} is the same.
Resp. **ACCEPT.** The candidate must state the assumption being used if the time intervals are said to be equal.

(5). 5.7/ 5.7*
The change in xenon worth with core age is negligible at FCS. This is reflected by the single xenon worth curve used throughout a core cycle.
Resp. **REJECT.** As a core ages the equilibrium concentration of xenon goes down. However, because of the large flux increase, the reactivity worth of the xenon goes up. The FCS curve only represents the net effect of these two changes.

(6) 5.9/ 1.4*
The answer to part D would be "lower" if the examinee assumed early in core life with a positive MTC.
Resp. **REJECT.** Adjusting the pressure setpoint for the pressurizer only affects the saturation temperature in the pressurizer and not the operating temperature of the RCS. Therefore, with no change in the RCS temperature it does not matter what the value of the MTC is.

* Denotes requalification examination

(7) 5.10/ 1.5* An additional explanation for Part A is that there is less competition with soluble poison as boron is expanded out of the core. An additional cause in Part B is the reduction in boron concentration as the core ages.
Resp. **ACCEPT.**

(8) 6.1/ 6.1*/ 3.4* For Part A, an additional answer is that the auto transfer switch must be in Auto. The USAR describes two additional means of 4160 volt load shed which should be included in the key. Alternate terminology for B.2 and B.3 is delayed, undervoltage load shed and backup load shed respectively.
Resp. **ACCEPT.**

(9) 6.2/ 6.2*/ 3.5* Part A could include APD depending on one or both subchannels failing.
Resp. **ACCEPT.**

(10) 6.3/ 3.6* The answer to Part A.2 is incorrect. The ROC trip is enabled above 10^{-4}% power and disabled below 10^{-4}% power. The answers to Part B are correct for increasing power. The exact opposite would be correct or decreasing power. Additionally, the key is not consistent in that Part A requires power level but Part B does not.
Resp. **ACCEPT.**

(11) 6.4/ 3.1* Steam generator level (for AFAS) and degraded voltage (for OPLS) should also be correct.
Resp. Half credit was given for these since they will cause safeguards action even though they are not integral to ESF Control Systems.

(12) 6.9/ 2.1* The brake in Part A is actually an electro-mechanical brake. Better answers for Parts C.1 and C.2 would be:
C.1 Dashpot action of piston in CEDM piston guide tube (velocity of piston is limited by the orifices).
C.2 Impact is reduced by an energy absorbing sacrificial hard stop in the event of a "dry trip".
The answer to Part D is incomplete. A list of verified indications and alarms is provided.
Resp. **ACCEPT.** All of these comments were accepted in whole or part based on NRC agreement that they addressed the question asked.

* Denotes requalification examination

(13) 6.10/ 6.6*/ 3.3* The list of prerequisites for startup of a feedwater pump is longer than that in the key. A list is provided. It is a lengthy list for an operator to have to memorize since the procedure would always be used.

Resp. The key was revised to include the entire list but only two answers were required from the list.

(14) 7.2/ 4.1* Part B should include "erratic nuclear instrumentation indication".

Resp. **ACCEPT.**

(15) 7.3/ 7.2* Part B should include the electrical equipment book as an alternate correct answer.

Resp. **ACCEPT.**

(16) 7.6/ 7.4*/ 4.3* Part A.2 is debatable since the plant would probably trip due to loss of coolant before RCS chemistry or activity changed significantly. For Part B, it should be noted that the T_{ave} - T_{ref} annunciator is normally illuminated at FCS.

Resp. **REJECT.** The question asks for long term effects while continuing to operate, not what is plant response with no operator action. Changes in RCS chemistry and activity is a legitimate concern for the question asked. The fact that FCS choses to operate in such a way as to make the T_{ave} - T_{ref} annunciator ineffective does not bear on the validity of the question as stated.

(17) 7.10/ 7.6*/ 4.6* Additional answers to Part A should be:
7. Closed indication, or green light, on shutdown cooling system valves.
8. Red (running) light for LPSI pump not on (green light may be on).

Resp. **ACCEPT.**

(18) 8.1/ 8.1* The Standing Order referenced is a "maintenance" standing order. The operators have no responsibility for ensuring the calibration of test equipment described in Part A.

Resp. **REJECT.** The Shift Supervisor is implicitly responsible for nearly everything that occurs in the plant especially testing which is generally performed to satisfy surveillence requirements of Technical Specifications. The knowledge solicited

*Denotes requalification examination

in this question is general in nature and while the Shift Supervisor is not personally required to do a number of things affecting plant operation, he/she is required to know who is responsible.

(19) 8.2 For Part A the condensate pump discharge chemistry results are also contained in the secondary chemistry summary report. Also the candidate should be given credit if he/she correctly describes where these reports and logs are kept without knowing the official name of the record. Since the results recorded in these logs is rarely given to the operators and since the operators are not responsible for the information in these logs, the operators should not need to know this information.

Resp. The comment for Part A was incorporated. The general comment for location was given consideration during the grading but not made a part of the key. In the same vein that the Shift Supervisor should know who is responsible for various actions (as discussed in item 18 above), the Shift Supervisor must be knowledgeable about the information kept in the control room which pertains to plant operation especially if the information is normally kept in the Shift Supervisor's office.

(20) 8.3/ 8.2* Part A may be misleading since the Radiation Protection Manual contains both NRC and OPPD quarterly limits and the question does not specify either limit. Also, it seems inappropriate to require an operator to know the entire procedure for authorizing an extension.

Resp. Standing Order T-10 used as the source for this question makes no distinction concerning the limits in question. Since each operator has a personal responsibility concerning his/her radiation exposure, it is appropriate to expect the operators to know in general the various processes which control their exposure.

(21) 8.4/ 8.3* A third correct answer to Part C should be "standing orders" or "administrative manual".

Resp. **ACCEPT.**

(22) 8.6 For Part D, it should be unnecessary to call out the FCS Manager as a separate answer since he is a member of the PRC.

*Denotes requalification examination

Resp. **REJECT.** Since alternates may be appointed to the PRC who are not prohibited by Technical Specifications from acting as PRC Chairman, it is possible that the plant manager may not sign as a member of the PRC. Therefore, he must sign as the plant manager to satisfy Standing Order G-3.

(23) 8.7/ 8.4* Additional answers to Part A are Axial Shape Index (ASI) and peaking factors.

Resp. **REJECT.** "Parameter" is most commonly used to denote a characteristic that is directly measurable such as temperature or pressure. ASI and peaking factors are computations based on directly measurable parameters.

(24) 8.10/ 8.7* Part A of this question is not at all applicable to the job performance of an operator. None of the emergency team members are operators. This part should be deleted.

Resp. **REJECT.** The Shift Supervisor is not simply an "operator". For at least 70% of the time that the plant is operating continuously at power, the Shift Supervisor is the senior management representative on site. Furthermore, the Shift Supervisor is the emergency coordinator during the early phases of an emergency and, depending on the accessibility of the site, may continue in this function for a considerable period of time. Because of this responsibility, the Shift Supervisor must be able to direct the efforts of emergency team members who are available which includes helping the members determine their assigned duties and responsibilities.

(25) 2.4* Either RM-055 or RM-055A would monitor the release and provide isolation signals. Normal practice has either HCV-691 or 692 shut with the other open so that auto closure of the open valve would isolate.

Resp. Either Radiation Monitor is acceptable. The fact that one of the two valves is normally closed has no bearing on the question because the valve that fails to shut may still be the one that was originally open.

General Resp. There were other comments made concerning question clarity or intent which had no effect on the grading. These comments will be used to revise questions in the examination bank for future use.

* Denotes requalification examination

B. Exit Meeting Summary

At the conclusion of the exam period, examiners met with representatives of the plant staff to discuss the results of the examinations. The following personnel were present for the exit interviews:

NRC	UTILITY
S. McCrory	J. Fluehr
J. Whittemore	J. Gasper
J. Pellet	W. G. Gates
R. Cooley	L. T. Kusek
P. Harrell	J. Gass

NRC informed the facility staff that all candidates except three were clear passes on the oral examinations. All of the marginal candidates were Senior Reactor Operators two of whom had taken requalification examinations. Generally, most candidates performed satisfactorily. Some areas where more than one candidate had difficulty were pointed out to the facility staff.

(1) Operators had no consistent approach for achieving a boron concentration change while in mode 5 or were unable to obtain the necessary information for making calculations.

(2) Some operators did not appear to understand the power distribution limits and had difficulty performing calculations without the plant computer.

(3) Some operators had difficulty locating reference material in the control room.

(4) Some operators were unable to mitigate the consequences of instrument failures due to lack of formal guidance.

(5) Some senior operators do not routinely review the key control or tagout logs during shift turnover since there is no administrative requirement to do so.

C. Generic Comments

Performance on the written examination was poor as evidenced by the high failure rate. Senior Operators performed poorly in all categories of the requalification examination. Reactor

Operators who were given many of the same questions as the Senior Operators performed significantly better in all categories. A review of the performance on individual questions did not identify specific weak areas but tended to support an evaluation that there is an overall programmatic weakness.

On December 12-13, 1985, NRC met with OPPD personnel to discuss the performance on the requalification examinations. OPPD provided copies of the facility requalification examinations administered during the current requalification cycle. NRC examiners graded a representative sample of these examinations and found that NRC and facility grading agreed within 5%. NRC pointed out that the questions developed by FCS training personnel were marginal in the scope and depth of knowledge required of operators.

On December 17, 1985, NRC conducted interviews with facility training personnel and operators to further assess the adequacy of the FCS requalification program. Attachment 1 is the questions that were asked in these interviews. Individual responses are not contained in this report. As a result of these interviews, NRC concluded that there is no evidence indicating compromise of the facility requalification examinations either during development or administration. However there were strong indications that the program lacked upper level management attention. Personnel above the level of the training coordinator admitted to little or no participation in developing or approving examinations prior to administration or in reviewing the grading or final results.

The FCS Requalification Program is evaluated as unsatisfactory for the purposes of certifying the proficiency of operators applying for license renewal. License renewals for FCS operators are subject to the following conditions:

(1) All renewal applications must continue to be submitted in a timely manner in accordance with 10 CFR Part 55.

(2) Until such time that the FCS requalification program is evaluated as satisfactory, all operators applying for license renewal after November 12, 1985, must pass an NRC administered requalification examination.

(3) Operators who apply for license renewal in accordance with 10 CFR Part 55 and who have passed a FCS administered requalification examination through December 12, 1985, may continue to exercise their privileges under the current license until an NRC examination can be administered.

(4) Operators who have passed an NRC administered requalification examination within one (1) year prior to the expiration of their current license and who have passed all interim requalification examinations will be considered for immediate license renewal.

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D. Requalification Program Evaluation Report

Facility: Fort Calhoun Station
Examiner: S. L. McCrory
Dates of Evaluation: 11/12/85
Areas Evaluated: X Written X Oral ____ Simulator

Written Examination
1. Evaluation of Examination: Unsatisfactory Performance
2. Evaluation of Facility Examination Grading: Satisfactory

Oral Examination
1. Overall Evaluation: Marginal
2. Number Observed: _____ Number Conducted: 8

Simulator Evaluation
1. Overall Evaluation: NA
2. Number Observed: _____ Number conducted: _____

Overall Program Evaluation

Satisfactory: ____ Marginal: ____ Unsatisfactory: X
(List major deficiency areas with brief descriptive comments)

See Section C. of the examination report for details reguarding the program evaluation.

Submitted: Forwarded: Approved:

Examiner Section Chief Branch Chief

E. FCS EXAMINATION KEY

Date Administered: 11/12/85

Exam Type: Senior Reactor Operator License
Senior Reactor Operator and Reactor Operator
Requalification

FCS EXAMINATION REPORT
No. Attachment 1

I. Describe how Requalification Examinations are generated and assembled.

A. Who is responsible for initial assembly?

B. How are the subject and scope of the questions determined before developing new questions or selecting questions from the bank?

C. What is the chain of approval for an examination?

D. How many different RO and SRO examinations are prepared and administered for a single session?

E. Describe how examinations and examination keys are safeguarded in the interim between examination preparation and administration.

1. How many copies of keys are made?
2. How are these copies distributed?
3. Who (name and title) is involved in examination and examination key preparation, assembly, copying and distribution? Include clerical and administrative personnel.

F. Typically, how long after final approval are the examinations administered?

G. What are all the approved sources (not reference material) for questions that can be utilized in an examination?

1. Who may submit questions for approval?
2. Describe the procedure or mechanism of approval.
3. May new questions be developed for a specific examination or must all come from the question bank?

H. What is your estimate of the minimum time needed to prepare and approve an examination, using your current system?

I. What are the total number of people that have access to the examination question bank?

1. What are the restrictions to access?
2. Who approves access?

II. Describe how written examinations are administered.

A. What are the facility requirements for proctoring written requalification examinations?

1. Specific individuals?
2. Proctor qualification (Operator, Instructor, Secretary, etc.)?

B. What verbal instructions are given to candidates? Provide a list if possible.

C. Are standard written instructions given to candidates. Provide a copy.

D. What specific instructions or guidelines are given to proctors to detect or prevent examination compromise (cheating) during administration.

1. What will the proctor do if cheating is detected?
2. What will the proctor do if cheating is suspected?

E. What materials may a candidate bring into and remove from the examination area?

F. What is the time limit allowed for taking examinations?

1. Is a break provided between examination categories? For lunch?
2. If yes, how is examination integrity guaranteed?

G. Are the examinations always administered in the same place?

1. Where?
2. What is done to ensure that the examination cannot be compromised once the candidates are assembled in the examination area? (All training aids removed, check for hidden cheat sheets)

Note: NRC examinations are usually administered at a motel meeting room. Apparently this is done to meet NRC requirements for spacing, etc. If requalification examinations are not given off-site, there is reason to suspect that adequate space requirements may not be met.

H. What is done if an individual shows up after the examination has started or does not show up at all for his/her scheduled examination? Is a new examination prepared or questions substituted?

III. Describe how written examinations are graded and evaluated.

A. Who (name and title) performs the initial grading of requalification examinations?

B. Who reviews the initial grading and how are grading deviations resolved?

1. Describe any extra review of marginal examination performance (78-82% overall, 68-72% category).

C. Who gives final approval for examination grading results?

D. What happens to copies of examinations and keys after administration and grading?

E. What procedures are used by the graders to detect compromise or cheating on an examination?

IV. Other relevent programmatic issues.

A. Describe the current mechanism or procedure for deleting or changing bank questions as a result of plant and procedure changes.

B. What criteria are used for deleting questions from an examination that has already been administered and graded?

C. How is question performance evaluated?

1. What feedback mechanism revises the question bank based on individual question performance?

D. Describe how examination performance results are recorded and filed?

1. Who (name and title) is responsible for entering results in permanent records?
2. What is the official "documentation of performance" on written examinations taken two years ago?

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

Facility: Fort Calhoun Station

Reactor Type: CE-PWR

Date Administered: 11/12/85

Examiner: S.L. McCrory

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

READ THE ATTACHED INSTRUCTION PAGE CAREFULLY. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up **SIX** (6) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Category Value	Category
25	25			5. Theory of Nuclear Power Plant Operations, Fluids, and Thermodynamics
25	25			6. Plant Systems Design, Control and Instrumentation
25	25			7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
25	25			8. Administrative Procedures Conditions, and Limitations
100				TOTALS
		Final Grade	%	

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

_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

    a. Assemble your examination as follows:
       (1) Exam questions on top.
       (2) Exam aids - figures, tables, etc.
       (3) Answer pages including figures which are a part of the answer.

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

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

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

    e. Do not dicuss the examination with other licensee staff personnel until the formal examination review is complete.

5. THEORY OF NUCLEAR POWER PLANT OPERATIONS, FLUIDS, AND THERMODYNAMICS

5.1 TRUE or FALSE? No explanation required. (2.0)

A. As condenser vacuum is increased (absolute pressure decreased), more energy can be extracted from the steam.

B. The main condenser uses the conduction mode of heat transfer to reject heat to the circulating water system.

C. Increasing condensate depression (subcooling) will increase overall plant efficiency.

D. Decreasing condensate depression (subcooling) will decrease condenser vacuum.

ANS:

A. TRUE
B. TRUE
C. FALSE
D. FALSE

KEY:

HTTRANS FLUID

REF:

BASIC FLUID MECHANICS AND HEAT TRANSFER

VAL:

0.5 pt each

5.2 What is the difference in CAVITATION and GAS BINDING in a centrifugal pump? (2.0)

ANS:

Gas binding occurs when a pump is filled with a gas, such as air, so that the pump cannot pump the fluid desired.

Cavitation occurs when inadequate NPSH is available so voiding or boiling of the pumped fluid occurs in the pump suction.

KEY:

FLUID

REF:

BASIC FLUID MECHANICS

VAL:

1 pt each

5.3 TRUE or FALSE? No explanation required. (2.0)

A. The operator can increase the heat removal rate from the RCS by reducing steam pressure.

B. A LOCA with no RCP's running can result in more inventory loss than a LOCA with RCP's running.

C. A total and prolonged loss of feedwater can lead to a loss of RCS liquid inventory.

D. The primary concern when fuel clad temperature reaches 1400°F is the production of hydrogen.

ANS:

A. TRUE
B. FALSE
C. TRUE
D. TRUE

KEY:

FLUID HTTRANS REAC

REF:

BASIC REACTOR THEORY

VAL:

0.5 pt each

5.4 A. What is the minimum reactivity that must be added to a critical reactor for it to be prompt critical? (1.0)

B. How much (by what factor) would power increase in one second at FCS if it were prompt critical? (2.0)

ANS:

A. p (reactivity) GE beta effective (beta value = 0.005 -0.007)

B. $T = l^*/p + (B-p)/\text{lamda } p$ (0.5)

So for prompt critical neglect the delayed term so that

$T = l^*/p$ (.25)

$l^* = 10^{-5} - 10^{-4}$ sec (.25)

$p = 0.005 - 0.007$ (.25)

$T = 10^{-5}/p = .0014 - 0.002$ sec (.25)

$P/P_o = e^{t/T} = e^{(50 - 700)/1 \text{ sec}}$ (0.5)

KEY:

RXTH COREOPS

REF:

BASIC REACTOR THEORY

VAL:

1 pt for A, and as indicated for B.

5.5 When loading fuel into the core, should fuel be loaded toward the detector or away from it? EXPLAIN (1.0)

ANS:

Fuel should be loaded toward the detector (0.33) so that the 1/M plot conservatively predicts criticality (0.67).

KEY:

RXTH COREOPS

REF:

BASIC REACTOR THEORY

VAL:

As indicated.

5.6 A. Explain how neutron production and indicated count rate would change if the neutron sources were removed from the reactor while it was subcritical (K_{eff} less than 1). (2.0)

B. Explain how long it would take to reach a steady-state count rate when K_{eff} is increased from 0.990 to 0.999 if it took one minute to achieve a steady-state count rate when K_{eff} was increased from 0.90 to 0.99. (1.0)

ANS:

A. The count rate would decrease to a small value since the reaction is not self-sustaining (1.0). Neutron production would not go to zero since spontaneous and cosmic fissions still occur, but the indicated count rate could be 0 due to instrument limitations (1.0).

B. Longer (0.7) - 10 minutes OR 10 times as long (0.3).
(If candidate states assumption of constant SUR, then accept that the time interval will be the same in both cases.)

KEY:

RXTH NEUT

REF:

BASIC REACTOR THEORY

VAL:

As indicated in the answer.

5.7 A. HOW does equilibrium Xenon reactivity (XE-eq) at hot full power change as a function of core age (EFPD)? (0.5)

B. WHY does Xe-eq change as a function of core age? (1.5)

ANS:

A. Xe-eq gets larger as a function of core age.
B. Xe-eq is a function of flux not power (0.75) and flux increases as a function of core age (0.75).

KEY:

RXTH POISONS

REF:

BASIC REACTOR THEORY

VAL:

As indicated.

5.8 How does the departure from nucleate boiling ratio (DNBR) change (INCREASE, DECREASE, or REMAIN THE SAME) for each of the following events or conditions? The answer should consider only initial plant response prior to automatic action. Briefly explain each answer.

A. Ejected CEA (1.0)

B. Main Steam line break (1.0)

C. Loss of coolant accident (1.0)

D. Loss of cooling water to letdown heat exchanger (1.0)

ANS:

A. Decrease - local power goes up

B. Increase - overcooling lowers temperature

C. Decrease - depressurization / reduced RCS flow

D. No effect - no change until letdown isolation on high temp.

KEY:

HTTRANS FLUID

REF:

Basic Thermo

VAL:

4 pts, 1 pt each (0.5 pt each for trend and explanation).

5.9 During a reactor startup, will the actual critical position be HIGHER, LOWER, or the SAME AS the estimated critical position calculated before the following changes? EXPLAIN your choices. (Consider each change separately). (3.0)

A. The operator starts using main steam to warm the turbine prior to reaching criticality.

B. Actual boron concentration was 30 ppm lower than the value used for figuring the ECP.

C. Criticality is achieved 4 hours earlier than the ECP time; a shutdown time of sixteen (16) hours was used for the ECP.

D. The pressurizer pressure setpoints are all lowered by 50 psi prior to criticality.

ANS:

A. LOWER - because the lowering of temperature will insert positive reactivity. (Will accept SAME if RCP heating is identified as being sufficient to overcome heat loss for turbine warmup.) OR
HIGHER - MTC for startup following refueling is slightly positive. (Must state BOL assumption for full credit)

B. LOWER - because the lower boron concentration inserts positive reactivity.

C. HIGHER - because the lack of Xe decay will insert negative reactivity.

D. HIGHER - because lowering the pressure inserts negative reactivity. (Will accept SAME if the change is considered insignificant but recognized.)

KEY:

REAC POISONS COREOPS

REF:

CE Rx theory

VAL:

3 pts, 0.25 for HIGHER/LOWER, and 0.5 for explanation.

5.10 For each of the following, choose the situation for which INDIVIDUAL rod worth will be greater. Briefly explain your choice. (3.0)

A. T_{ave} equal to 150°F or 500°F?

B. Early in core life or late in core life?

C. Near the center of the core or near the edge of the core?

ANS:

A. 500°F - at higher temperatures, the diffusion length is greater, allowing neutrons to reach control rods from further away and enhancing control rod effectiveness. OR at higher temperatures, there is less competition with boron which is expanded out of the core.

B. Late in life - as the core ages the flux density goes up causing rod worth to go up. OR as the core ages the boron concentration is reduced.

C. Near the center - flux density tends to be higher near the center of the core due to less leakage.

KEY:

REAC COREOPS RXTH

REF:

CE reactor theory

VAL:

3 pts, 0.4 for choice and 0.6 for explanation.

END OF CATEGORY 5

6. PLANT SYSTEMS DESIGN, CONTROL AND INSTRUMENTATION

6.1 A. Indicate 4 of 5 conditions that must exist for a fast transfer to alternate power on a 4.16 KV bus to occur. (1.0)

B. Describe 3 mechanisms by which loads are shed from 4.16 KV busses. (1.5)

ANS:

A. (ANY 4)
1. Sources synchronized
2. No faults
3. Correct voltage on on-coming source
4. Original source breakers open properly
5. Breaker switches properly aligned.
6. Bus transfer switch in AUTO.

B. 1. Lockout relays which operate as a result of bus faults.
2. Undervoltage relays (delay or uv load shed).
3. Relays operated by logic of aux. contacts on supply breakers (backup load shed).
4. Relays operated by contacts of logic relays (Accept specific methods that use this mechanism)
5. Manual

KEY:

ELEDST CNTRL

REF:

FCS SD II-1, pgs 27, 28

VAL:

A. 0.25 ea
B. 0.5 ea

6.2 A. Which reactor trips will NOT initiate a trip on a loss of analog signal? (1.5)

B. What are the effect(s) on the protection system of a failure of a logic matrix trip relay to deactuate? Why? (1.0)

ANS:

A.
1. High power
2. High rate of change of power
3. High pressurizer pressure
4. APD

B. Should have no effect as there are 6 logic matrices whose trip relays will initiate trip action.

KEY:

RPS CNTRL

REF:

FCS SD II-5, pgs 37, 38

VAL:

A. 0.5 ea
B. 1 pt

6.3 A. State the purposes of the 2 bistables that interface Wide Range Log Power with the Reactor Protection System. (1.0)

B. What is accomplished by the bistable that interfaces the Safety Power Range to the Protection System? (1.5)

C. Describe how the signal due to gamma is negated in the Wide Range. (0.5)

ANS:

A. 1. Remove the zero mode bypass (above 10^{-4}% power).
2. Disables the ROC trip as power decreases (below 10^{-4}% power) OR Enables the ROC trip as power increases (above 10^{-4}% power).

B. 1. Disables ROC trip.
2. Enables APD trip
3. Enables loss of load trip
(If the candidate states a power decrease as an assumption, then the reverse of the above three answers is correct.)

C. Pulses produced by gamma in both detectors are of a smaller magnitude and are discriminated out (0.25). When the signal is Campbelled (squared), contribution from gamma becomes insignificant (0.25).

KEY:

RPS NI INTLK

REF:

FCS SD II-6, pgs 4-7

VAL:

A. 0.5 ea
B. 0.5 ea
C. as indicated

6.4 What 5 critical parameters are used in the Engineered Safeguards control system to provide control/initiation signals? (1.5)

ANS:

1. Reactor coolant pressure
2. Containment pressure
3. Containment radiation
4. SIRW tank level
5. S/G pressure

Give ½ credit for S/G level or degraded voltage since these signals will cause safeguards action even though they are not integral to ESF Control Systems.

KEY:

ESF CNTRL

REF:

FCS SD II-7, pgs 3, 4

VAL:

0.3 ea

6.5 A. Explain how it is possible to operate the Turbine Driven Auxiliary Feed Pump should all air and electrical power, including DC, be lost. (1.0)

B. What 4 parameters can be monitored in the Control Room to provide indication of adequate suction for an operating AFW pump? (1.0)

ANS:

A. Steam to the turbine can be manually controlled locally at the pump (0.5). Lube oil pressure for bearings will be provided by an attached unit pump (0.5).

B. Storage tank level
Pump discharge pressure
Pump flow
Motor current

KEY:

AFW IND CNRTL

REF:

FCS SD III-4, pgs 7, 14, 20

VAL:

A. as indicated
B. 0.25 ea

6.6 A. Describe how the steam dump valves will react to the following: (1.0)

1. Turbine trip at 68% power
2. Turbine trip at 18% power

B. Describe how the steam bypass valve will react to the following: (1.0)

1. Turbine trip at 68% power
2. 10% load reject at 28% power.

ANS:

A. 1. Will trip full open and modulate shut at dT of 3°F.
2. Modulate open at 8°F dT and will be fully shut when dT reaches 3°F.

B. 1. Same as A.1.
2. Will modulate open to maintain no-load steam pressure.

KEY:

MNSTM CNTRL VALVE

REF:

FCS SD III-2, pgs 32, 33

VAL:

0.5 ea

6.7 A. What provides indication of RCS level/volume in the control room when the system is drained below pressurizer level taps? (1.0)

B. Aside from indication, what are the specific uses of the signals generated by the low range pressurizer pressure detector? (1.0)

C. What specific abnormality would result in low Surge Line Temperature indication? (No other immediate indication.) (0.5)

ANS:

A. Control room indication is provided by differential pressure transmitter (LI 197) between a low pressurizer level tap and a hot leg.

B. 1. Shutdown cooling pressure interlock.
2. Low temperature overpressure protection.

C. A low surge line temperature alarm would indicate a decrease in continuous spray line flow.

KEY:

RCS CNTRL INTLK VALVE

REF:

FCS SD I-4, pgs 51, 52, 71

VAL:

A. 1 pt
B. 0.5 ea
C. 0.5

6.8 Describe the primary protection function or basis for the following reactor trips: (3.0)

A. Thermal margin/low pressure
B. Axial power distribution
C. High reactor power
D. High rate of change of reactor power
E. High pressurizer pressure
F. Containment high pressure
G. Low steam generator water level
H. Low steam generator pressure
I. Low reactor coolant flow
J. Manual

ANS:

A. Prevents reactor operations when DNBR LT minimum design
B. Prevents peak local power from damaging core (KW/ft fuel centerline melt)
C. Protect fuel cladding against reactivity excursions too rapid to be protected by high pressure or TM/LP (CEA ejection)
D. Uncontrolled CEA withdrawal or boron dilution incident during startup or very low power levels
E. Prevent excessive blowdown of RCS by a PORV or safety valve opening by preventing the reactor from generating more heat than can be removed by the steam generators.
F. Ensures the reactor is tripped on conditions which require safety injection.
G. Loss of feedwater accident, assures RCS pressure does not exceed design.
H. Protects against excessively high steam flow caused by a major steam leak
I. DNB core protection on a sudden flow decrease.
J. Permits the operator to trip when the reactor should be tripped prior to forcing automatic action.

KEY:

CNTRL LMTS RPS

REF:

FCS SD II-5, pgs 3-8

VAL:

0.3 each

6.9 A. What prevents inadvertant motion of a CEA when power to the drive motor is interrupted? (0.5)

B. What prevents upward movement of a CEA when the electromagnetic clutch is de-energized? (0.5)

C. What limits the velocity and impact of a CEA when it drops into the core? (Two answers required for full credit) (1.0)

D. List 5 indications of rod position. These indications may not give actual rod position but may only indicate that a rod or rod group has met certain conditions of withdrawal or insertion. (1.0)

ANS:

A. A electro-mechanical brake engages when the motor is de-energized.

B. Anti-reversing clutch

C. 1. Orifices in the tube enclosing the rack assembly.
2. Dashpot action of the lower guide tube.
3. Shock absorbing stop
(Accept answers 1 & 2 or 2 & 3)

D. (ANY 5)
1. Primary CEA indication system
2. Secondary CEA indicating system
3. Metrascope
4. Group deviation
5. rod bottom lights
6. Power dependent insertion limit
7. Lower electric limit light
8. Dropped rod alarm
9. Shutdown group insertion permissive alarm
10. Regulating group withdrawal prohibit alarm

KEY:

RODCNTRL INTLK IND

REF:

FCS SD I-3, pg 13** This SD was titled "Reactor" and a new SD with the same number was recently issued with the title "Post Accident Sampling System"

VAL:

A-C 0.5 ea
D. 0.2 ea

6.10 How will the loss of control air and/or electrical power affect the feed pump recirculation system? (0.5)

B. What is the purpose of the 3 pressure switches associated with each feed pump lube oil system? (1.5)

C. Aside from switch and breaker lineup, what conditions must be met to start a feed pump? (1.0)

ANS:

A. The recirc valve will fail open.

B. (ANY THREE)
1. Allows MFP to start at normal LO pressure
2. Starts motor driven pump on decreasing oil pressure.
3. Stops MFP on Lo-Lo oil pressure.
4. Alarm

C. (ANY TWO)
1. Check the lube oil reservoir level.
2. Ensure pumps are preheated to operating temperatures.
3. Start oil pump and verify oil flow through the bearing.
4. Verify turbine plant cooling water flow to lube oil cooler, and seal coolers.
5. Open cold condensate injection valve to mechanical seals.
6. After maintenance:
   a. Fill pump by opening suction bypass
   b. Crack open seal water vent
   c. Open suction
   d. Close vent after pump reaches operating temperature
7. Check that lockout relay in back of CB-10 is reset.
8. Place auto-off switch in off
9. Start pump and ensure recirculation valves and motor operated discharge valve open.

KEY:

MFW PUMP CNTRL

REF:

FCS SD III-5, pgs 34-36

VAL:

0.5 ea

END OF CATEGORY 6

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

7.1 A. During the initial stages of a load rejection incident, why might the operator observe that spray valves are open and pressurizer heaters are energized at the same time? (1.0)

B. Follow up action requires that the operator ensures that any lifted steam system safety valves reseat after proper blowdown. What is blowdown and why is it a design function of the safety valves. (1.0)

C. The operator is further required to cool the quench tank if necessary. How is this cooling accomplished? (0.5)

ANS:

A. 1. Spray valves open in response to increasing RCS pressure.
2. The heaters respond to increasing pressurizer level.

B. 1. The amount of pressure reduction below lift setpoint.
2. This characteristic is designed into the Safety Valves to prevent chatter or oscillation at lift setpoint.

C. By alternate spraying and draining as necessary.

KEY:

EOP RCS VALVE CNTRL

REF:

FCS EP-2, pgs 1, 2

VAL:

0.5 ea

7.2 A. During a Loss of Coolant Accident (LOCA), what are 3 conditions that require the operator to trip the Reactor Coolant Pumps? (1.0)

B. Aside from subcooling and varying pressurizer level, what are 3 indications that core voiding is occuring? (1.0)

C. During a LOCA with subsequent loss of all off site power, explain how the operator can use pressurizer heaters for RCS pressure control. (1.0)

ANS:

A. 1. RCS pressure LT 1350 psia
2. Subcooled margin LT 20^{o}F.
3. Containment radiation alarm

B. (ANY 3)
1. Increasing core dT
2. Erratic S/G dP
3. Erratic RCP motor current
4. RCP vibrations
5. Erratic NI indication

C. The proportional heaters and one group of backup heaters from each bank are available after 480 VAC load shed and sequencing (0.5). The back up heaters must be "reset" before they can be used (0.5)

KEY:

EOP RCS ELEDST PUMP

REF:

FCS EP-5, pgs 3-5

VAL:

A & B 0.33 ea
C. as indicated

7.3 A. Immediate action for "Loss of Instrument Bus Power" requires the operator to place affected reactor trip channels in "bypass". How is plant safety affected should the operator FAIL to carry out this action? Explain. (1.0)

B. How will the operator determine specific equipment affected by loss of a specific instrument bus? (0.5)

C. What are two general conditions where this incident may cause a reactor trip? (1.0)

ANS:

A. Plant safety is unimpaired.
In a case where the loss of power causes a channel trip, only one more trip would be required to trip the reactor.

B. Specific loads are listed in the technical data book or electrical equipment book.

C. 1. If a channel on an unaffected bus was previously tripped.
2. If loss of power affected control of a parameter which provided a trip signal (such as S/G or PZR level).

KEY:

RPS AOP IND ELEDST

REF:

FCS EP-20, pgs 1, 2

VAL:

A. 0.33 ea
B. 0.5 ea
C. 0.5 ea

7.4 System operation procedures require the operator to position the manually operated Condensate Pump discharge valve differently upon starting the pump, dependent on whether another pump is operating. Explain how and why the valve is positioned for the two different starting conditions. (2.0)

ANS:

If another pump is not operating, the discahrge valve on the pump being started should be nearly shut to minimize the time that peak starting current is applied to the motor. (Accept starting current.)

If another pump is operating, a pump may be started with the valve open as pressure from the running pump will seat the discharge check valve and restrict flow upon starting to minimize starting current.

KEY:

NOP MFW COND PUMP

REF:

FCS OI-FW-1, pgs 2,3 and OI-FW-2, pg 4

VAL:

1 pt ea

7.5 A. Why should the following temperature limits be adhered to during RCS leak testing? (1.5)

1. Maximum pressurizer temperature of approximately 388°F.
2. Minimum RCS loop temperature of 360°F.

B. Why should the pressurizer temperature be maintained above loop temperature during leak testing? (1.0)

ANS:

A. 1. To allow rapid depressurization of the RCS to a low value (approx. 200 psig).
2. So that base metal does not undergo brittle fracture during test.

B. So that a void will form in the pressurizer instead of the vessel head should inadvertant depressurization occur.

KEY:

AOP RCS LMTS

REF:

FCS OI-RC-2B, pgs 1, 2

VAL:

A. 0.75 ea
B. 1 pt

7.6 A. During normal operation at power, it becomes necessary to secure charging and letdown. Describe any long term effects on the RCS while continuing to operate with charging and letdown secured. (1.0)

B. Shortly after shifting to a new purification system ion exchanger column during steady state power operation, a valid T_{ave}-T_{ref} deviation alarm is received. What is most likely occuring and what are the required short term and long term actions to correct the problem? (1.0)

C. What is done before drawing a SIRWT sample to ensure the sample is representative? Be specific as to equipment used. (1.0)

ANS:

A. (ANY TWO)
1. RCS volume will decrease approximately 4 gal/min due to pump seal leakage.
2. RCS activity may increase and other chemical parameters may change due to loss of purification.
3. Boron concentration cannot be controlled.

B. The new ion exchanger is reducing RCS boron concentration.
Stop dilution by isolating purification.
Re-establish T_{ave} by rod insertion or boration.
Place a properly borated ion exchanger on line.

C. Tank is recirced (0.33) using a LPSI pump (0.33) and a fuel transfer canal drain pump (0.33).

KEY:

AOP CVCS PATH DESGN

REF:

FCS OI-CH-1, pg 4, CH-2, pgs 1-6, and CH-4, pg 18

VAL:

A. 0.5 ea
B. 0.25 ea
C. as indicated

7.7 What are the permissible accumulated doses (PAD) for each of the cases below? (2.0)

A. Normal O.P.P.D. daily PAD.

B. Normal O.P.P.D. weekly PAD.

C. Normal O.P.P.D. quarterly PAD.

D. Normal O.P.P.D. yearly PAD.

E. Maximum quarterly PAD.

F. Maximum yearly PAD.

ANS:

a. 100 millirem (mr)., b. 300 mr, c. 1250 mr, d. 5000 mr, e. 3 rem, f. 12 rem.

KEY:

RADCON LMTS

REF:

FCS RADIATION PROTECTION MANUAL, Section 2.4.1, pg. VII-2-4

VAL:

0.333 ea

7.8 What are the threshold (or minimum) exposure levels that require an area be posted as: (2.0)

A. a Radiation Area, and

B. a High Radiation Area.

ANS:

a. Where a major portion of the body could receive in any 1 hour a dose in excess of 5 mr, or in any 5 consecutive days a dose in excess of 100 mr.(1.0)
b. Where a major portion of the body could receive exposure greater than 100 mr/hr.(1.0)

KEY:

RADCON LMTS

REF:

FCS RADIATION PROTECTION MANUAL, Section 3.1.7/8, pg. VII-3-4/5

VAL:

1 pt ea

7.9 A. When may a standing rather than job specific Radiation Work Permit (RWP) be issued? (1.0)

B. What is the normal period for which a standing RWP is issued? (0.5)

C. Who (by job title) must sign a standing RWP for it to be issued? (1.0)

ANS:

A. For jobs which are of low exposure, routine and repetitive, or other circumstances as approved by the Super.-Chem. & Rad. Protect. or designate. (1.0)
B. 1 month. (0.5)
C. Rad. Protect. Tech.,
Shift Super.,
2/3 of Plant HP, Super.-Chem. & Rad. Protect., or Plant Mgr. (4 ans. req'd. @ 0.25)

KEY:

RADCON NOP

REF:

FCS RADIATION PROTECTION MANUAL, RRP-20, pg. VII-8-20-1, 7

VAL:

A. 1 pt
B. 0.5
C. 0.25 ea

7.10 A. What are three (3) indications that may be present if shutdown cooling (SDC) is lost with the Reactor Vessel head removed (Do NOT include alarms.)? (1.5)

B. What are three (3) means of restoring residual heat removal if SDC is lost with the head removed? (1.5)

ANS:

A. (ANY 3)
1. Low/zero LPSI pump current.
2. Zero LPSI header flow.
3. Decreasing LPSI header pressure.
4. Hi/increasing SDC heat exchanger discharge temp.
5. Hi/abnormal RCS loop temperature.
6. Hi/increasing core exit thermocouple temp.
7. Closed indication on SDC valves
8. Off indication (green) on LPSI pump.

B. (ANY 3)
1. Restore SDC.
2. Establish charging and letdown.
3. Flow via SDC suction - CS pumps - HPSI pumps - loop injection valves.
4. Flow via SWIRT - HPSI pumps - RCS - RCDT - RCDT pumps - SWIRT (i.e., use HPSI & overflow).
5. Flow via SWIRT - fuel transfer canal drain pumps - SFP - storage pool drain pumps - SWIRT w/ canal open & pit flooded (i.e., use SFP).

KEY WORD:
EOP RHR SFP PATH CORE

REF:
FCS EP-37B, pg. 1-2

VAL:
0.5 ea, CONCEPT OK - exact answer not required

END OF CATEGORY 7

8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS

8.1 A. Who has responsibility to ensure that test equipment is currently calibrated? (0.5)

B. During calibration of plant instrumentation, it is determined that a piece of test equipmnet is faulty. How could this occurrence affect plant operations? How can other plant instrumentation possibly affected by the faulty test equipment be identified? (1.5)

ANS:

A. The individual technician or craft actually using the equipment.

B. Since the instrument indication is not accurate certain T.S. LCO's may not be satisfied such that the plant may be in an action statement requiring a reduction in power or shutdown.

A review of completed surveillance procedures and maintenance orders will reveal where the test equipment was previously used.

KEY:

JOB SURV TS

REF:

FCS S.O. M-28, pg 6, 7

VAL:

0.5 pt for A and 0.75 pt for each statement in B.

8.2 In what logs or reports would the latest analytical results for the following secondary samples be found: (1.5)

A. Condensate
B. # 6 Feedheater
C. S/G blowdown
D. Steam
E. Feedwater

ANS:

A. FW & Condensate Log or Secondary Chemistry Summary Report
B. Secondary Chemistry Summary Report
C. Secondary Chemistry Summary Report
D. FW & Condensate Log
E. FW & Condensate Log

KEY:

LOG JOB

REF:

FCS S.O. T-7, pg 1

VAL:

0.3 each

8.3 A. During a refueling outage, it becomes necessary for an operator assigned to your shift to receive exposure in excess of the Radiation Protection Manual quarterly limits. Explain the mechanism for obtaining authorization. (1.0)

B. An individual is forced to leave a controlled area due to his pencil dosimeter going off scale. What are 2 options for action that will allow him to re-enter the area? (1.0)

C. A person working in a controlled area reaches an exposure of 2400 mrem for the current quarter as recorded by pencil dosimeter. Is it allowable for the person to continue working in the area prior to obtaining authorization for more exposure? Explain. (1.0)

ANS:

A. 1. Supervisor of individual initiates request.
2. Request reviewed by HP group
3. Authorization granted by Chem. and Rad. Prot. Supervisor and Manager, FCS.

B. 1. Estimate or calculate the dose received based on conditions.
2. Read the individual's TLD.

C. The individual may stay in the area (0.33) and receive an additional 100 mrem (0.33) until such time that the TLD can be read (0.33).

KEY:

RADCON JOB

REF:

FCS S.O. T-10, pgs 4, 5

VAL:

A. 0.33 each
B. 0.5 each
C. As indicated

8.4 A. During the performance of surveillance, a page containing data and verification initials becomes wet and unusable. How is this problem resolved? (1.0)

B. What is the senior operator's responsibility upon becoming aware of anomalies or deficiencies discovered during the performance of surveillance? (1.0)

C. Following repair of safety related equipment, what are 2 places where surveillance requirements are specified? (1.0)

ANS:

A. (It is the responsibility of the "lead man" or other designated person to) ensure that all data and initials are transcribed to a new copy (0.5) which will become the official copy of record (0.5).

B. Ensure that operability requirements (LCO's) are met (0.5) or action statements are complied with (0.5).

C. (ANY TWO)
1. Maintenance order
2. PRC approved procedure
3. Standing Orders (O-30)

KEY:

SURV JOB TS

REF:

FCS S.O. G-23, pgs 2, 3

VAL:

A & B as indicated
C. 0.5 ea

8.5 A. What provisions are available for preparation of a priority 5 maintenance order on backshift with the maintenance computer system unavailable? (1.0)

B. What 3 items are reviewed and documented on a maintenance order by the Shift Supervisor before releasing the maintenance order? (1.0)

C. When would a Temporary Clearance Supplement be utilized during the performance of maintenance? (1.0)

ANS:

A. Fill out a serialized hard copy of a blank maintenance order form kept in the control room.

B. 1. Redundant equipment
2. Applicable T.S.
3. Outage

C. When the task requires that equipment be tagged out and restored several times before completion.

KEY:

JOB TAG

REF:

FCS S.O. G-17, pgs 10, 13, 16

VAL:

A & C 1 pt each
B. 0.33 ea

8.6 A. What is the purpose of Special Orders at Fort Calhoun? (.75)

B. Who issues and approves Special Orders? (1.0)

C. When are Special Procedures issued at Frot Calhoun? (.75)

D. Who reviews and approves Special Procedures having safety significance? (1.0)

ANS:

A. To issue plant management instructions which have short term applicability.

B. Normally issued and approved by the Plant Manager (0.5). Must be approved by PRC if order has safety significance (0.5).

C. When a written procedure is not available for a task that requires a written procedure.

D. FCS Mgr, PRC, SARC.

KEY:

JOE

REF:

FCS S.O. G-2 & 3

VAL:

A & C 0.75 ea
B. as indicated
C. 0.33 ea

8.7 A. If a Core Safety Limit is based on Departure from Nucleate Boiling (DNB) which is not an observable parameter, what parameters are monitored which directly relate to DNB? (1.0)

B. How is it assured that a minumum DNB Ratio (DNBR) is not exceeded? (1.0)

ANS:

A. 1. Nuclear flux (dT power)
2. RCS TEMP
3. RCS PRESS
4. RCS FLOW

B. By observing CEA insertion limits (0.5) and axial power distribution limits (0.5).

KEY:

TS LMTS

REF:

FCS TS, pgs 1-1,2

VAL:

A. 0.25 ea
B. as indicated

8.8 A. What is the basis for the limits on radioactivity of the RCS coolant? (1.0)

B. Why are there provisions for allowing operation to continue when a particular sample is significantly above one of the radioactivity limits? (.75)

C. Why is there an RCS temperature limit imposed when a radioactivity limit is exceeded? (.75)

ANS:

A. To limit the 2 hour dose at the site boundary (0.5) following a S/G tube rupture (0.5).

B. To accommodate the possible Iodine spiking which may accompany changes in thermal power.

C. Prevents a release by keeping saturation temperature below setpoint for S/G atmospheric relief valves.

KEY:

LMTS TS RADCON

REF:

FCS TS 2.1.3 Basis

VAL:

A. as indicated
B & C 0.75 ea

8.9 To whom are the five (5) initial notifications required to be made by the Shift Supervisor (or his designee) if an Emergency Action Level is declared? Time limits are not required. (2.5)

ANS:

1. Manager of FCS (or designee)
2. Station emergency personnel
3. Nebraska State Patrol
4. Security Force
5. NRC

KEY:

EPLAN JOB

REF:

FCS RERP E-1

VAL:

0.5 each.

8.10 A. If he is unsure, how does a member of the Emergency Team determine his assignment when reporting to the site during an emergency? (0.5)

B. How are Emergency Team members recognizable after reporting? (0.5)

C. Who exercises direct authority over the Emergency Team during the course of an emergency? (1.0)

ANS:

A. By checking the Emergency Team Assignment Boards.

B. Displays the tag from the assignment board on his person.

C. Initially controlled by site director (0.5) until such time HP/Chem Supervisor or Monitor controller reports to the Tech Support Center (0.5).

KEY:

EPLAN

REF:

FCS EP SEC B.2.4

VAL:

A & B 0.5 ea
C. as indicated

END OF CATEGORY 8

U.S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR REQUALIFICATION EXAMINATION

Facility: Fort Calhoun Station

Reactor Type: CE-PWR

Date Administered: 11/12/85

Examiner: S.L. McCrory

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

READ THE ATTACHED INSTRUCTION PAGE CAREFULLY. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up ~~FOUR~~ (4) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Category Value	Category
15	24			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
16	25.6			2. Plant Design Including Safety and Emergency Systems
15	24			3. Instruments and Controls
16.5	26.4			4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
62.5				TOTALS
		Final Grade	%	

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

_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

    a. Assemble your examination as follows:
       (1) Exam questions on top.
       (2) Exam aids - figures, tables, etc.
       (3) Answer pages including figures which are a part of the answer.

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

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

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

    e. Do not dicuss the examination with other licensee staff personnel until the formal examination review is complete.

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

1.1 TRUE or FALSE? No explanation required. (2.0)

A. As condenser vacuum is increased (absolute pressure decreased), more energy can be extracted from the steam.
B. The main condenser uses the conduction mode of heat transfer to reject heat to the circulating water system.
C. Increasing condensate depression (subcooling) will increase overall plant efficiency.
D. Decreasing condensate depression (subcooling) will decrease condenser vacuum.

ANS:

A. TRUE
B. TRUE
C. FALSE
D. FALSE

KEY:

HTTRANS FLUID

REF:

BASIC FLUID MECHANICS AND HEAT TRANSFER

VAL:

0.5 pt each

1.2 How does the departure from nucleate boiling ratio (DNBR) change (INCREASE, DECREASE, or REMAIN THE SAME) for each of the following events or conditions? The answer should consider only initial plant response prior to automatic action. Briefly explain each answer.

A. Ejected CEA (1.0)

B. Main Steam line break (1.0)

C. Loss of coolant accident (1.0)

D. Loss of cooling water to letdown heat exchanger (1.0)

ANS:

A. Decrease - local power goes up

B. Increase - overcooling lowers temperature

C. Decrease - depressurization / reduced RCS flow

D. No effect - no change until letdown isolation on high temp.

KEY:

HTTRANS FLUID

REF:

Basic Thermo

VAL:

4 pts, 1 pt each (0.5 pt each for trend and explanation).

1.3 A. Explain how neutron production and indicated count rate would change if the neutron sources were removed from the reactor while it was subcritical (K_{eff} less than 1). (2.0)

B. Explain how long it would take to reach a steady-state count rate when K_{eff} is increased from 0.990 to 0.999 if it took one minute to achieve a steady-state count rate when K_{eff} was increased from 0.90 to 0.99. (1.0)

ANS:

A. The count rate would decrease to a small value since the reaction is not self-sustaining (1.0). Neutron production would not go to zero since spontaneous and cosmic fissions still occur, but the indicated count rate could be 0 due to instrument limitations (1.0).

B. Longer (0.7) - 10 minutes OR 10 times as long (0.3). (If candidate states assumption of constant SUR, then accept that the time interval will be the same in both cases.)

KEY:

RXTH NEUT

REF:

BASIC REACTOR THEORY

VAL:

As indicated in the answer.

1.4 During a reactor startup, will the actual critical position be HIGHER, LOWER, or the SAME AS the estimated critical position calculated before the following changes? EXPLAIN your choices. (Consider each change separately). (3.0)

A. The operator starts using main steam to warm the turbine prior to reaching criticality.

B. Actual boron concentration was 30 ppm lower than the value used for figuring the ECP.

C. Criticality is achieved 4 hours earlier than the ECP time; a shutdown time of sixteen (16) hours was used for the ECP.

D. The pressurizer pressure setpoints are all lowered by 50 psi prior to criticality.

ANS:

A. LOWER - because the lowering of temperature will insert positive reactivity. (Will accept SAME if RCP heating is identified as being sufficient to over come heat loss for turbine warmup.) OR
HIGHER - MTC for startup following refueling is slightly positive. (Must state BOL assumption for full credit)

B. LOWER - because the lower boron concentration inserts positive reactivity.

C. HIGHER - because the lack of Xe decay will insert negative reactivity.

D. HIGHER - because lowering the pressure inserts negative reactivity. (Will accept SAME if the change is considered insignificant but recognized.)

KEY:

REAC POISONS COREOPS

REF:

CE Rx theory

VAL:

3 pts 0.25 for HIGHER/LOWER, and 0.5 for explanation.

1.5 For each of the following, choose the situation for which INDIVIDUAL rod worth will be greater. Briefly explain your choice. (3.0)

A. T_{ave} equal to 150°F or 500°F?

B. Early in core life or late in core life?

C. Near the center of the core or near the edge of the core?

ANS:

A. 500°F - at higher temperatures, the diffusion length is greater, allowing neutrons to reach control rods from further away and enhancing control rod effectiveness. OR at higher temperatures, there is less competition with boron which is expanded out of the core.

B. Late in life - as the core ages the flux density goes up causing rod worth to go up. OR as the core ages the boron concentration is reduced.

C. Near the center - flux density tends to be higher near the center of the core due to less leakage.

KEY:

REAC COREOPS RXTH

REF:

CE reactor theory

VAL:

3 pts, 0.4 for choice and 0.6 for explanation.

END OF CATEGORY 1

2. PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS

2.1 A. What prevent inadvertant motion of a CEA when power to the drive motor is interrupted? (0.5)

B. What prevent upward movement of a CEA when the electromagnetic clutch is de-energized? (0.5)

C. What limits the velocity and impact of a CEA when it drops into the core? (Two answers required for full credit.) (1.0)

D. List 5 indications of rod position. These indications may not give actual rod position but may only indicate that a rod or rod group has met certain conditions of withdrawal or insertion. (1.0)

ANS:

A. A electro-mechanical brake engages when the motor is de-energized.

B. Anti-reversing clutch

C. 1. Orifices in the tube enclosing the rack assembly.
2. Dashpot action of the lower guide tube.
3. Shock absorbing stop
(Accept answers 1 & 2 or 2 & 3)

D. (ANY 5)
1. Primary CEA indication system
2. Secondary CEA indicating system
3. Metrascope
4. Group deviation
5. rod bottom lights
6. Power dependent insertion limit
7. Lower electric limit light
8. Dropped rod alarm
9. Shutdown group insertion permissive alarm
10. Regulating group withdrawal prohibit alarm

KEY:

RODCNTRL INTLK IND

REF:

FCS SD I-3, pg 13** This SD was titled "Reactor" and a new SD with the same number was recently issued with the title "Post Accident Sampling System"

VAL:

A-C 0.5 ea
D. 0.2 ea

2.2 A. Explain how it is possible to operate the Turbine Driven Auxiliary Feed Pump should all air and electrical power, including DC, be lost. (1.0)

B. What 4 parameters can be monitored in the Control Room to provide indication of adequate suction for an operating AFW pump? (1.0)

ANS:

A. Steam to the turbine can be manually controlled locally at the pump (0.5). Lube oil pressure for bearings will be provided by an attached unit pump (0.5).

B. Storage tank level
Pump discharge pressure
Pump flow
Motor current

KEY:

AFW IND CNRTL

REF:

FCS SD III-4, pgs 7, 14, 20

VAL:

A. as indicated
B. 0.25 ea

2.3 A. List 16 components which are capable of being cooled by Component Cooling Water (CCW). Where two or more elements of a component are cooled by CCW it is not necessary to identify each separately. Example: For pumps which have both lube oil and seals cooled by CCW, list only the pumps. (2.4)

B. For each component, indicate (YES or NO) whether it can be cooled directly by Raw Water if CCW is lost. (1.6)

ANS:

A.
1. Letdown heat exchanger
2. RCPs (lube oil coolers and seal coolers)
3. Charging pump oil coolers
4. CEDM seal coolers
5. Waste Evaporator
* 6. Containment air cooling (Cooling Units - Cooling & Filter unit)
7. Sampling heat exchangers (Primary & Secondary)
8. Safety injection tank leakage coolers
* 9. Control room air conditioning
10. Nuclear detector well coolers
11. Storage pool heat exchanger
12. Waste gas compressor seal water heat exchangers.
* 13. Shutdown heat exchangers
* 14. LPSI pumps (seal and bearing coolers)
* 15. Containment spray pump bearing coolers
* 16. HPSI pumps (seal and oil coolers)

B. Items marked * in A may be cooled directly by Raw Water.

KEY:

CCW PATH DESGN

REF:

A. FCS SD I-7-1,2 (R3 12-3-81)
B. FCS SD III-8-1 (R3 4-19-83)

VAL:

4 pts, 0.15 each for components, and 0.1 for YES or NO.

2.4 HVC-691 and HVC-692 are the isolation valves for the waste liquid release from the Monitor Tanks WD-22A and B. (1.5)

A. Where is the automatic isolation signal generated?

B. Will the discharge be isolated if either valve fails to shut? EXPLAIN

ANS:

A. A high radiation signal generated by RM-55A or RM-055 initiates the isolation.

B. NO. The valves are in parallel so that both must shut to achieve isolation.

KEY:

RADWASTE DESGN DET

REF:

FCS USAR 11.2-21

VAL:

1.5 pts, 0.75 each for A and B, 0.25 for NO in part B.

2.5 Describe the flow path of the containment air recirculation system (filtered) while operating in the accident mode. Briefly describe the main function of EACH component in the flow path. (4.0)

ANS:

(containment atmosphere) -- (inlet face dampers) -- (baffle type) moisture separators -- (media type) mist eliminators -- HEPA filters -- charcoal filters -- cooling coils -- vent fans -- plenum -- (containment atmosphere)

Moisture separators -- first stage of moisture removal to protect the HEPA filters from damage and blockage ("blinding")
Mist eliminators -- second stage of moisture removal (for same reason)
HEPA filters -- high efficiency mechanical (particle) filters which help prevent clogging of the charcoal filters
Charcoal filters -- remove gases particularly radioactive iodine
Cooling coils -- condense moisture (post accident) to reduce containment pressure and cool air to maintain favorable environment for proper equipment operation and to allow containment entry.
Vent fans -- pull air through the filter and cooling train
Plenum -- provides a common discharge for the vent fans to enhance mixing of containment atmosphere.

KEY:

HVAC PATH DESGN

REF:

FCS Sys Description I-17

VAL:

4 pts, 0.8 pt for flow path, 0.22 ea for components in flow path except those in parentheses (8 items), 0.2 ea for function (8 items).

2.6 Explain why the deborating ion exchangers are installed in the Chemical and Volume Control System. (1.5)

ANS:

At end of core life, boron concentration is reduced by using the ion exchangers to reduce the large volume of waste that would be generated by normal dilution since the normal critical boron concentration is very low.

KEY:

CVCS IX

REF:

FCS Sys Description I-5

VAL:

1.5 pts, critical elements are remove B at EOL, low B concentration, and reduce waste at 0.5 ea.

END OF CATEGORY 2

3. INSTRUMENTS AND CONTROLS

3.1 What 5 critical parameters are used in the Engineered Safeguards control system to provide control/initiation signals? (1.5)

ANS:

1. Reactor coolant pressure
2. Containment pressure
3. Containment radiation
4. SIRW tank level
5. S/G pressure

Give ½ credit for S/G level or degraded voltage since these signals will cause safeguards action even though they are not integral to ESF Control Systems.

KEY:

ESF CNTRL

REF:

FCS SD II-7, pgs 3, 4

VAL:

0.3 ea

3.2 A. What provides indication of RCS level/volume in the control room when the system is drained below pressurizer level taps? (1.0)

B. Aside from indication, what are the specific uses of the signals generated by the low range pressurizer pressure detector? (1.0)

C. What specific abnormality would result in low Surge Line Temperature indication? (No other immediate indication.) (0.5)

ANS:

A. Control room indication is provided by differential pressure transmitter (LI 197) between a low pressurizer level tap and a hot leg.

B. 1. Shutdown cooling pressure interlock.
2. Low temperature overpressure protection.

C. A low surge line temperature alarm would indicate a decrease in continuous spray line flow.

KEY:

RCS CNTRL INTLK VALVE

REF:

FCS SD I-4, pgs 51, 52, 71

VAL:

A. 1 pt
B. 0.5 ea
C. 0.5

3.3 A. How will the loss of control air and/or electrical power affect the feed pump recirculation system? (0.5)

B. What is the purpose of the 3 pressure switches associated with each feed pump lube oil system? (1.5)

C. Aside from switch and breaker lineup, what conditions must be met to start a feed pump? (1.0)

ANS:

A. The recirc valve will fail open.

B. 1. Allows MFP to start at normal LO pressure
2. Starts motor driven pump on decreasing oil pressure.
3. Stops MFP on Lo-Lo oil pressure.
4. Alarm

C. (ANY TWO)
1. Check the lube oil reservoir level.
2. Ensure pumps are preheated to operating temperatures.
3. Start oil pump and verify oil flow through the bearing.
4. Verify turbine plant cooling water flow to lube oil cooler, and seal coolers.
5. Open cold condensate injection valve to mechanical seals.
6. After maintenance:
   a. Fill pump by opening suction bypass
   b. Crack open seal water vent
   c. Open suction
   d. Close vent after pump reaches operating temperature
7. Check that lockout relay in back of CB-10 is reset.
8. Place auto-off switch in off
9. Start pump and ensure recirculation valves and motor operated discharge valve open.

KEY:

MFW PUMP CNTRL

REF:

FCS SD III-5, pgs 34-36

VAL:

0.5 ea

3.4 A. Indicate 4 of 5 conditions that must exist for a fast transfer to alternate power on a 4.16 KV bus to occur. (1.0)

B. Describe 3 mechanisms by which loads are shed from 4.16 KV busses. (1.5)

ANS:

A. (ANY 4)
1. Sources synchronized
2. No faults
3. Correct voltage on on-coming source
4. Original source breakers open properly
5. Breaker switches properly aligned.
6. Bus transfer switch in AUTO.

B. 1. Lockout relays which operate as a result of bus faults.
2. Undervoltage relays (delay or uv load shed).
3. Relays operated by logic of aux. contacts on supply breakers (backup load shed).
4. Relays operated by contacts of logic relays (Accept specific methods that use this mechanism)
5. Manual

KEY:

ELEDST CNTRL

REF:

FCS SD II-1, pgs 27, 28

VAL:

A. 0.25 ea
B. 0.5 ea

3.5 A. Which reactor trips will NOT initiate a trip on a loss of analog signal? (1.5)

B. What are the effect(s) on the protection system of a failure of a logic matrix trip relay to deactuate? Why? (1.0)

ANS:

A.
1. High power
2. High rate of change of power
3. High pressurizer pressure
4. APD

B. Should have no effect as there are 6 logic matrices whose trip relays will initiate trip action.

KEY:

RPS CNTRL

REF:

FCS SD II-5, pgs 37, 38

VAL:

A. 0.5 ea
B. 1 pt

3.6 A. State the purposes of the 2 bistables that interface Wide Range Log Power with the Reactor Protection System. (1.0)

B. What is accomplished by the bistable that interfaces the Safety Power Range to the Protection System? (1.5)

C. Describe how the signal due to gamma is negated in the Wide Range. (0.5)

ANS:

A. 1. Remove the zero mode bypass (above 10^{-4}% power).
2. Disables the ROC trip as power decreases (below 10^{-4}% power) OR Enables the ROC trip as power increases (above 10^{-4}% power).

B. 1. Disables ROC trip.
2. Enables APD trip
3. Enables loss of load trip
(If the candidate states a power decrease as an assumption, then the reverse of the above three answers is correct.)

C. Pulses produced by gamma in both detectors are of a smaller magnitude and are discriminated out (0.25). When the signal is Campbelled (squared), contribution from gamma becomes insignificant (0.25).

KEY:

RPS NI INTLK

REF:

FCS SD II-6, pgs 4-7

VAL:

A. 0.5 ea
B. 0.5 ea
C. as indicated

END OF CATEGORY 3

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

4.1 A. During a Loss of Coolant Accident (LOCA), what are 3 conditions that require the operator to trip the Reactor Coolant Pumps? (1.0)

B. Aside from subcooling and varying pressurizer level, what are 3 indications that core voiding is occuring? (1.0)

C. During a LOCA with subsequent loss of all off site power, explain how the operator can use pressurizer heaters for RCS pressure control. (1.0)

ANS:

A. 1. RCS pressure LT 1350 psia
2. Subcooled margin LT 20°F.
3. Containment radiation alarm

B. (ANY 3)
1. Increasing core dT
2. Erratic S/G dP
3. Erratic RCP motor current
4. RCP vibrations
5. Erratic NI indication

C. The proportional heaters and one group of backup heaters from each bank are available after 480 VAC load shed and sequencing (0.5). The back up heaters must be "reset" before they can be used (0.5)

KEY:

EOP RCS ELEDST PUMP

REF:

FCS EP-5, pgs 3-5

VAL:

A & B 0.33 ea
C. as indicated

4.2 A. System operation procedures require the operator to position the manually operated Condensate Pump discharge valve differently upon starting the pump, dependent on whether another pump is operating. Explain how and why the valve is positioned for the two different starting conditions. (2.0)

B. What 3 indications should be monitored in the control room to monitor condensate pump stability of operation? (.75)

C. What 3 items should be checked locally when a feedwater pump is shutdown by the operator dispatched to the pump? (.75)

ANS:

A. If another pump is not operating, the discharge valve on the pump being started should be nearly shut to minimize the time that peak starting current is applied to the motor. (Accept starting current.)

If another pump is operating, a pump may be started with the valve open as pressure from the running pump will seat the discharge check valve and restrict flow upon starting to minimize starting current.

B. 1. Pump discharge pressure
2. Motor amps
3. Bearing temperatures

C. 1. Recirculation valve shuts
2. Discharge valve shuts
3. Aux Lube Oil pump starts

KEY:

NOP MFW COND PUMP

REF:

FCS OI-FW-1, pgs 2,3 and OI-FW-2, pg 4

VAL:

A. 1 pt ea
B. 0.25 ea
C. 0.25 ea

4.3 A. During normal operation at power, it becomes necessary to secure charging and letdown. Describe any long term effects on the RCS while continuing to operate with charging and letdown secured. (1.0)

B. Shortly after shifting to a new purification system ion exchanger column during steady state power operation, a valid T_{ave}-T_{ref} deviation alarm is received. What is most likely occuring and what are the required short term and long term actions to correct the problem? (1.0)

C. What is done before drawing a SIRWT sample to ensure the sample is representative? Be specific as to equipment used. (1.0)

ANS:

A. (ANY TWO)
1. RCS volume will decrease approximately 4 gal/min due to pump seal leakage.
2. RCS activity may increase and other chemical parameters may change due to loss of purification.
3. Boron concentration cannot be controlled.

B. The new ion exchanger is reducing RCS boron concentration.
Stop dilution by isolating purification.
Re-establish T_{ave} by rod insertion or boration.
Place a properly borated ion exchanger on line.

C. Tank is recirced (0.33) using a LPSI pump (0.33) and a fuel transfer canal drain pump (0.33).

KEY:

AOP CVCS PATH DESGN

REF:

FCS OI-CH-1, pg 4, CH-2, pgs 1-6, and CH-4, pg 18

VAL:

A. 0.5 ea
B. 0.25 ea
C. as indicated

4.4 What are the permissible accumulated doses (PAD) for each of the cases below? (2.0)

A. Normal O.P.P.D. daily PAD.

B. Normal O.P.P.D. weekly PAD.

C. Normal O.P.P.D. quarterly PAD.

D. Normal O.P.P.D. yearly PAD.

E. Maximum quarterly PAD.

F. Maximum yearly PAD.

ANS:

a. 100 millirem (mr)., b. 300 mr, c. 1250 mr,
d. 5000 mr, e. 3 rem, f. 12 rem.

KEY:

RADCON LMTS

REF:

FCS RADIATION PROTECTION MANUAL, Section 2.4.1, pg. VII-2-4

VAL:

0.333 ea

4.5 What are the threshold (or minimum) exposure levels that require an area be posted as: (2.0)

A. a Radiation Area, and

B. a High Radiation Area.

ANS:

a. Where a major portion of the body could receive in any 1 hour a dose in excess of 5 mr, or in any 5 consecutive days a dose in excess of 100 mr.(1.0)
b. Where a major portion of the body could receive exposure greater than 100 mr/hr.(1.0)

KEY:

RADCON LMTS

REF:

FCS RADIATION PROTECTION MANUAL, Section 3.1.7/8, pg. VII-3-4/5

VAL:

1 pt ea

4.6 A. What are three (3) indications that may be present if shutdown cooling (SDC) is lost with the Reactor Vessel head removed (Do NOT include alarms.)? (1.5)

B. What are three (3) means of restoring residual heat removal if SDC is lost with the head removed? (1.5)

ANS:

A. (ANY 3)
1. Low/zero LPSI pump current.
2. Zero LPSI header flow.
3. Decreasing LPSI header pressure.
4. Hi/increasing SDC heat exchanger discharge temp.
5. Hi/abnormal RCS loop temperature.
6. Hi/increasing core exit thermocouple temp.

B. (ANY 3)
1. Restore SDC.
2. Establish charging and letdown.
3. Flow via SDC suction - CS pumps - HPSI pumps - loop injection valves.
4. Flow via SWIRT - HPSI pumps - RCS - RCDT - RCDT pumps - SWIRT (i.e., use HPSI & overflow).
5. Flow via SWIRT - fuel transfer canal drain pumps - SFP - storage pool drain pumps - SWIRT w/ canal open & pit flooded (i.e., use SFP).

KEY WORD:
EOP RHR SFP PATH CORE

REF:
FCS EP-37B, pg. 1-2

VAL:
0.5 ea, CONCEPT OK - exact answer not required

END OF CATEGORY 4

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

Facility: Fort Calhoun Station

Reactor Type: CE-PWR

Date Administered: 11/12/85

Examiner: S.L. McCrory

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

READ THE ATTACHED INSTRUCTION PAGE CAREFULLY. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up **FOUR** (4) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Category Value	Category
15	23.6			5. Theory of Nuclear Power Plant Operations, Fluids, and Thermodynamics
15.5	24.4			6. Plant Systems Design, Control and Instrumentation
16	25.2			7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
17	26.8			8. Administrative Procedures Conditions, and Limitations
63,5				TOTALS
		Final Grade	%	

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

_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.
2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.
3. Use black ink or dark pencil only to facilitate legible reproductions.
4. Print your name in the blank provided on the cover sheet of the examination.
5. Fill in the date on the cover sheet of the examination (if necessary).
6. Use only the paper provided for answers.
7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.
8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write on only one side of the paper, and write "Last Page" on the last answer sheet.
9. Number each answer as to category and number, for example, 1.4, 6.3.
10. Skip at least three lines between each answer.
11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.
12. Use abbreviations only if they are commonly used in facility literature.
13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.
14. Show all calcualtions, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.
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    e. Do not dicuss the examination with other licensee staff personnel until the formal examination review is complete.

5. THEORY OF NUCLEAR POWER PLANT OPERATIONS, FLUIDS, AND THERMODYNAMICS

5.1 TRUE or FALSE? No explanation required. (2.0)

A. As condenser vacuum is increased (absolute pressure decreased), more energy can be extracted from the steam.

B. The main condenser uses the conduction mode of heat transfer to reject heat to the circulating water system.

C. Increasing condensate depression (subcooling) will increase overall plant efficiency.

D. Decreasing condensate depression (subcooling) will decrease condenser vacuum.

ANS:

A. TRUE
B. TRUE
C. FALSE
D. FALSE

KEY:

HTTRANS FLUID

REF:

BASIC FLUID MECHANICS AND HEAT TRANSFER

VAL:

0.5 pt each

5.2 What is the difference in CAVITATION and GAS BINDING in a centrifugal pump? (2.0)

ANS:

Gas binding occurs when a pump is filled with a gas, such as air, so that the pump cannot pump the fluid desired.

Cavitation occurs when inadequate NPSH is available so voiding or boiling of the pumped fluid occurs in the pump suction.

KEY:

FLUID

REF:

BASIC FLUID MECHANICS

VAL:

1 pt each

5.3 TRUE or FALSE? No explanation required. (2.0)

A. The operator can increase the heat removal rate from the RCS by reducing steam pressure.
B. A LOCA with no RCP's running can result in more inventory loss than a LOCA with RCP's running.
C. A total and prolonged loss of feedwater can lead to a loss of RCS liquid inventory.
D. The primary concern when fuel clad temperature reaches 1400°F is the production of hydrogen.

ANS:

A. TRUE
B. FALSE
C. TRUE
D. TRUE

KEY:

FLUID HTTRANS REAC

REF:

BASIC REACTOR THEORY

VAL:

0.5 pt each

5.4 A. What is the minimum reactivity that must be added to a critical reactor for it to be prompt critical? (1.0)

B. How much (by what factor) would power increase in one second at FCS if it were prompt critical? (2.0)

ANS:

A. p (reactivity) GE beta effective (beta value = 0.005 -0.007)

B. $T = l^*/p + (B-p)/\text{lamda } p$ (0.5)

So for prompt critical neglect the delayed term so that

$T = l^*/p$ (.25)

$l^* = 10^{-4} - 10^{-5}$ sec (.25)

$p = 0.005 - 0.007$ (.25)

$T = 10^{-5}/p = .0014 - 0.002$ sec (.25)

$P/P_o = e^{t/T} = e^{(50 - 700)/1 \text{ sec}}$ (0.5)

KEY:

RXTH COREOPS

REF:

BASIC REACTOR THEORY

VAL:

1 pt for A, and as indicated for B.

5.5 When loading fuel into the core, should fuel be loaded toward the detector or away from it? EXPLAIN (1.0)

ANS:

Fuel should be loaded toward the detector (0.33) so that the 1/M plot conservatively predicts criticality (0.67).

KEY:

RXTH COREOPS

REF:

BASIC REACTOR THEORY

VAL:

As indicated.

5.6 A. Explain how neutron production and indicated count rate would change if the neutron sources were removed from the reactor while it was subcritical (K_{eff} less than 1). (2.0)

B. Explain how long it would take to reach a steady-state count rate when K_{eff} is increased from 0.990 to 0.999 if it took one minute to achieve a steady-state count rate when K_{eff} was increased from 0.90 to 0.99. (1.0)

ANS:

A. The count rate would decrease to a small value since the reaction is not self-sustaining (1.0). Neutron production would not go to zero since spontaneous and cosmic fissions still occur, but the indicated count rate could be 0 due to instrument limitations (1.0).

B. Longer (0.7) - 10 minutes OR 10 times as long (0.3). (If candidate states assumption of constant SUR, then accept that the time interval will be the same in both cases.)

KEY:

RXTH NEUT

REF:

BASIC REACTOR THEORY

VAL:

As indicated in the answer.

5.7 A. HOW does equilibrium Xenon reactivity (XE-eq) at hot full power change as a function of core age (EFPD)? (0.5)

B. WHY does Xe-eq change as a function of core age? (1.5)

ANS:

A. Xe-eq gets larger as a function of core age.
B. Xe-eq is a function of flux not power (0.75) and flux increases as a function of core age (0.75).

KEY:

RXTH POISONS

REF:

BASIC REACTOR THEORY

VAL:

As indicated.

END OF CATEGORY 5

6. PLANT SYSTEMS DESIGN, CONTROL AND INSTRUMENTATION

6.1 A. Indicate 4 of 5 conditions that must exist for a fast transfer to alternate power on a 4.16 KV bus to occur. (1.0)

B. Describe 3 mechanisms by which loads are shed from 4.16 KV busses. (1.5)

ANS:

A. (ANY 4)
1. Sources synchronized
2. No faults
3. Correct voltage on on-coming source
4. Original source breakers open properly
5. Breaker switches properly aligned.
6. Bus transfer switch in AUTO.

B. 1. Lockout relays which operate as a result of bus faults.
2. Undervoltage relays (delay or uv load shed).
3. Relays operated by logic of aux. contacts on supply breakers (backup load shed).
4. Relays operated by contacts of logic relays (Accept specific methods that use this mechanism)
5. Manual

KEY:

ELEDST CNTRL

REF:

FCS SD II-1, pgs 27, 28

VAL:

A. 0.25 ea
B. 0.5 ea

6.2 A. Which reactor trips will NOT initiate a trip on a loss of analog signal? (1.5)

B. What are the effect(s) on the protection system of a failure of a logic matrix trip relay to deactuate? Why? (1.0)

ANS:

A.
1. High power
2. High rate of change of power
3. High pressurizer pressure
4. APD

B. Should have no effect as there are 6 logic matrices whose trip relays will initiate trip action.

KEY:

RPS CNTRL

REF:

FCS SD II-5, pgs 37, 38

VAL:

A. 0.5 ea
B. 1 pt

6.3 A. Explain how it is possible to operate the Turbine Driven Auxiliary Feed Pump should all air and electrical power, including DC, be lost. (1.0)

B. What 4 parameters can be monitored in the Control Room to provide indication of adequate suction for an operating AFW pump? (1.0)

ANS:

A. Steam to the turbine can be manually controlled locally at the pump (0.5). Lube oil pressure for bearings will be provided by an attached unit pump (0.5).

B. Storage tank level
Pump discharge pressure
Pump flow
Motor current

KEY:

AFW IND CNRTL

REF:

FCS SD III-4, pgs 7, 14, 20

VAL:

A. as indicated
B. 0.25 ea

6.4 A. What provides indication of RCS level/volume in the control room when the system is drained below pressurizer level taps? (1.0)

B. Aside from indication, what are the specific uses of the signals generated by the low range pressurizer pressure detector? (1.0)

C. What specific abnormality would result in low Surge Line Temperature indication? (No other immediate indication.) (0.5)

ANS:

A. Control room indication is provided by differential pressure transmitter (LI 197) between a low pressurizer level tap and a hot leg.

B. 1. Shutdown cooling pressure interlock.
2. Low temperature overpressure protection.

C. A low surge line temperature alarm would indicate a decrease in continuous spray line flow.

KEY:

RCS CNTRL INTLK VALVE

REF:

FCS SD I-4, pgs 51, 52, 71

VAL:

A. 1 pt
B. 0.5 ea
C. 0.5

6.5 Describe the primary protection function or basis for the following reactor trips: (3.0)

A. Thermal margin/low pressure
B. Axial power distribution
C. High reactor power
D. High rate of change of reactor power
E. High pressurizer pressure
F. Containment high pressure
G. Low steam generator water level
H. Low steam generator pressure
I. Low reactor coolant flow
J. Manual

ANS:

A. Prevents reactor operations when DNBR LT minimum design
B. Prevents peak local power from damaging core (KW/ft fuel centerline melt)
C. Protect fuel cladding against reactivity excursions too rapid to be protected by high pressure or TM/LP (CEA ejection)
D. Uncontrolled CEA withdrawal or boron dilution incident during startup or very low power levels
E. Prevent excessive blowdown of RCS by a PORV or safety valve opening by preventing the reactor from generating more heat than can be removed by the steam generators.
F. Ensures the reactor is tripped on conditions which require safety injection.
G. Loss of feedwater accident, assures RCS pressure does not exceed design.
H. Protects against excessively high steam flow caused by a major steam leak
I. DNB core protection on a sudden flow decrease.
J. Permits the operator to trip when the reactor should be tripped prior to forcing automatic action.

KEY:

CNTRL LMTS RPS

REF:

FCS SD II-5, pgs 3-8

VAL:

0.3 each

6.6 A. How will the loss of control air and/or electrical power affect the feed pump recirculation system? (0.5)

B. What is the purpose of the 3 pressure switches associated with each feed pump lube oil system? (1.5)

C. Aside from switch and breaker lineup, what conditions must be met to start a feed pump? (1.0)

ANS:

A. The recirc valve will fail open.

B. 1. Allows MFP to start at normal LO pressure
2. Starts motor driven pump on decreasing oil pressure.
3. Stops MFP on Lo-Lo oil pressure.
4. Alarm

C. (ANY TWO)
1. Check the lube oil reservoir level.
2. Ensure pumps are preheated to operating temperatures.
3. Start oil pump and verify oil flow through the bearing.
4. Verify turbine plant cooling water flow to lube oil cooler, and seal coolers.
5. Open cold condensate injection valve to mechanical seals.
6. After maintenance:
   a. Fill pump by opening suction bypass
   b. Crack open seal water vent
   c. Open suction
   d. Close vent after pump reaches operating temperature
7. Check that lockout relay in back of CB-10 is reset.
8. Place auto-off switch in off
9. Start pump and ensure recirculation valves and motor operated discharge valve open.

KEY:

MFW PUMP CNTRL

REF:

FCS SD III-5, pgs 34-36

VAL:

0.5 ea

END OF CATEGORY 6

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

7.1 A. During the initial stages of a load rejection incident, why might the operator observe that spray valves are open and pressurizer heaters are energized at the same time? (1.0)

B. Follow up action requires that the operator ensures that any lifted steam system safety valves reseat after proper blowdown. What is blowdown and why is it a design function of the safety valves. (1.0)

C. The operator is further required to cool the quench tank if necessary. How is this cooling accomplished? (0.5)

ANS:

A. 1. Spray valves open in response to increasing RCS pressure.
2. The heaters respond to increasing pressurizer level.

B. 1. The amount of pressure reduction below lift setpoint.
2. This characteristic is designed into the Safety Valves to prevent chatter or oscillation at lift setpoint.

C. By alternate spraying and draining as necessary.

KEY:

EOP RCS VALVE CNTRL

REF:

FCS EP-2, pgs 1, 2

VAL:

0.5 ea

7.2 A. Immediate action for "Loss of Instrument Bus Power" requires the operator to place affected reactor trip channels in "bypass". How is plant safety affected should the operator FAIL to carry out this action? Explain. (1.0)

B. How will the operator determine specific equipmint affected by loss of a specific instrument bus? (0.5)

C. What are two general conditions where this incident may cause a reactor trip? (1.0)

ANS:

A. Plant safety is unimpaired.
In a case where the loss of power causes a channel trip, only one more trip would be required to trip the reactor.

B. Specific loads are listed in the technical data book or electrical equipment book.

C. 1. If a channel on an unaffected bus was previously tripped.
2. If loss of power affected control of a parameter which provided a trip signal (such as S/G or PZR level).

KEY:

RPS AOP IND ELEDST

REF:

FCS EP-20, pgs 1, 2

VAL:

A. 0.33 ea
B. 0.5 ea
C. 0.5 ea

7.3 A. Why should the following temperature limits be adhered to during RCS leak testing? (1.5)

1. Maximum pressurizer temperature of approximately 388°F.
2. Minimun RCS loop temperature of 360°F.

B. Why should the pressurizer temperature be maintained above loop temperature during leak testing? (1.0)

ANS:

A. 1. To allow rapid depressurization of the RCS to a low value (approx. 200 psig).
2. So that base metal does not undergo brittle fracture during test.

B. So that a void will form in the pressurizer instead of the vessel head should inadvertant depressurization occur.

KEY:

AOP RCS LMTS

REF:

FCS OI-RC-2B, pgs 1, 2

VAL:

A. 0.75 ea
B. 1 pt

7.4 A. During normal operation at power, it becomes necessary to secure charging and letdown. Describe any long term effects on the RCS while continuing to operate with charging and letdown secured. (1.0)

B. Shortly after shifting to a new purification system ion exchanger column during steady state power operation, a valid T_{ave}-T_{ref} deviation alarm is received. What is most likely occuring and what are the required short term and long term actions to correct the problem? (1.0)

C. What is done before drawing a SIRWT sample to ensure the sample is representative? Be specific as to equipment used. (1.0)

ANS:

A. (ANY TWO)
1. RCS volume will decrease approximately 4 gal/min due to pump seal leakage.
2. RCS activity may increase and other chemical parameters may change due to loss of purification.
3. Boron concentration cannot be controlled.

B. The new ion exchanger is reducing RCS boron concentration.
Stop dilution by isolating purification.
Re-establish T_{ave} by rod insertion or boration.
Place a properly borated ion exchanger on line.

C. Tank is recirced (0.33) using a LPSI pump (0.33) and a fuel transfer canal drain pump (0.33).

KEY:

AOP CVCS PATH DESGN

REF:

FCS OI-CH-1, pg 4, CH-2, pgs 1-6, and CH-4, pg 18

VAL:

A. 0.5 ea
B. 0.25 ea
C. as indicated

7.5 A. When may a standing rather than job specific Radiation Work Permit (RWP) be issued? (1.0)

B. What is the normal period for which a standing RWP is issued? (0.5)

C. Who (by job title) must sign a standing RWP for it to be issued? (1.0)

ANS:

A. For jobs which are of low exposure, routine and repetitive, or other circumstances as approved by the Super.-Chem. & Rad. Protect. or designate. (1.0)
B. 1 month. (0.5)
C. Rad. Protect. Tech.,
Shift Super.,
2/3 of Plant HP, Super.-Chem. & Rad. Protect., or Plant Mgr. (4 ans. req'd. @ 0.25)

KEY:

RADCON NOP

REF:

FCS RADIATION PROTECTION MANUAL, RRP-20, pg. VII-8-20-1, 7

VAL:

A. 1 pt
B. 0.5
C. 0.25 ea

7.6 A. What are three (3) indications that may be present if shutdown cooling (SDC) is lost with the Reactor Vessel head removed (Do NOT include alarms.)? (1.5)

B. What are three (3) means of restoring residual heat removal if SDC is lost with the head removed? (1.5)

ANS:

A. (ANY 3)
1. Low/zero LPSI pump current.
2. Zero LPSI header flow.
3. Decreasing LPSI header pressure.
4. Hi/increasing SDC heat exchanger discharge temp.
5. Hi/abnormal RCS loop temperature.
6. Hi/increasing core exit thermocouple temp.
7. Closed indication on SDC valves
8. Off indication (green) on LPSI pump.

B. (ANY 3)
1. Restore SDC.
2. Establish charging and letdown.
3. Flow via SDC suction - CS pumps - HPSI pumps - loop injection valves.
4. Flow via SWIRT - HPSI pumps - RCS - RCDT - RCDT pumps - SWIRT (i.e., use HPSI & overflow).
5. Flow via SWIRT - fuel transfer canal drain pumps - SFP - storage pool drain pumps - SWIRT w/ canal open & pit flooded (i.e., use SFP).

KEY WORD:
EOP RHR SFP PATH CORE

REF:
FCS EP-37B, pg. 1-2

VAL:
0.5 ea, CONCEPT OK - exact answer not required

END OF CATEGORY 7

8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS

8.1 A. Who has responsibility to ensure that test equipment is currently calibrated? (0.5)

B. During calibration of plant instrumentation, it is determined that a piece of test equipmnet is faulty. How could this occurrence affect plant operations? How can other plant instrumentation possibly affected by the faulty test equipment be identified? (1.5)

ANS:

A. The individual technician or craft actually using the equipment.

B. Since the instrument indication is not accurate certian T.S. LCO's may not be satisfied such that the plant may be in an action statement requiring a reduction in power or shutdown.

A review of completed surveillance procedures and maintenance orders will reveal where the test equipment was previously used.

KEY:

JOB SURV TS

REF:

FCS S.O. M-28, pg 6, 7

VAL:

0.5 pt for A and 0.75 pt for each statement in B.

8.2 A. During a refueling outage, it becomes necessary for an operator assigned to your shift to receive exposure in excess of the Radiation Protection Manual quarterly limits. Explain the mechanism for obtaining authorization. (1.0)

B. An individual is forced to leave a controlled area due to his pencil dosimeter going off scale. What are 2 options for action that will allow him to re-enter the area? (1.0)

C. A person working in a controlled area reaches an exposure of 2400 mrem for the current quarter as recorded by pencil dosimeter. Is it allowable for the person to continue working in the area prior to obtaining authorization for more exposure? Explain. (1.0)

ANS:

A. 1. Supervisor of individual initiates request.
2. Request reviewed by HP group
3. Authorization granted by Chem. and Rad. Prot. Supervisor and Manager, FCS.

B. 1. Estimate or calculate the dose received based on conditions.
2. Read the individual's TLD.

C. The individual may stay in the area (0.33) and receive an additional 100 mrem (0.33) until such time that the TLD can be read (0.33).

KEY:

RADCON JOB

REF:

FCS S.O. T-10, pgs 4, 5

VAL:

A. 0.33 each
B. 0.5 each
C. As indicated

8.3 A. During the performance of surveillance, a page containing data and verification initials becomes wet and unusable. How is this problem resolved? (1.0)

B. What is the senior operator's responsibility upon becoming aware of anomalies or deficiencies discovered during the performance of surveillance? (1.0)

C. Following repair of safety related equipment, what are 2 places where surveillance requirements are specified? (1.0)

ANS:

A. (It is the responsibility of the "lead man" or other designated person to) ensure that all data and initials are transcribed to a new copy (0.5) which will become the official copy of record (0.5).

B. Ensure that operability requirements (LCO's) are met (0.5) or action statements are complied with (0.5).

C. (ANY TWO)
1. Maintenance order
2. PRC approved procedure
3. Standing Orders (O-30)

KEY:

SURV JOB TS

REF:

FCS S.O. G-23, pgs 2, 3

VAL:

A & B as indicated
C. 0.5 ea

8.4 A. If a Core Safety Limit is based on Departure from Nucleate Boiling (DNB) which is not an observable parameter, what parameters are monitored which directly relate to DNB? (1.0)

B. How is it assured that a minumum DNB Ratio (DNBR) is not exceeded? (1.0)

ANS:

A. 1. Nuclear flux (dT power)
2. RCS TEMP
3. RCS PRESS
4. RCS FLOW

B. By observing CEA insertion limits (0.5) and axial power distribution limits (0.5).

KEY:

TS LMTS

REF:

FCS TS, pgs 1-1,2

VAL:

A. 0.25 ea
B. as indicated

8.5 A. What is the basis for the limits on radioactivity of the RCS coolant? (1.0)

B. Why are there provisions for allowing operation to continue when a particular sample is significantly above one of the radioactivity limits? (.75)

C. Why is there an RCS temperature limit imposed when a radioactivity limit is exceeded? (.75)

ANS:

A. To limit the 2 hour dose at the site boundary (0.5) following a S/G tube rupture (0.5).

B. To accommodate the possible Iodine spiking which may accompany changes in thermal power.

C. Prevents a release by keeping saturation temperature below setpoint for S/G atmospheric relief valves.

KEY:

LMTS TS RADCON

REF:

FCS TS 2.1.3 Basis

VAL:

A. as indicated
B & C 0.75 ea

8.6 To whom are the five (5) initial notifications required to be made by the Shift Supervisor (or his designee) if an Emergency Action Level is declared? Time limits are not required. (2.5)

ANS:

1. Manager of FCS (or designee)
2. Station emergency personnel
3. Nebraska State Patrol
4. Security Force
5. NRC

KEY:

EPLAN JOB

REF:

FCS RERP E-1

VAL:

0.5 each.

8.7 A. If he is unsure, how does a member of the Emergency Team determine his assignment when reporting to the site during an emergency? (0.5)

B. How are Emergency Team members recognizable after reporting? (0.5)

C. Who exercises direct authority over the Emergency Team during the course of an emergency? (1.0)

ANS:

A. By checking the Emergency Team Assignment Boards.

B. Displays the tag from the assignment board on his person.

C. Initially controlled by site director (0.5) until such time HP/Chem Supervisor or Monitor controller reports to the Tech Support Center (0.5).

KEY:

EPLAN

REF:

FCS EP SEC B.2.4

VAL:

A & B 0.5 ea
C. as indicated

END OF CATEGORY 8