ENCLOSURE 1

EXAMINATION REPORT - 50-302/OL-86-01

Facility Licensee: Florida Power Corporation

Facility Name: Crystal River Unit 3

Facility Docket No.: 50-302

Written examinations were administered at Crystal River Training Center near Crystal River, Florida. Oral examinations were administered at Crystal River Unit 3 near Red Level, Florida.

Chief Examiner: for Sandy Lawyer — 11/6/86 Date Signed

Approved by: for John F. Munro, Section Chief — 11/6/86 Date Signed

Summary:

Examinations on August 19-22, 1986.

Oral examinations were administered to seven RO candidates, all of whom passed. Written examinations were administered to seven RO candidates, six of whom passed. An oral and a written examination were administered to one SRO upgrade candidate, who passed. A written requalification examination was administered to one SRO licensee, who passed.

Based on the results described above, six of seven ROs passed and two of two SROs passed.

REPORT DETAILS

1. Facility Employees Contacted:

*Larry Kelley, Florida Power Corporation (FPC), Training Manager
*Ray Wittman, FPC Operation Support
*Bruce J. Hickle, FPC Nuclear Plant Operations Manager
*Marsha Watson, FPC Training
*James P. Owen, MEC/FPC Training
*Steve Blake, FPC Training
*Paul McKee, FPC Director Nuclear Plant Operations
*Tom Stetka, NRC SRI

*Attended Exit Meeting

2. Examiners:

J. C. Huenefeld
W. J. Apley
*Sandy Lawyer

*Chief Examiner

3. Examination Review Meeting

At the conclusion of the written examinations, the examiners provided Mr. Johnie Smith with a copy of the written examination and answer key for review. The comments made by the facility reviewers are included as Enclosure 3 to this report, and the NRC resolutions to these comments are listed below.

a. RO Exam

(1) Question 1.05

NRC Response:

Agreed. The answer key was changed accordingly.

(2) Question 1.13

NRC Resolution:

If the proposed assumptions are clearly stated by the candidate, the proposed answer will be accepted. While neither of these cases is specifically addressed by the reference, the general theory needed to analyze and explain this situation is covered by this and other references. No change required.

(3) Question 1.14

NRC Resolution:

A reactor operator with an acceptable level of perception would easily ascertain the vertical line. No change required.

(4) Question 1.15

NRC Resolution:

A wording change was made in the answer key to better reflect utility terminology.

(5) Question 2.05

NRC Resolution:

Based upon the reference material supplied, the additional answer, "oxygen", was added to the answer key.

(6) Question 2.12

NRC Response:

The comment, technically speaking, is correct. However, none of the material supplied identified an alternate set of engine "name plate" ratings. Rather, most of the material supplied consists of a "summary of normal operating" data. We will, however, accept the additional answers "3250 Kw - 168 hour maintenance interval" and "12,433 cu.in." as stated in the supplied material. The answer key was changed accordingly.

(7) Question 2.14

NRC Response:

Facility comment accepted. The answer key and reference were changed accordingly. The facility material should be corrected prior to future use.

(8) Question 2.18

NRC Response:

The question as written strongly implies an AUTOMATIC Actuation. The very act of questioning which feedwater valves go shut implies an AUTOMATIC main steam line actuation. A knowledgeable operator will have no problem inferring that the isolation is automatic. No change required.

(9) Question 2.21

NRC Response:

Agreed. The answer key was changed accordingly.

(10 Question 2.23

NRC Response:

Agreed. The answer key was changed accordingly.

(11) Question 3.6

NRC Response:

The operation of control board switches is considered to be of paramount importance. No material was supplied to support the facilities contention regarding knowledge of control board switches. No change required.

(12) Question 3.19

NRC Response:

Agreed. The answer key was changed accordingly.

(13) Question 4.2

NRC Response:

Agreed. The reason was put in parentheses to indicate that it is not part of the required answer.

(14) Question 4.3

NRC Response:

Agreed. The answer key was changed accordingly. The original reference material should be updated to include opening MUV-103. In addition, previous response #5 was put in parentheses since it is not required in order to feed.

(15) Question 4.3

NRC Response:

Agreed in so far as the additional limit is concerned. The answer key was changed to incorporate the 1000 mrem/week.

(16) Question 4.11

NRC Resolution:

It was noted prior to final examination grading that other conceptually equivalent RCS leakage indicators are available to the operator. These were added to the answer key.

(17) Question 4.13

NRC Response:

The candidate was asked what the Verification Procedure states and therefore should respond as the answer predicts. However, as stated in the material supplied, 65% will be accepted. The answer key was changed accordingly. The procedural error should be corrected promptly.

(18) Question 4.11 and 4.13

NRC Response:

Memorization is not required. A conceptual knowledge of the intent of the emergency procedures is all that is required to answer these questions. No change required.

(19) Question 4.19

NRC Response

The required knowledge in this case was tested (multiple choice question) utilizing the candidates cognitive faculties as opposed to memorization. Therefore, it is for testing purpose, moot as to where in the procedure the "important action" is located. No change required.

b. SRO Exam

(1) Question 5.02

NRC Response:

The utility "equal valid" arguments ignore the question's assumption that the generator is synchronized with the grid. Under this condition, real load and output voltage are not proportional to excitation current. The facility attempts to explain that real load and output voltage are proportional by offering two explanations. Both explanations, as described below, are erroneous.

(a) When a sychronous machine is in parallel with a large grid, the grid becomes the determining factor regarding voltage. Change in excitation, once paralleled, will have a reduced effect upon output/line voltage. Instead the excitation current will shift the amount of reactive load being supplied by or to the main generator to the other machines operating on the grid. Therefor output/line voltage is absolutely NOT proportional to reactive load.

(b) True, load power factor is essentially fixed and determined by the grid; however, with one or more additional machines running in parallel on the grid the dynamics of reactive load sharing increase the complexity of the situation. In this situation (more than one machine in parallel) grid voltage will be more or less a constant. Attempts to change output voltage at one machine by changing excitation current will not change voltage. Rather, it will change the reactive load sharing between the paralleled machines. Changes in excitation will NOT cause appreciable changes in real load. Now, if real load is changed, in order to maintain a constant terminal voltage there must be an accompanying change in excitation. This means that the converse of what the facility is saying is true, a change in real load will result in a change in reactive load. However, the facility's assertion is false; changes in reactive load may be made independently of real load. Additional reference can be found at Principles of Alternating Machinery, Lawrence & Richards, McGraw Hill Book Co., p. 366 and Electric Machinery by Fitzgerald, Kingsley and Kusho. We note that this question, in identical form, was utilized in the March 5, 1985 Crystal River SRO requalification examination without comment. No change required.

(2) Question 5.09

NRC Response:

The recommended response is equivalent to answer b on the answer sheet. This was clarified prior to grading.

(3) Question 5.22

NRC Response:

Strictly speaking, the utility proposed additional consideration is valid and a complete answer would have to include it in addition to the answer key answer. However, it is commonly accepted that the term "decay" (without reference to polarity of the charge) refers to the more common B minus decay rather than both. Therefore, the answer key answer (for B minus decay) will be accepted for full credit. No change required.

(4) Question 6.92

NRC Response:

The indicated conditions causing alarm C-3-12 are listed on page 8 of AP-303. The R. C. Drain Tank Cooler is not one of the differential flows indicated. All three of the other differential flows are listed. The utility submitted flow diagram indicates where flows are measured but does not indicate how the differential flows are arrived at. Since the newly submitted information does not refute AP-303 no change to the examination or answer key is required.

(5) Question 6.03

The utility comment is correct and is additionally supported by OP-603, p.2. The answer key was changed as recommended.

(6) Question 6.06

Choice b and the utility comment are incorrect in that the push - button does not indicate loss of air to the E/P controller for MUV-51. We note that this question, in identical form, was utilized in the December 17, 1984 Crystal River RO examination without comment. No change required.

(7) Question 6.08

NRC Resolution:

Agreed. The answer key was changed accordingly.

(8) Question 6.18

NRC Resolution:

Agreed. The answer key was changed accordingly. We note that a similar change needs to be made to Question Bank question 2.26.

(9) Question 6.21

NRC Resolution:

Agreed. The answer key was changed accordingly.

(10 Question 6.25

NRC Resolution:

Agreed that it is feedwater vice reactor power that is being changed. The answer key was changed accordingly.

(11) Question 6.26

NRC Resolution:

Agreed. The answer key was changed accordingly.

(12) Question 6.28

NRC Resolution:

The utility comment was lacking in specificity. No particular examples of additional valve combinations were proposed. The additional material supplied was not specific enough to support either the comment or the recommendation. No change required.

(13) Question 7.7

NRC Resolution:

The utility supplied reference gives >30 mr as a suggestion. RSP-101 p9 states PIC's must be re-zeroed prior to reaching 3/4 scale. The question asks for the requirement, not the suggestion. Additionally, the procedure should be considered governing if there were a conflict between it and a GET lesson plan. No change required.

(14) Question 7.8

NRC Resolution:

It is necessary that an SRO know these four indications that the frisker is operable. We agree that they need not be memorized. Any wording which conveys the same meaning will be acceptable. No change required.

(15) Question 7.11

NRC Resolution:

Agreed. The answer key was changed accordingly.

(16) Question 7.13

NRC Resolution:

We agree that operators should not be required to memorize procedure names and numbers verbatum. However, they must know some identifying feature of often used procedures by which they may communicate with their colleagues. Here, any description which uniquely identifies the Nuclear Services Cooling System operating procedure will be accepted. No change required.

(17) Question 7.19

NRC Resolution:

Agreed. The question was deleted.

(18) Question 8.21b

NRC Resolution:

During post examination review it was discovered that an additional NSS responsibility was not originally included on the answer sheet. The answer key was changed accordingly.

4. Exit Meeting

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

There were no generic weaknesses noted during the oral examination.

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

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

FINAL MARKED UP MASTER

5

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

FACILITY: CRYSTAL RIVER

REACTOR TYPE: PWR-B&W177

DATE ADMINISTERED: 86/09/18

EXAMINER: LAWYER, SANDY

CANDIDATE: MASTER

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
30.00	25.00			5.	THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
~~30.00~~ 29.00	25.00			6.	PLANT SYSYEMS DESIGN, CONTROL, AND INSTRUMENTATION
~~30.00~~ 29.00	25.00			7.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
30.00	25.00			8.	ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
~~120.00~~ 118.00					Totals
		Final Grade			

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

Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

18. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top,

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

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

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

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

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

QUESTION 5.01 (1.00)

Which of the following sources can potentially introduce the largest (in standard cubic feet) amount of non-condensible gas into the RCS?

a. Zirc-water reaction.

b. Core flood tanks.

c. Pressurizer steam space.

d. 100% failed fuel.

QUESTION 5.02 (1.00)

When the main generator is synchronized with the grid, excitation current is proportional to:

a. reactive load (MVAR)

b. real load (MW)

c. output voltage (KV)

d. generator speed (RPM)

QUESTION 5.03 (1.00)

During a reactor startup, power is being raised above the point of adding heat (POAH). Which of the following statements is CORRECT? (Assume a linear reactor power increase to about 3% power).

a. Since header pressure is 885 psig, Tave will not rise above the corresponding saturation temperature of 532 degF.

b. Since the OTSGs are low level limited and header pressure is being maintained at 885 psig, Tave will rise and the steam temperature will tend to follow Th.

c. With the header pressure being maintained at 885 psig, the OTSGs will remain at saturated conditions and no superheat will be added.

d. Since the OTSGs are low level limited, the steam is superheated at zero power conditions and rises proportionally with power.

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

QUESTION 5.04 (1.00)

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

CR1/CR2 = (1-Keff2)/(1-Keff1).

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

a. Both Keff1 and Keff2 have to be less than 1.0.

b. Equal changes in Keff result in equal changes in subcritical multiplication level.

c. The equation only approximates the instantaneous change in count rate; once the equilibrium value is reached, the count rate will be higher.

d. A second doubling of the count rate will result in the reactor becoming critical or supercritical.

e. The statement is approximately correct but CR1 and CR2 are inverted.

QUESTION 5.05 (1.00)

Which one of the following statements is CORRECT concerning the paralleling of electrical systems?

a. Although it is desirable to have speed and phase position matched, it is much more important to have voltages matched.

b. If voltages are not matched at the time the synchronizing switch is closed, there will be VAR flow from the lower voltage source to the higher one.

c. If the incoming machine is at synchronous speed but out of phase with the running bus when the breaker is closed, heavy currents will flow to either accelerate or retard the incoming machine.

d. If the incoming machine is in phase but slightly faster than synchronous speed when paralleled, the system will tend to speed up the incoming machine to synchronous speed.

e. If the resistances are not matched at the time the synchronizing switch is closed, heavy currents will flow to tend to speed up the incoming machine to synchronous speed.

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

QUESTION 5.06 (1.00)

The reactor is at 70% power with the ICS in full auto. Power level is increased to 80%. Choose the statement that best describes what happens to the shutdown margin. Assume sufficient rod worth to accomodate the power change, and no boron changes.

a. Immediately following the power increase the shutdown margin will have increased, approximately five hours after the transient, shutdown margin will be at its highest value and will start decreasing.

b. Power level has no effect on shutdown margin.

c. Immediately following the power increase the shutdown margin will be unchanged, it will then decrease for approximately the first five hours following the transient, then start increasing.

d. Immediately following the power increase the shutdown margin will be unchanged, it will then increase for approximately the first five hours following the transient, then start decreasing.

QUESTION 5.07 (1.50)

Will the following parameters increase, decrease or remain the same if you start with saturated steam and superheat it isobarically?

a. Enthalpy

b. Temperature

c. Density

d. Pressure

e. Specific volume

f. Specific weight

QUESTION 5.08 (2.00)

Describe the heat transfer mechanism (type of heat transfer) that is taking place at points 1 thru 6 on the attached boiling water curve (fig 105').

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

QUESTION 5.09 (1.00)

List the two reasons why the maximum linear heat rate is limited.

QUESTION 5.10 (1.00)

According to the bases for the limiting safety system settings, which of the RPS trips will be reached first during a slow reactivity insertion accident from low or high power?

QUESTION 5.11 (2.00)

Assume the following plant conditions exist:
Controlled cooldown of 210 degF/hr in progress using both OTSGs
RCS at 525 degF
RMA-12 in high alarm

a. Determine the plant transient in progress. (0.5)

b. List the three plant conditions, any of which make a cooldown rate of 210 degF/hr acceptable during this transient. (1.5)

QUESTION 5.12 (1.00)

The limit imposed on quantity of aluminum in the containment building is based on minimizing post-LOCA hydrogen generation. What two compounds are necessary in addition to aluminum to produce this hydrogen?

QUESTION 5.13 (1.50)

What temperature instrument responses (instrument and direction) best indicate the presence of natural circulation if OTSG pressure is decreased according to plant verification procedure VP-580? Assume the reactor is in hot standby with no reactor coolant pumps running.

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

QUESTION 5.14 (2.00)

The minimum temperature for criticality LCO ensures that the reactor will not be made critical with the reactor coolant system average temperature less than 525 degF. What are the four things ensured by this limitation, ie, what is the basis for this LCO?

QUESTION 5.15 (.50)

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

QUESTION 5.16 (1.00)

Why does OP-404, Decay Heat Removal System, require the operator to open the drop line to the RB sump within 24 hours after a LOCA? Include in your reason the RCS P-T condition under which this would be most important.

QUESTION 5.17 (1.50)

About what percentage of the total neutrons in the core at BOL are delayed neutrons? Explain how such a small percentage of neutrons can affect the operation of the reactor so much. Assume a new core.

QUESTION 5.18 (1.00)

Describe,very generally and qualitatively, the difference between the behavior of xenon concentration and of samarium concentration when taking the plant from shutdown to full power following an extended full power run.

QUESTION 5.19 (1.00)

Compare a power change from, 10% to 30% to a power change from 30% to 50%. Is the same amount of reactivity required for both changes? Explain your answer.

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

QUESTION 5.20 (1.00)

If the plant is heated up to normal operating temperature/pressure from the reactor being in a cold shutdown condition without any change in rod position or boron concentration, what will happen to the shutdown margin? Explain.

QUESTION 5.21 (1.00)

Describe the photoelectric effect as it occurs in certain radiation monitoring instrumentation in terms of the detected ray or particle, how it interacts, what it interacts with, and what causes the subsequent ionization.

QUESTION 5.22 (1.00)

Describe the changes that occu in the atomic number and mass number of an atom when it decays by beta emission. Remember the atomic number is the number of protons and the mass number is the number of neutrons plus protons.

QUESTION 5.23 (1.00)

Explain the effect on MTC and fuel temperature coefficient as the core ages (fuel depletion). Note whether they become more or less negative and the reason for the change.

QUESTION 5.24 (2.00)

a. Sketch a trace of logarithmic neutron countrate versus time following a reactor trip. Label the axes of your trace, and clearly show the effects of prompt and delayed neutrons. Label this curve a.

b. The trip in part a inserts a value of reactivity much greater than Beta (delayed neutron fraction). Now, on the same sketch prepared for part a., sketch a trace of reactor power versus time for the case where the reactor is made to be subcritical by an amount much less than Beta. Label this curve b.

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

QUESTION 5.25 (1.00)

The speed of a centrifugal pump is decreased to half of its ititial value. Given the following initial conditions, what are the final conditions?

a. Fluid horsepower 25 HP
b. Flow 45 gpm
c. Head 250 psi

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

QUESTION 6.01 (1.00)

Which of the following statements about RB purge control is NOT true?

a. Both purge supply fans must be operating to permit start of the exhaust fans.

b. Exhaust duct temperature greater than 135 degF will shut down the exhaust fans.

c. Dampers D - 93 and 94 automatically adjust to maintain vent flow rate about 50,000 CFM when purge valves are open and fans are operating.

d. Purge valves are automatically closed by a HIGH radiation alarm, but supply and exhaust fans continue operating.

QUESTION 6.02 (1.00)

Which one of the following is NOT an indicated condition of annunciator C-3-12, 'NS CCC SYST RB LEAK'.

a. differential flow to AH units

b. differential flow to letdown coolers

c. differential flow to RC drain tank cooler

d. differential flow to RCPs

QUESTION 6.03 (1.00)

Select the INCORRECT statement regarding the condensate injection system.

a. Condensate injection is used for main turbine head sprays in the high pressure turbine, pump seals in the feedwateer system, and valve steam sealing to prevent in-leakage of air to the condensers.

b. When condensate pressure is above 220 psig the condensate pumps are supplying seal and spray water.

c. If the discharge pressure decreases to ~200 psig, the G.W.P. that has been selected will start automatically.

d. The condensate injection system supplies water to the desuperheaters in the auxiliary steam system, steam supplies to both evaporators, and the gland steam system.

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

QUESTION 6.04 (1.00)

Which of the following is NOT controlled by the feedwater control subsystem in the ICS?

a. Feedwater ratio distribution between the OTSGs.

b. Total feedwater flow based on unit load.

c. BTU availability to the OTSGs.

d. Level conditions in the OTSGs.

QUESTION 6.05 (1.00)

The EFIC system will automatically initiate EFW upon detection of:

a. Loss of both main feedwater pumps and reactor power >10%.

b. Low level (<24") in either OTSG.

c. Loss of all RCPs.

d. Low pressure (<750 psig) in either OTSG.

e. HPI actuation on either A or B ESAS channel.

QUESTION 6.06 (1.00)

Which one of the follqwing is CORRECT concerning the "air fail reset" pushbuttons for MUV-16, 31 and 51.

a. The pushbutton only indicates loss of air to the associated valve E/P controller.

b. The pushbutton indicates loss of air to E/P controllers for MUV-16 and 51 and also loss of air to the valve positioner for MUV-31.

c. On loss of air supply, the solenoid valve supplying air to the air lock valve will deenergize, causing the affected valve (16, 31 or 51) to close.

d. When air pressure has increased, depressing the air fail reset pushbutton will unlock MUV-16, 31 or 51.

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

QUESTION 6.07 (1.00)

Which of the following is the reason that the reactor control subsystem low limits reactor demand at 10%.

a. Inability of the control circuits to smoothly control reactor power due to the small magnitude of the signals involved.

b. Prevent the reactor control subsystem from ramping Tave automatically and without the control board operator's knowledge.

c. Due to decay heat considerations.

d. Prevents the reactor control subsystem from ramping Tave automatically without the operator's knowledge and provides a minimum demand for decay heat considerations.

QUESTION 6.08 (1.00)

To start any circulating water pump, four start permissives must be satisfied. Name all four and give their setpoints as applicable.

QUESTION 6.09 (1.00)

List eight separate systems or components that receive their supply from the auxiliary steam system.

QUESTION 6.10 (1.00)

Identify the abnormal reactor condition which has occurred or is occurring as indicated by the PT trace on the attached figure 1076.

QUESTION 6.11 (1.00)

Where, as a general rule, should the speed droop control be set for a D-G unit when running alone?

QUESTION 6.12 (1.50)

List the five EFIC channel maintenance bypass function interlock features.

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

QUESTION 6.13 (1.00)

Name three types of failure mode for which the fuel handling grapple mechanism is protected when the grapple is loaded.

QUESTION 6.14 (1.00)

What is the primary fire protection system protecting the emergency diesel generators?

QUESTION 6.15 (1.00)

What are your immediate actions in the event of actuation of:

a. RMA-3?

b. RMA-4?

QUESTION 6.16 (1.00)

From where will the megawatt calibrating integral receive its input if the main turbine is in manual and all other ICS stations are in automatic?

QUESTION 6.17 (1.00)

What is the normal method used for reducing RCS gas concentration?

QUESTION 6.18 (1.50)

The decay heat removal system is protected from overpressurization by an automatic closure initiation (ACI). List the valves monitored by the ACI feature, the setpoint for actuation, and the automatic actions that will occur.

QUESTION 6.19 (1.00)

What are the only heater drain valves with control switches on the main control board?

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

QUESTION 6.20 (1.00)

List and explain the difference between the two types of monitors (two functional areas) that make up the loose parts monitoring system.

QUESTION 6.21 (1.00)

Discuss the arming of the RBS by stating the arming signal and the automatic actions that occur to accomplish the arming.

QUESTION 6.22 (1.00)

Describe the location in the makeup and purification system where the letdown line connections to the decay heat removal system connect.

QUESTION 6.23 (1.50)

What do you expect the status of the amber lamp (DC parallel block act) and breaker 3210 to be if breakers 3209,3205 and 3206 are closed? What can you say of the interlocking of breaker 3210 under these conditions? What is the purpose of this interlock? See figure 859 attached.

QUESTION 6.24 (1.00)

What is the purpose of the clamp/clamp release switch on the diamond panel?

QUESTION 6.25 (1.00)

Describe the control function of the ICS neutron cross limit.

QUESTION 6.26 (1.00)

Name and give the location of the power supply for the post accident sampling system.

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

QUESTION 6.27 (1.50)

What reactor mode, steaming condition and time limit determine the minimum condensate water storage tank volume?

QUESTION 6.28 (1.00)

Under what positioning of the governor and/or throttle valves are the OTSG steam headers cross connected?

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

QUESTION 7.01 (1.00)

Which of the following conditions is a procedural requirement for manually tripping the reactor?

a. Emergency feedwater actuates.

b. Subcooling margin drops below 50 degF during power operation.

c. Shutdown margin is determined to be less than 1.0% delta k/k.

d. Feedwater flow is lost.

QUESTION 7.02 (1.00)

According to the RCP operation procedure (OP-302), which of the following statements is CORRECT?

a. During cooldown, following transfer to the decay heat (DH) system, the RCPs should be sequentially stopped, about 5 seconds apart.

b. RCPs may be operated in an emergency without seal injection flow provided NSCCCW is in service.

c. If RCP start permissives are bypassed, the maximum allowable reactor power for starting the fourth RCP is 30%.

d. The AC or DC lift oil pumps should be run for at least 2 minutes prior to stopping an RCP.

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

QUESTION 7.03 (1.00)

Which one of the following is correctly stated regarding a permissible dose to an operator in a restricted area as specified in 10CFR20?

a. Under non-accident conditions, the operator is permitted to receive no more than 7 1/2 rems per calendar quarter to each hand and to each foot.

b. Under non-accident conditions, the operator is permitted to receive no more than 1 1/4 rad of beta per calendar quarter to the lens of the eye.

c. Under accident or emergency conditions, the operator is permitted to receive up to 25 rem once in a lifetime exposure.

d. Under accident or emergency conditions, the operator is permitted to receive up to 100 rem once in a lifetime exposure.

QUESTION 7.04 (2.00)

Answer the following TRUE or FALSE according to OP-412 'Waste Gas Disposal System '.

a. An increase on a portable radiation detector (such as an E-102) is used to indicate that all water has been drained from the waste gas surge tank drain pot.

b. The 'operator at the controls' is responsible for verification of the radiation monitor setpoints as they are specified on the release permit.

c. If meteorological conditions show a delta temperature of zero or positive, you are NOT allowed to proceed with a gaseous release.

d. If the flowrate monitor is inoperable, tech specs allow continuing the gaseous release assuming the flow rate is estimated as specified.

QUESTION 7.05 (1.00)

According to OP-210, 'Reactor Startup', an RCS sample should be taken periodicaly during a certain evolution. What is the evolution and what is the sample analyzed for?

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

QUESTION 7.06 (1.00)

Reactor coolant pumps have been lost because of a loss of offsite power. Plant control is being maintained in accordance with the "Natural Circulation" procedure, AP-530. According to this procedure an OTSG level setpoint of 95% should be selected under two conditions. What are the two conditions?

QUESTION 7.07 (1.00)

What are the three intervals (conditions) at which the PICs must be zeroed?

QUESTION 7.08 (1.00)

List the four observations that "Basic Radiological Safety Information and Instructions for Radiation Workers", RSP-101, requires prior to frisking. Refer to figure 1101 for the steps which immediately follow these observations.

QUESTION 7.09 (1.00)

According to the OSIM, during an emergency, when is it permissible to use the PORV to prevent a high pressure trip? (2 conditions).

QUESTION 7.10 (1.00)

According to FP-203, what are the only two highly radioactive components that are allowed to be temporarily stored above the seal plate during fuel or core internals handling operations?

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

QUESTION 7.11 (3.00)

a. List the immediate actions that are common (identical) for the four runback APs:

AP-540	Loss of booster pump
AP-541	Loss of main feed pump
AP-542	Asymmetric rod
AP-543	Loss of one RCP

b. List the additional immediate actions for AP-541 'Loss of Main Feed Pump Runback'.

c. Match the runback condition with the approximate power level at which you expect the plant to stabilize:

i	AP-540	a.	50%
ii	AP-541	b.	55%
iii	AP-542	c.	60%
iv	AP-543	d.	65%
		e.	70%
		f.	75%

QUESTION 7.12 (1.00)

What are the 5 immediate operator actions in response to a confirmed fire in the plant according to AP-880?

QUESTION 7.13 (1.00)

Where would you expect to find the correct procedure to transfer cooling water for the 3A and 3C makeup pumps from the DC system to the SW system; ie, in what operating procedure(s)?

QUESTION 7.14 (1.00)

List your immediate actions in response to an alarm from RM-L2.

QUESTION 7.15 (2.00)

List your immediate actions for AP-990, 'Shutdown from Outside Control Room'.

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

QUESTION 7.16 (1.00)

According to OP-204, "Power Operation", if during a power decrease, either OTSG goes on low level control, what is the appropriate operator action?

QUESTION 7.17 (2.00)

Engineered safeguards has actuated due to low RC pressure.

a. When are you required to stop the reactor coolant pumps?

b. Under what conditions (according to the remedial actions of AP-380) should the RCPs be kept running?

QUESTION 7.18 (1.00)

During plant heatup the fourth RCP is started at 500degF. What is the reason for waiting till we reach this temperature (other than waiting for the pump interlock to clear)?

QUESTION 7.19 (1.00)

OP-203 cautions against selecting both OTSG level transmitters at the same time. What is the reason for this caution?

QUESTION 7.20 (1.00)

Why is the affected OTSG isolated at less than or equal to 540degF per EP-390, "OTSG tube rupture"?

QUESTION 7.21 (1.00)

According to the ATOG guidelines, excessive use of HPI during a tube rupture can cause at least three problems with plant control. Name all three.

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

QUESTION 7.22 (1.00)

What is the reason for the caution "Use of temporary lead blankets must not be allowed on any piping or components without nuclear plant engineering approval" in CP-113, Handling and Controlling Work Requests and Work Packages?

QUESTION 7.23 (1.00)

RSP-101 provides a list of items which identifies a ""high radiation area" (>100 mr/hr but < 1000 mr/hr) and another list which identifies a "high radiation area" (=or>1000 mr/hr). List the differences between these two lists and identify which area each applies to. Do not list any items which are common to the two lists.

QUESTION 7.24 (2.00)

An actual plume release has occurred with a projected dose to the general population of 15 Rem whole body and 100 Rem thyroid. If the wind direction is constant from SSE, answer the following for the general population. See figures 1105 A, B, and C attached.

a. Between 0 and 5 miles, which sectors should evacuate?

b. Between 5 and 10 miles, which sectors should evacuate?

c. Beyond 10 miles, which sectors should evacuate?

d. How long will it take to evacuate handicapped, elderly and hospitalized individuals from within 5 miles considering that normal conditions are present.

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

QUESTION 8.01 (1.00)

While conducting a cooldown in Mode 5, if both diesel generators become inoperable:

a. no technical specification action statement is entered.

b. technical specifications require that immediate actions should be taken to establish Mode 6.

c. technical specifications require that positive reactivity changes be stopped.

d. technical specifications require that OTSGs must remain operable as a means of heat removal.

QUESTION 8.02 (1.00)

Which of the following may proceed given that a technical specification action statement has been entered requiring you to 'suspend all core alterations'?

a. Removing a neutron source from the core or positioning the auxiliary neutron detector.

b. Using the bridge in the core is allowed, provided that the low load limit is jumpered out.

c. Control rods and burnable poison rods may be shuffled as long as Keff =or< 0.95.

d. Completion of the movement of a component to a conservative position.

QUESTION 8.03 (1.00)

According to the technical specifications, while operating in modes 1 thru 3, the maximum level allowed in the OTSGs on the operating range is:

a. 83%

b. 87%

c. 96%

d. 98%

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

QUESTION 8.04 (1.00)

Which of the following statements is correct concerning the Quadrant Power Tilt (QPT)?

a. If QPT exceeds the maximum limit of 20.0, the reactor must be immediately shutdown.

b. If misalignment of a control rod causes the QPT to exceed the transient limit, thermal power must be reduced within 30 minutes.

c. No action is required within one hour regardless of the QPT limit exceeded (steady state, transient or maximum).

d. If QPT exceeds the steady state limit, but is less than the transient limit, operation may continue indefinitely only up to 60% allowable for the RCP combination.

QUESTION 8.05 (1.00)

An event in process which indicates a potential degradation of the level of safety of the plant is classified as:

a. an unusual event

b. an alert

c. a site emergency

d. a general emergency

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

QUESTION 8.06 (1.00)

The attached figure 1132 is the Crystal River technical specifications bases figure 2.1 Which one of the following statements is correct concerning these curves?

a. These curves represent the conditions at which a minimum DNBR of 1.30 is predicted at the maximum possible thermal power for the number of reactor coolant pumps in operation.

b. For each of these curves, a pressure-temperature point below and to the right of the curve would result in a DNBR greater than 1.30.

c. These curves include the potential effects of the ejected control rod and reactor coolant pump locked rotor accidents.

d. The DNBR curve for four pump operation is more restrictive than any other reactor coolant pump situation.

QUESTION 8.07 (1.00)

Only one of the following components has a maximum boron concentration specified in technical specification for the operational mode indicated. Which one?

a. Pressurizer - mode 2

b. Concentrated boric acid storage system - mode 3

c. Core flood tank - mode 4

d. BWST - mode 5

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

QUESTION 8.08 (1.00)

DG A, which supplies ES 4 KV bus A is inoperable. LPI pump B supplied by ES 4 KV bus B is inoperable. Which statement below is correct concerning continued operation in mode 1? The tech specs for ECCS subsystems and AC sources are attached as figures 1134A,B and C.

a. The action statements for both the LPI pump and the DG are applied independently, each must be restored to operable in 72 hours.

b. Since the DG is required in mode 4 and the LPI pump is not, the unit must be taken to mode 4 within 72 hours.

c. TS 3.0.3 applies; it requires action to place the unit in a mode in which the specificaqtion does not apply within 1 hour.

d. TS 3.0.5 applies; it requires action to place the unit in a mode in which the specification does not apply within 2 hours.

QUESTION 8.09 (2.00)

a. What is the only condition under which the designated "operator at the controls" can leave the red-carpeted general area for non-emergency purposes?

b. In the event of an emergency affecting the safety of operations, the "operator at the controls" may momentarily be absent from the general area in front of the control board provided ... (complete this sentence).

QUESTION 8.10 (1.00)

Consideration should be given to shutting down the plant and investigating the leaking OTSG tube(s) when primary to secondary leakage through the steam generator exceeds the value specified by the OSIM. What is the value of this leakage and how long does OSIM predict before tube rupture would occur?

QUESTION 8.11 (1.00)

State the requirements for correcting an error in the "narrative log".

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

QUESTION 8.12 (1.00)

During power operation, OP-204, the Power Operation procedure requires that the Chem Rad department be notified of power changes. What is the lower limit on power and time for which this notification must be made?

QUESTION 8.13 (1.00)

What is the maximum number of main steam code safety valves that may be inoperable in Mode 3? What actions must be taken if this many valves are inoperable?

QUESTION 8.14 (1.00)

OSIM lists seven systems requiring prior approval before performing maintenance on them such as RPS and ESAS. List the other five.

QUESTION 8.15 (1.00)

During a plant startup with the reactor at 2% power, one power range channel, NI-6, is found to be inoperable. What are the only 2 restrictions on proceeding to 100% rated thermal power? Refer to the attached TS on figures 1129A,B,C.

QUESTION 8.16 (1.00)

According to the OSIM, what is the preferred method of locating condenser tube leaks? Explain why.

QUESTION 8.17 (1.00)

When are the protective actions as specified in the protective action guidelines warranted? ie, how do you judge whether or not to recommend the protective action be taken?

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

QUESTION 8.18 (2.00)

OP-115, "In-plant Equipment Clearance and Switching Orders" states four conditions that require PRC approval of a clearance prior to issuance. List these four conditions.

QUESTION 8.19 (3.00)

After using the PORV to prevent a reactor trip from 100% power on RCS pressure - high, indications lead you to suspect that the automatic reset of the PORV is out of calibration at 0200 hours. You request a calibration of the PORV lift setpoint and reset setpoints to verify PORV operability. The calibration procedure requires removing power to the PORV's solenoid valve which occurs at 0230 hours. Answer the following for this situation. See Technical Specifications attached. (figure 1120)

a. By what clock time must the block valve be closed to avoid being in Hot Standby within 6 hours? Explain your decision.

b. Attempts to close the block valve at 0245 hours are unsuccessful. I&C technicians determine that the pressure bistable must be replaced which may take up to 8 hours. Since the PORV is already closed and power removed from the solenoid, can operation in Mode 1 continue? Explain.

c. While in Hot Standby, the pressure bistable is replaced, thus returning the PORV to operability; however, the block valve remains inoperable in the open position. Can the unit return to power operations? Explain your answer.

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

QUESTION 8.20 (2.00)

Consider the table concerning RCS leakage past CFV-1 during a reactor startup and answer the questions below. Technical Specifications are attached. Figures 1121A,B and C.

Time	Power	CFV-1 leakage
0100 hours	15%	0 gpm
0600 hours	50%	2 gpm
1800 hours	80%	No Measurement made
2300 hours	100%	4 gpm

a. Do the technicial specifications allow the unit to be at 80 percent power at 1800 hours? Explain your answer.

b. During shift turnover, at 2400 hours, you are handed the 4 gpm leakrate measurement. What actions are required by the technical specifications?

QUESTION 8.21 (2.00)

When a reactor trip or plant shutdown occurs, the Nuclear Shift Supervisor first ensures that the plant is placed in a safe condition by having the necessary operations performed in accordance with approved procedures.

a. He then makes 5 notifications: List them

b. Explain the NSS's responsibilities concerning form 912212, Reactor Trip and Shutdown Report.

QUESTION 8.22 (1.00)

Define 'short term instruction' as used in AI-500, 'Conduct of Operations'. When do they expire? Who has the responsibility to audit short term instructions?

QUESTION 8.23 (1.00)

Define an Immediate Temporary change as used in AI-401, 'Origination of and Revisions to PQQAM Procedures', by comparison to an Interim change.

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

QUESTION 8.24 (1.00)

In any case where a general emergency has been declared, what is the minimum protective action recommendation?

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

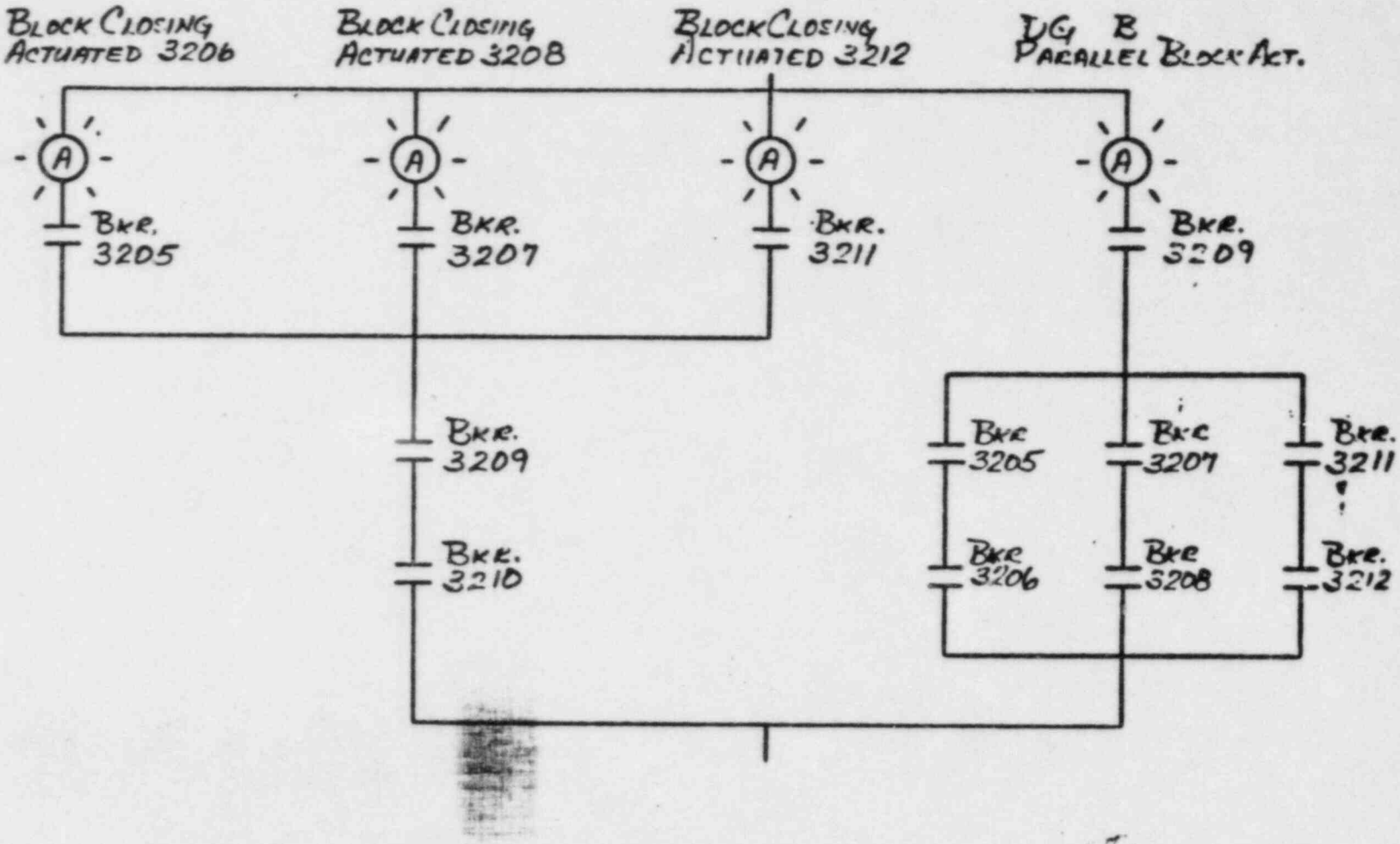

BLOCK CLOSING ACTUATED 3206
BLOCK CLOSING ACTUATED 3208
BLOCK CLOSING ACTUATED 3212
DG B PARALLEL BLOCK ACT.
A
BKR. 3205
BKR. 3207
BKR. 3211
BKR. 3209
BKR. 3209
BKR. 3210
BKR 3205
BKR 3207
BKR. 3211
BKR 3206
BKR 3208
BKR. 3212

Figure 859

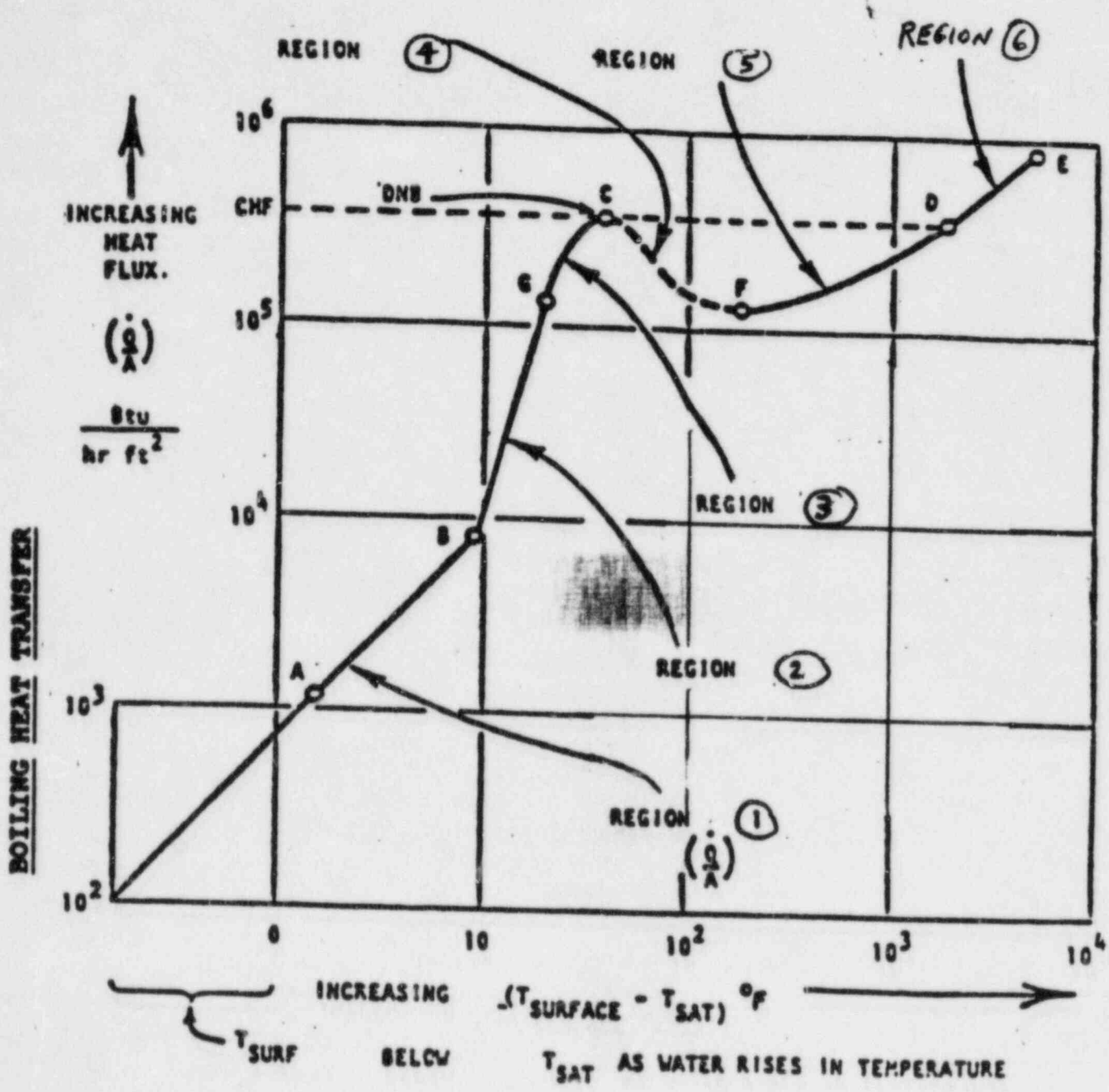

REGION 4
REGION 5
REGION 6
INCREASING HEAT FLUX.
$(\frac{\dot{Q}}{A})$
$\frac{Btu}{hr\ ft^2}$
10^6
CHF
DNB
C
D
E
F
G
10^5
10^4
REGION 3
B
A
10^3
REGION 2
REGION 1
$(\frac{\dot{Q}}{A})$
10^2
BOILING HEAT TRANSFER
0
10
10^2
10^3
10^4
INCREASING $(T_{SURFACE} - T_{SAT})\ ^oF$
T_{SURF} BELOW T_{SAT} AS WATER RISES IN TEMPERATURE

Figure 1057

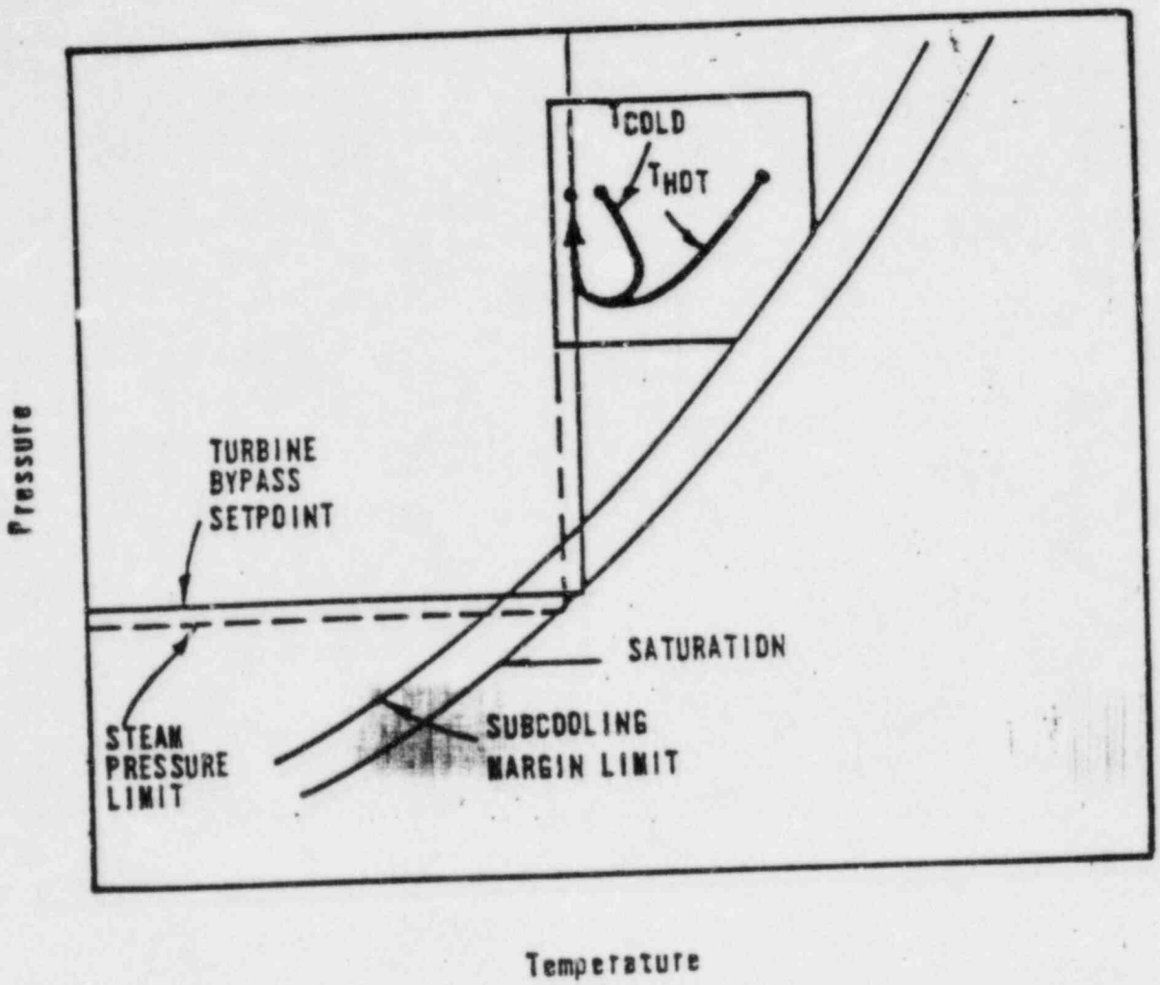

Pressure
T COLD
T HOT
TURBINE
BYPASS
SETPOINT
SATURATION
STEAM
PRESSURE
LIMIT
SUBCOOLING
MARGIN LIMIT
Temperature

Figure 1076

NOTE: IF any problems are encountered, THEN notify "Health Physics" personnel immediately.

3.3.2 Conduct "Whole Body Frisk"

NOTES: 1) The distance between the probe and surface being monitored should not exceed 1/4".

2) IF a significant increase (i.e, greater than 50 "cpm" above background) in count rate is noted, THEN return the probe to the suspected area of "Contamination".

3) IF the "Alarm" sounds, THEN notify "Health Physics" personnel immediately and remain in present location until assistance arrives.

4) DECONTAMINATION MUST BE CONDUCTED UNDER THE GUIDANCE OF "HEALTH PHYSICS" PERSONNEL.

Figure 1101

GUIDELINES FOR RECOMMENDED PROTECTIVE ACTIONS FOR GASEOUS PLUME EXPOSURE*

NON-ESSENTIAL GENERATING COMPLEX PERSONNEL AND GENERAL POPULATION

CONDITION	RECOMMENDED ACTION
1. A General Emergency has been declared.	Two mile, 360°, precautionary evacuation. Five mile shelter of potentially effected sectors.**
2. A General Emergency has been declared. Substantial core damage in progress or projected. No containment failure has been projected. No substantial fission product inventory in containment.	Two mile, 360°, precautionary evacuation. Five mile evacuation of potentially effected sectors.**
3. A General Emergency has been declared. Substantial core damage in progress or projected. No containment failure has been projected. Fission product inventory in containment ≤ GAS GAP.	SAME AS ABOVE
4. A General Emergency has been declared. Substantial core damage in progress or projected. Containment failure and release likely but not imminent. Fission product inventory in containment > GAS GAP.	Five mile, 360°, evacuation. Ten mile evacuation of potentially effected sectors.**
5. A General Emergency has been declared. Substantial core damage in progress or projected. Containment failure is projected to be imminent. No substantial fission product inventory in containment.	Five mile, 360°, evacuation. Ten mile evacuation of potentially effected sectors.** Shelter areas which can not be evacuated before plume arrival.
6. A General Emergency has been declared. Substantial core damage in progress. Containment failure is projected to be imminent. Fission product inventory in containment > GAS GAP.	SAME AS ABOVE
An actual release has occurred or is in progress. Dose to the population is projected to be: a) Whole Body: >0.5 to ≤1.0 Rem b) Thyroid: >1.0 to ≤5.0 Rem	Two mile, 360°, shelter. Ten mile shelter of potentially effected sectors.**
8. An actual release has occurred or is in progress. Dose to the population is projected to be: a) Whole Body: >1.0 to ≤5.0 Rem b) Thyroid: >5.0 to ≤ 25 Rem	Two mile, 360°, evacuation. Ten mile evacuation of potentially effected sectors.** Ten mile shelter of remaining sectors.
9. An actual release has occurred or is in progress. Dose to the population is projected to be: a) Whole Body: >5.0 Rem b) Thyroid: > 25 Rem	Five mile, 360°, evacuation. Ten mile evacuation of potentially effected sectors.** Ten mile shelter of remaining sectors.

EMERGENCY WORKERS

1. An actual release has occurred or is in progress. Dose to an emergency worker is projected to be: a) Whole Body: > 25 to < 75 Rem b) Thyroid: >125 Rem	Control exposure of emergency workers, except for lifesaving missions to 25 Rem Whole Body, 125 Rem Thyroid. (Appropriate controls for emergency workers include time limitations and respirators.)
2. An actual release has occurred or is in progress. Dose to an emergency worker is projected to be: a) Whole Body: ≥ 75 Rem	Control exposure of emergency workers performing lifesaving missions to 75 Rem Whole Body. (Control of time exposure will be most effective.) NOTE: Although respirators should be used where effective to control dose to emergency workers, thyroid dose may not be a limiting factor for lifesaving missions.

NOTE: References for this table are a combination of Table 5.1, page 5.31, Rev. 6/79 - Manual of Protective Actions for Nuclear Incidents and NUREG-0654, dated 1/80.

**Affected sectors include, as a minimum, the downwind sector(s) and adjacent sectors.

Fig 1105A

GUIDELINES FOR RECOMMENDED PROTECTIVE ACTIONS FOR GASEOUS PLUME EXPOSURE

EVACUATION TIME ESTIMATE TABLES*

Distance (miles)	SECTORS A-D Hr.-Min.	E-H Hr.-Min.	J-M Hr.-Min.	N-R Hr.-Min.	All Hr.-Min.
GENERAL POPULATION (NORMAL CONDITIONS)					
0 - 2**	1 - 30	0 - 45	0 - 45	0 - 45	2 - 30
0 - 5	1 - 30	1 - 30	0 - 45**	0 - 45**	4 - 00
0 - 10	3 - 00	3 - 00	0 - 45**	0 - 45**	6 - 30
GENERAL POPULATION (ADVERSE CONDITIONS)					
0 - 2**	3 - 00	1 - 00	1 - 00	1 - 00	3 - 00
0 - 5	3 - 00	3 - 00	1 - 00**	1 - 00**	8 - 00
0 - 10	6 - 00	6 - 00	2 - 00**	2 - 00**	13 - 00
SPECIAL POPULATION (NORMAL CONDITIONS)***					
0 - 2**	N/A	N/A	N/A	N/A	N/A
0 - 5	2 - 00	2 - 00	N/A	N/A	5 - 00
0 - 10	3 - 00	3 - 00	N/A	N/A	6 - 30
SPECIAL POPULATION (ADVERSE CONDITIONS)***					
0 - 2**	N/A	N/A	N/A	N/A	N/A
0 - 5	4 - 00	4 - 00	N/A	N/A	N/A
0 - 10	6 - 00	6 - 00	N/A	N/A	13 - 00

25

*These are conservative estimates and are inclusive of warning times.

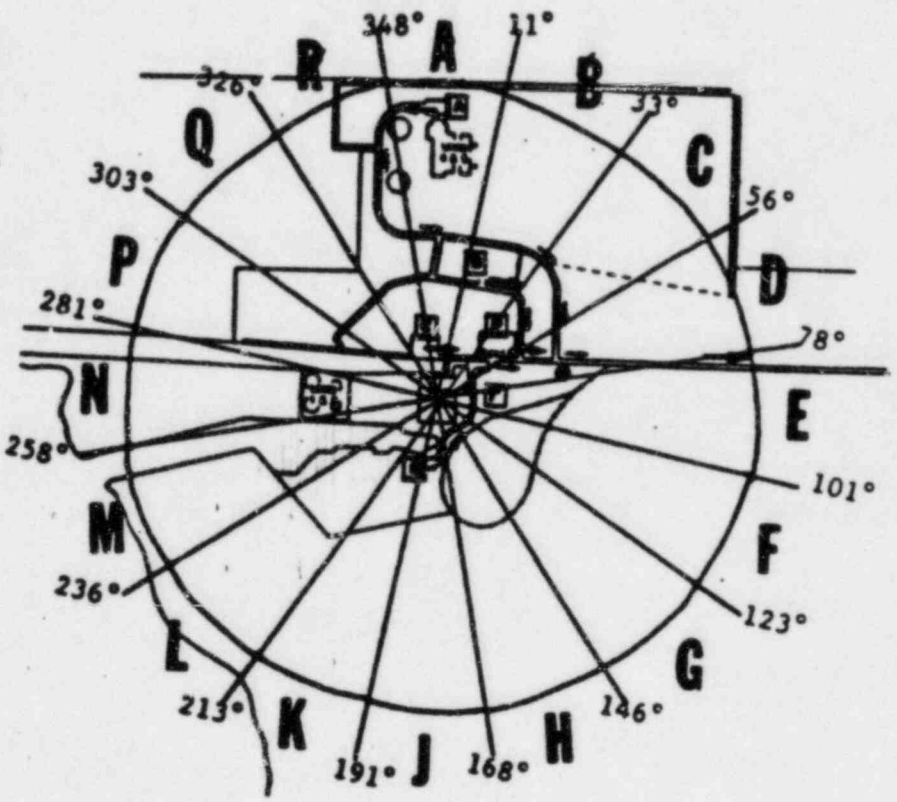
**These estimates are for personnel on FPC property. Evacuation time is based on a staged/sequenced generating complex evacuation via the plant access road.

***This category includes the handicapped, elderly, and hospitalized individuals and is inclusive of the general population.

WIND DIRECTION DATA

	Wind From	Degrees	Wind Toward	Sectors Affected
(A)	N	349-11	S	S J K
(B)	NNE	12-33	SSW	J K L
(C)	NE	34-56	SW	K L M
(D)	ENE	57-78	WSW	L M N
(E)	E	79-101	W	M N P
(F)	ESE	102-123	WNW	N P Q
(G)	SE	124-146	NW	P Q R
(H)	SSE	147-168	NNW	Q R A
(J)	S	169-191	N	R A B
(K)	SSW	192-213	NNE	A B C
(L)	SW	214-236	NE	B C D
(M)	WSW	237-258	ENE	C D E
(N)	W	259-281	E	D E F
(P)	WNW	282-303	ESE	E F G
(Q)	NW	304-326	SE	F G H
(R)	NNW	327-348	SSE	G H J

CRYSTAL RIVER GENERATING COMPLEX



LEGEND

Units 4 & 5 Staff Administration Parking
Construction Work Force Parking
Units 1 & 2 Staff Administration Parking
Unit 3 Staff Administration Parking
Units 1 & 2 Coal Pile Parking
Unit 3 Warehouses and Temporary Offices

Points of contact for personnel assembly are provided below:

SECTOR	AREA	CONTACT
A	Units 4 & 5	Units 4 & 5 Control Room
B / C	CR3 Administration Bldg.	Public Address System
B / C	North Coal Yard	Units 4 & 5 Control Room
D / E	CR3 Warehouse Area	Corporate Security Specialist
D / E	Rec - Ops Trailers	Corporate Security Specialist
E, F, G, and J	Coal Train Area	Units 4 & 5 Control Room
J, K, and L	South Coal Yard	Units 1 & 2 Control Room
H	Units 1 & 2	Units 1 & 2 Control Room

REACTOR COOLANT SYSTEM

POWER OPERATED RELIEF VALVES

LIMITING CONDITION FOR OPERATION

3.4.3.2 The power operated relief valve (PORV) and its associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

a. With the PORV inoperable, within 1 hour either restore the PORV to OPERABLE status or close the associated block valve and remove power from the block valve; otherwise, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With the block valve inoperable, within 1 hour either restore the block valve to OPERABLE status or close the block valve and remove power from the block valve or close the PORV and remove power from the associated solenoid valve; otherwise, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.4.3.2.1 In addition to the requirements of Specifications 4.0.5, the PORV shall be demonstrated OPERABLE at least once per 18 months by performance of a CHANNEL CALIBRATION.

4.4.3.2.2 The block valve shall be demonstrated OPERABLE at least once per 92 days by operating the valve through one complete cycle of full travel.

Figure 1120

REACTOR COOLANT SYSTEM

RELIEF VALVES - OPERATING

CODE SAFETY VALVES

LIMITING CONDITION FOR OPERATION

3.4.3.1 All pressurizer code safety valves shall be OPERABLE with a lift setting of 2500 psig ± 1%.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

With one pressurizer code safety valve inoperable, either restore the inoperable valve to OPERABLE status within 15 minutes or be in HOT SHUTDOWN within 12 hours.

SURVEILLANCE REQUIREMENTS

4.4.3.1 No additional Surveillance Requirements other than those required by Specification 4.0.5.

OPERATIONAL LEAKAGE

LIMITING CONDITION FOR OPERATION

3.4.6.2 Reactor Coolant System leakage shall be limited to:

a. No PRESSURE BOUNDARY LEAKAGE.

b. 1 GPM UNIDENTIFIED LEAKAGE.

c. 1 GPM total primary-to-secondary leakage through steam generators.

d. 10 GPM IDENTIFIED LEAKAGE from the Reactor Coolant System.

e. 10 GPM CONTROLLED LEAKAGE at a Reactor Coolant System pressure of 2150 ± 20 psig, and

f. Leakage as specified in Table 3.4-2 for those Reactor Coolant System Pressure Isolation Valves identified in Table 3.4-2.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With any PRESSURE BOUNDARY LEAKAGE, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With any Reactor Coolant System leakage greater than any one of the above limits, excluding PRESSURE BOUNDARY LEAKAGE, reduce the leakage rate to within limits within 4 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. With any Reactor Coolant System Pressure Isolation Valve leakage greater than the above limit, reactor operation may continue provided that at least two valves in each high pressure line having a non-functional valve are in, and remain in, the mode corresponding to the isolated condition. (Motor operated valves shall be placed in the closed position and power supplies deenergized.)

d. The provisions of Section 3.0.4 are not applicable for entry into MODES 3 and 4 for the purpose of testing the isolation check valves.

Figure 1121 A

SURVEILLANCE REQUIREMENTS

4.4.6.2.1 Reactor Coolant System leakages shall be demonstrated to be within each of the above limits by:

a. Monitoring the containment atmosphere iodine radioactivity monitor at least once per 12 hours,

b. Monitoring the containment sump inventory and discharge at least once per 12 hours,

c. Measurement of the CONTROLLED LEAKAGE from the reactor coolant pump seals when the Reactor Coolant System pressure is 2150 ± 20 psig at least once per 31 days,

d. Performance of a Reactor Coolant System water inventory balance at least once per 72 hours during steady state operation.

4.4.6.2.2 Each Reactor Coolant System Pressure Isolation Valve specified in Table 3.4-2 shall be individually demonstrated OPERABLE prior to entering MODE 2 by verifying leakage to be within its limit:

a. After each refueling outage,

b. Whenever the plant has been in COLD SHUTDOWN for 72 hours, or more, if leakage testing has not been performed in the previous 9 months, and

c. Prior to returning the valve to service following maintenance, repair or replacement work on the valve.

4.4.6.2.3 Whenever integrity of a pressure isolation valve listed in Table 3.4-2 cannot be demonstrated, the integrity of the remaining valve in each high pressure line having a leaking valve shall be determined and recorded daily. In addition, the position of the other closed valve located in the high pressure piping shall be recorded daily.

Figure 1121 B

TABLE 3.4-2

REACTOR COOLANT SYSTEM PRESSURE ISOLATION VALVES

System	Valve	Maximum Allowable Leakage(a)(b)(c)
Decay Heat/Low Pressure Injection	CFV-1	< 5.0 gpm
	DHV-2	< 5.0 gpm
	CFV-3	< 5.0 gpm
	DHV-1	< 5.0 gpm

Notes:

(a) Maximum Allowable Leakage (each valve):

1. Leakage rates less than or equal to 1.0 gpm are considered acceptable.

2. Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered acceptable if the latest measured rate has not exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.

3. Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered unacceptable if the latest measured rate exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.

4. Leakage rates greater than 5.0 gpm are considered unacceptable.

(b) To satisfy ALARA requirements, leakage may be measured indirectly (as from the performance of pressure indicators) if accomplished in accordance with approved procedures and supported by computations showing that the method is capable of demonstrating valve compliance with the leakage criteria.

(c) Minimum differential test pressure shall not be less than 150 psid.

Figure 1121C

Figure 1129A

TABLE 3.3-1

REACTOR PROTECTION SYSTEM INSTRUMENTATION

	FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
1.	Manual Reactor Trip	1	1	1	1, 2 and *	8
2.	Nuclear Overpower	4	2	3	1, 2	2#
3.	RCS Outlet Temperature - High	4	2	3	1, 2	
4.	Nuclear Overpower Based on RCS Flow and AXIAL POWER IMBALANCE	4	2(a)	3	1, 2	2#
5.	RCS Pressure - Low	4	2(a)	3	1, 2	3#
6.	RCS Pressure - High	4	2	3	1, 2	3#
7.	Variable Low RCS Pressure	4	2(a)	3	1, 2	3#
8.	Reactor Containment Pressure - High	4	2	3	1, 2	3#
9.	Intermediate Range, Neutron Flux and Rate	2	0	2	1, 2 and *	4
10.	Source Range, Neutron Flux and Rate					
	A. Startup	2	0	2	2## and *	5
	B. Shutdown	2	0	1	3, 4 and 5	6
11.	Control Rod Drive Trip Breakers	2 per trip system	1 per trip system	2 per trip system	1, 2 and *	7#
12.	Reactor Trip Module	2 per trip system	1 per trip system	2 per trip system	1, 2 and *	7#
13.	Shutdown Bypass RCS Pressure - High	4	2	3	2**, 3**, 4**, 5**	6#
14.	Reactor Coolant Pump Power Monitors	2 per pump	1 from 2 or more pumps (a,b)	2 per pump	1, 2	2#

TABLE 3.3-1 (Continued)

TABLE NOTATION

•With the control rod drive trip breakers in the closed position and the control rod drive system capable of rod withdrawal.

••When Shutdown Bypass is actuated.

#The provisions of Specification 3.0.4 are not applicable.

##High voltage to detector may be de-energized above 10^{-10} amps on both Intermediate Range channels.

(a) Trip may be manually bypassed when RCS pressure ≤ 1720 psig by actuating Shutdown Bypass provided that:

(1) The Nuclear Overpower Trip Setpoint is ≤ 5% of RATED THERMAL POWER,

(2) The Shutdown Bypass RCS Pressure - High Trip Setpoint of ≤ 1720 psig is imposed, and

(3) The Shutdown Bypass is removed when RCS pressure >1800 psig.

(b) Trip may be manually bypassed when reactor power is less than or equal to 2475 MWt and 4 reactor coolant pumps are operating.

ACTION STATEMENTS

ACTION 1 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and/or open the control rod drive trip breakers.

ACTION 2 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided all of the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within one hour.

b. The Minimum Channels OPERABLE requirement is met; however, one additional channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.1.1.

Figure
1129B

TABLE 3.3-1 (Continued)

ACTION STATEMENTS (Continued)

and the inoperable channel above may be bypassed for up to 30 minutes in any 24 hour period when necessary to test the trip breaker associated with the logic of the channel being tested per Specification 4.3.1.1, and

c. Either, THERMAL POWER is restricted to ≤ 75% of RATED RATED THERMAL and the Nuclear Overpower Trip Setpoint is reduced to ≤ 85% of RATED THERMAL POWER within 4 hours or the QUADRANT POWER TILT is monitored at least once per 12 hours.

ACTION 3 - With the number of OPERABLE channels one less than the Total Number of Channels STARTUP and POWER OPERATION may proceed provided both of the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within one hour.

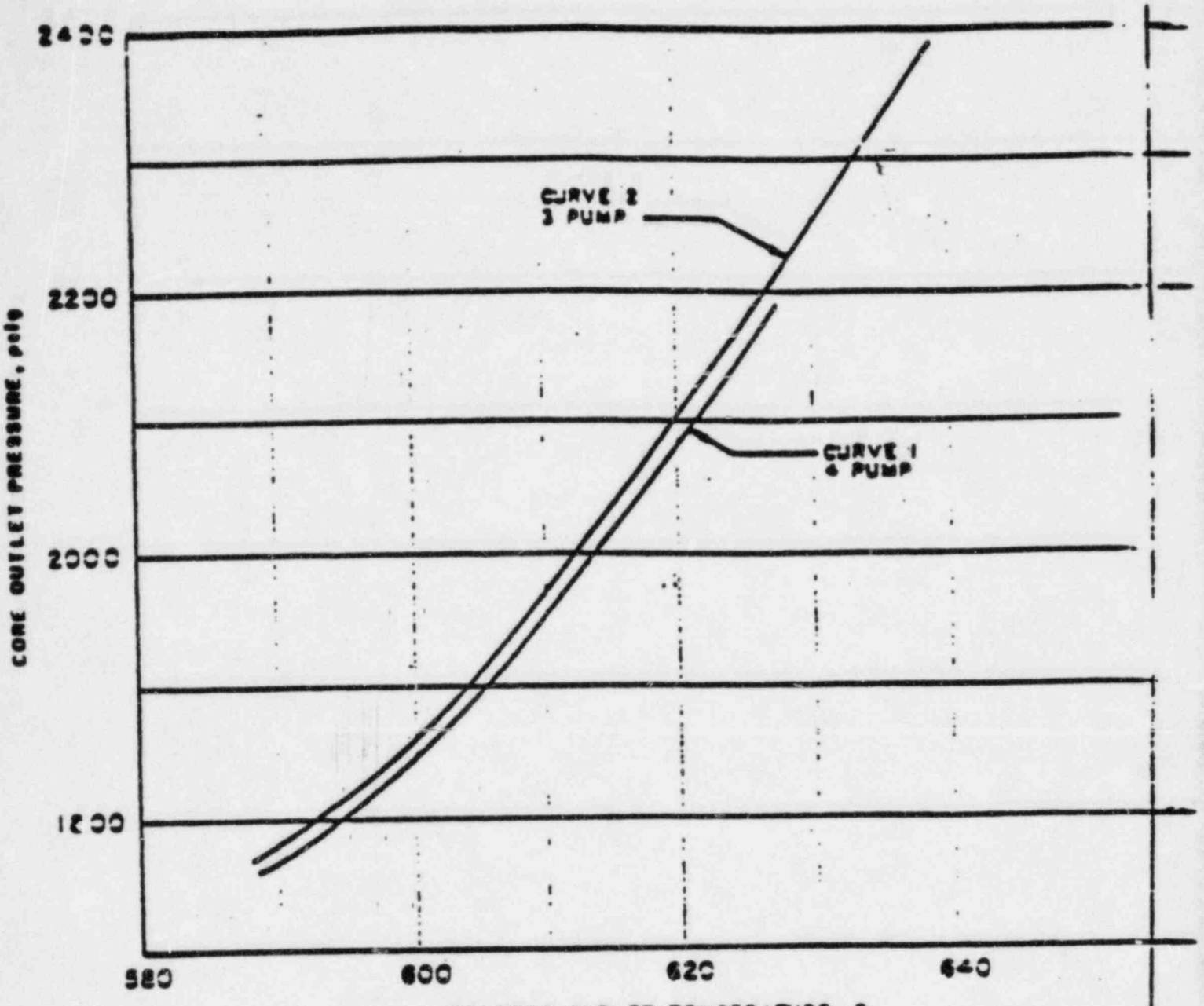
b. The Minimum Channels OPERABLE requirement is met; however, one additional channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.1.1, and the inoperable channel above may be bypassed for up to 30 minutes in any 24 hour period when necessary to test the trip breaker associated with the logic of the channel being tested per Specification 4.3.1.1.

Action 4 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement and with the THERMAL Power level:

a. < 5% of RATED THERMAL POWER restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above 5% of RATED THERMAL POWER.

b. >5% of RATED THERMAL POWER, POWER OPERATION may continue.

Figure
1129C



REACTOR COOLANT FLOW

CURVE	FLOW (% DESIGN)	POWER (RTP)	PUMPS OPERATING (TYPE OF LIMIT)
1	138.7×10^6 (106.8%)	113.08 %	4 PUMPS (DNBR)
2	104.4×10^6 (79.6%)	90.84 %	3 PUMPS (DNBR)

BASES FIGURE 2.1

Figure 1132

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T_{avg} > 280°F

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent ECCS subsystems shall be OPERABLE with each subsystem comprised of:

a. One OPERABLE high pressure injection (HPI) pump,

b. One OPERABLE low pressure injection (LPI) pump,

c. One OPERABLE decay heat cooler, and

d. An OPERABLE flow path capable of taking suction from the borated water storage tank (BWST) on a safety injection signal and manually transferring suction to the containment sump during the recirculation phase of operation.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in HOT SHUTDOWN within the next 12 hours.

b. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.

FIGURE 1134A

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

a. Two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system, and

b. Two separate and independent diesel generators each with:

1. A separate day fuel tank containing a minimum volume of 400 gallons of fuel,

2. A separate fuel storage system containing a minimum volume of 20,300 gallons of fuel, and

3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With either an offsite circuit or diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; restore at least two offsite circuits and two diesel generators to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With one offsite circuit and one diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; restore at least one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore at least two offsite circuits and two diesel generators to OPERABLE status within 72 hours from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

Figure 1134B

ACTION (Continued)

c. With two of the above required offsite A.C. circuits inoperable, demonstrate the OPERABILITY of two diesel generators by performing Surveillance Requirement 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter, unless the diesel generators are already operating; restore at least one of the inoperable offsite sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 6 hours. With only one offsite source restored, restore at least two offsite circuits to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

d. With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1.a within one hour and at least once per 8 hours thereafter; restore at least one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore at least two diesel generators to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each independent circuit between the offsite transmission network and the onsite Class 1E distribution system shall be:

a. Determined OPERABLE at least once per 7 days by verifying;

1. Correct breaker alignments and indicated power availability, and

2. That the sump pumps in the tunnel containing the DC control feeds to the 230kv switchgear are OPERABLE.

b. Demonstrated OPERABLE at least once per 18 months during shutdown by transferring unit power supply from the normal circuit to the alternate circuit.

Figure 1134C

FINAL MARKEDUPMASTER

5

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

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 5.01 (1.00)

(a) - 420,000scf; 26,000 scf(b); 140 scf(c); 1,320 scf(d)

REFERENCE
CR lesson "Fundamentals of Natural Circulation"; CR, ROT 3-14, p2

K

302 03/05/85 02 00 05 00 07 -0.429 -0.429

ANSWER 5.02 (1.00)

(a)

REFERENCE
CR, OP-203 Rev. 47, p 20.

K

302 03/05/85 03 00 01 06 10 +0.800 +0.800
302 08/18/86

ANSWER 5.03 (1.00)

(b)

REFERENCE
OC OP 1102/01, encl 4.3, p 3; CR, STM 504, p111; OC, IC-ICS, p 85;
OC CM-SG, p 19.
CR HTFF, pp 148-156.

035/010 K1.09

269 8/19/85 12 00 04 00 +0.500 +0.500

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 5.04 (1.00)

(a)

REFERENCE
OC FNRE, p 120; OC, NETRO, 12.1-4; CR, NETRO, 12.1-4.

001/010 K 5.16 (2.9/3.5)

269 8/19/85 09 03 03 01 16 +0.250 +0.250

ANSWER 5.05 (1.00)

(c)

REFERENCE
OC, OP 1106/01, p 10, ; BK,GP-03, p 19.
CR3, power system ops., pp 22-23. BK, 20-2-C4, p 37.

62/0 A4.03 (2.8/2.9)

269 8/19/85 10 02 03 01 16 +0.375 +0.375
325 5/19/86 06 02 00 00 08 +0.500 +0.417
302 8/18/86

ANSWER 5.06 (1.00)

(c)

REFERENCE
CR, Reactivity Balance Calculations SP-421.

ANSWER 5.07 (1.50)

a. Increase
b. Increase
c. Decrease
d. Remain the same
e. Increase
f. Decrease

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, ROT 2-2, p 78.

ANSWER 5.08 (2.00)

1. Subcooled water receiving heat
2. Bubbles collapse in subcooled water
3. Bubbles remain out into water channel
4. Partial bubbles, partial unstable film
5. Complete vapor film
6. Dryout

REFERENCE
CR, NETPP, p 3.3-3; CR, 081.16.

ANSWER 5.09 (1.00)

a. To prevent centerline fuel melt
b. To ensure that clad temperatures remain less than or equal to 2200 degF on worst case LOCA. (To maintain → DNBR ≥ 1.3).

REFERENCE
CR, TS, pp B2-2, B 3/4 2-1.

ANSWER 5.10 (1.00)

RCS pressure high setpoint

REFERENCE
CR, TS, p B 2-6

ANSWER 5.11 (2.00)

a. steam generator tube rupture (0.5)

b. main condenser not available (1.5)
HPI required to maintain pressurizer level
RCPs not operating

REFERENCE
CR, ROT 3-8, p SGTR14.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 5.12 (1.00)

a. Sodium Hydroxide
b. Water

REFERENCE
CR, ROT 3-14, p 4.

ANSWER 5.13 (1.50)

a. Tc decrease
b. Th decrease
c. Incores decrease

REFERENCE
CR, VF-580 R5, p 7.

ANSWER 5.14 (2.00)

1. the moderator temperature coefficient is within its analyzed temperature range,
2. the protective instrumentation is within its normal operating range,
3. the pressurizer is capable of being in an operable status with a steam bubble, and
4. the reactor pressure vessel is above its minimum RTndt temperature.

REFERENCE
CR, TS, p 83/4 1-2.

ANSWER 5.15 (.50)

Doppler coefficient.

REFERENCE
CR, NETRO, p 8.2-2.

ANSWER 5.16 (1.00)

To avoid boron precipitation in the event the RCS is not subcooled.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, ROT 3-6, p 7.

ANSWER 5.17 (1.50)

a. 0.7% (0.5)
b. Delayed neutrons have a generation time of 12.7 seconds while prompt neutrons have a generation time of 10E-5 seconds. If we use weighted averages, we can see that the average generation time is reduced to about 0.1 second. This factor provides better reactor control. (1.0)

REFERENCE
CR, NETRO, pp 5.3-1,5.4-7.

ANSWER 5.18 (1.00)

Xenon concentrations may increase or decrease but samarium will always decrease during this transient.

REFERENCE
CR, FNRE, pp 162,168.

ANSWER 5.19 (1.00)

No. A larger amount of reactivity is required to increase power from 10% to 30% because Tave and Tfuel will be required to increase. This will add negative reactivity from both. A power increase from 30% to 50% will add reactivity only due to the change in Tfuel.

REFERENCE
CR, STM 504, p 177.

ANSWER 5.20 (1.00)

Increase. The MTC will introduce negative reactivity due to the temperature increase.

REFERENCE
CR, NETRO, p 8.4-3.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 5.21 (1.00)

A gamma is completely asbsorbed by an orbital electron, the electron is ejected from the atom, causing the detector gases to ionize.

REFERENCE
CR, NETBNC, p 8.2-3; CR, GB 1.99.

ANSWER 5.22 (1.00)

The new element will have increased in atomic number by one and the mass number will remain the same as the original element.

REFERENCE
CR, NETBNC, p 7.3-1.

ANSWER 5.23 (1.00)

1. The fuel temperature coefficient becomes more negative as Pu-240 builds up causing increased resonance capture.
2. The MTC becomes more negative due to the reduction of the soluble poison effect as temperature increases.

REFERENCE
CR, NETRO, p 11.4-4.

ANSWER 5.24 (2.00)

See Answer figure 1055 attached.

REFERENCE
OC, FNRE, pp 97, 105; CR, Principles of NRE, Glasstone,S., p 238; CR, NETRO, fig 6.6-2.

OC 07/14/86
CR 08/18/86

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 5.25 (1.00)

a. 3.125 HP
b. 22.5 gpm
c. 62.5 psi

REFERENCE
CR, NETPP, p 6.2-3.

K

302 8/18/86

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 6.01 (1.00)

(a)

REFERENCE
STM-22, p22-25.

240E0000

K

302 03/05/85 00 03 05 02 10 -0.600 -0.600

ANSWER 6.02 (1.00)

(c)

REFERENCE
CR, AP-303, p 8.

K

302 12/17/84 04 00 00 00 04 +1.000 +1.000

ANSWER 6.03 (1.00)

(a) or (b)

REFERENCE
CR, STM 25-13/14.

K

302 12/17/84 03 01 00 00 04 +0.500 +0.500

ANSWER 6.04 (1.00)

(c)

REFERENCE
CR, STM-504, s 1.3.4, p 7.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 6.05 (1.00)

(c)

REFERENCE
CR, ROT 4-15, p 14.

302 08/18/86

ANSWER 6.06 (1.00)

(d)

REFERENCE
CR, STM 17-17/18; CR, ROT 4-1, p 71.

K

302 12/17/84 03 01 00 00 04 +0.500 +0.500

ANSWER 6.07 (1.00)

(c)

REFERENCE
CR, STM-504, s 4.1, (QB); CR, STM 504, p 124.

ANSWER 6.08 (1.00) Cooling and seal water flow-normal: pressure 15 psi at bearing (±2psi).

1. ~~condenser vacuum of at least 27inches Hg is established.~~
2. Lube water flow =or> ~~10~~ 5 gpm (+or- ~~5~~ 0.5 gpm).
3. Water box has been primed to =or> 115 feet (+or- 15 feet).
4. Pump trip permit: thirty seconds has elapsed since pump last ran. (+or-3 sec).

REFERENCE
CR, STM 35-7.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 6.09 (1.00)

1. Gland sealing steam system
2. RW evaporator
3. RC evaporator
4. CBAST
5. CWST
6. MFWPs
7. Deaerator sparger nozzles
8. EFP-2
9. Ultrasonic sink
10. Deaerator dome (tray section)
11. Decon pit

(any 8 @ 0.125 each)

REFERENCE
CR, STM 606, pp 7,8 (QB)

ANSWER 6.10 (1.00)

Normal PT trace following a reactor trip.

REFERENCE
CR, Generic ATOG guideline, figure 10-4; CR, ROT 4-17.

ANSWER 6.11 (1.00)

It should be set on zero.

REFERENCE
CR, STM 10, pp 36,37; CR, ROT 4-6, p 19.

ANSWER 6.12 (1.50)

a. If a NI/RPS channel is in channel bypass only the corresponeing EFIC channel may be bypassed.
b. If an EFIC channel is in maintenance bypass, and any other but the corresdponding NI/RPS channel is placed in bypass, the bypass for the EFIC channel will be removed.
c. Placing a NI/RPS channel in bypass will cause the corresponding EFIC channel's maintenance bypass indication to actuate and the bypass condition for the EFIC channel will be annunciated, even though the EFIC channel is not actually in maintenance bypass.
d. Only one EFIC channel may be bypassed at a time.
e. The EFIC maintenance bypass feature does not bypass the EFW initiation from ES-HPI.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, ROT 4-15, p 21.

ANSWER 6.13 (1.00)

a. operator error
b. electric failure
c. hydraulic failure

REFERENCE
CR, Requal fuel handling lesson plan rev 1, p 13; CR, FP 601, p6.

ANSWER 6.14 (1.00)

Preaction sprinkler system (dry pipe)

REFERENCE
CR, Training letter TRA 0013.

ANSWER 6.15 (1.00)

a. RMA-3 - ensure stopped AHF-11A and 11B. (0.66)
b. RMA-4 - ensure stopped AHF-10. (0.33)

REFERENCE
CR, AP-243 and AP-244; p 2.

ANSWER 6.16 (1.00)

from pressure error

REFERENCE
CR, STM 504, p 82.

ANSWER 6.17 (1.00)

Venting the PZR to the makeup tank.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, OP-301, (QB).

ANSWER 6.18 (1.50)

DHV-3,4,41 and 91 are monitored. (0.5)
284(+or-15psi) (0.5)
DHV-3 and 4 will automatically close. (If DHV-41 or 91 are open an alarm will be actuated). (0.5)
REFERENCE
CR, ROT 4-1, p 77, (QB).

ANSWER 6.19 (1.00)

High level dumps for the HP flash tanks.

REFERENCE
CR, STM 628, p 15.

ANSWER 6.20 (1.00)

1. Active - these channels are continously monitored.
2. Passive - these channels must be manually configured to be monitored.

REFERENCE
CR, ROT 4-2, p (8) (QB).

ANSWER 6.21 (1.00)

either D
^A RB pressure of 4 psi arms the RB spray system by opening the NaOH tank outlet valves (BSV-11 & 12) and by opening the RB spray pump suction valves (BSV-3 & 4) to the 1550 gpm position or 2) actuation of the HPI ES channels from either the 1500 or 500 RCS pressure setpoint or by the 4psig R.B. pressure setpoint.
REFERENCE
CR, STM-5, pp 1-4; CR, ROT 4-1, p 89; ROT 4-13, RO, pp 49,50.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 6.22 (1.00)

Prior to the prefilters and after the block orifice and check valve 252.

REFERENCE
CR, STM 17, pp 4,5; CR, ROT 4-1, fig 9.

ANSWER 6.23 (1.50)

The amber lamp will be lit and breaker 3210 will be open and cannot be closed. (1.0)
This is the cross tie interlock provided to prevent paralleling the DGs. (0.5)

REFERENCE
CR, STM 10, pp 56,57; CR, ROT 4-3, p 17.

ANSWER 6.24 (1.00)

It is used to cross connect the auxiliary power supply and DL hold bus.

REFERENCE
CR, STM 504, (QB)

ANSWER 6.25 (1.00)

If a neutron demand (reactor demand vs actual neutron power) of >5% is generated, a signal will be generated to modify feedwater demand either up or down as appropriate to match actual neutron power to feedwater (±5%).

REFERENCE
CR, STM 504, p 79, (QB).

ANSWER 6.26 (1.00)

An uninterruptable power supply located in the 4160 ES "A" switchgear room.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, dwg 302-693, (08).

ANSWER 6.27 (1.50)

a. hot standby
b. steam discharge to atmosphere
c. 24 hours

REFERENCE
CR, TS, p B 3/4 7-2.

ANSWER 6.28 (1.00)

When both throttle valves in one steam chest are open.

REFERENCE
CR, NAO 83, p 1; CR, NAO 83, dwg FD-302-011.

stet.

10/7/86

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.01 (1.00)

(d)

REFERENCE
CR, OP-204, Rev. 42, p 8.

ANSWER 7.02 (1.00)

(b)

REFERENCE
CR, OP-302, p 2.

ANSWER 7.03 (1.00)

(b)

REFERENCE
10CRF20.101 R 1/1/86, p 258.

ANSWER 7.04 (2.00)

a. True
b. False
c. False
d. True

REFERENCE
CR, OP-412, pp 8,11,14,16.

ANSWER 7.05 (1.00)

a. criticality by deboration
b. boron concentration

REFERENCE
CR, OP 210, p 10.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.06 (1.00)

a. Less than adequate subcooling margin
b. Less than 2 HPI pumps are available

REFERENCE
CR, AP-530, p 3.

ANSWER 7.07 (1.00)

a. As directed by "health physics" personnel
b. As specified by appropriate "RWP"
c. Prior to reaching 3/4 scale (ie, normally 150 mr)

REFERENCE
CR, RSP-101 rev 5, p 9.

ANSWER 7.08 (1.00)

a. Observe knob (labeled "OFF, BATT, X100, X10, X1") is set on "X1".
b. Observe "Response" switch is in the "slow" position.
c. Observe meter movement for upscale deflection.
d. Listen for audible response.

REFERENCE
CR, RSP-101 rev 5, pp 19,20.

ANSWER 7.09 (1.00)

a. The PORV block valve is operable (capable of closing).
b. The operator on the switch does not leave the PORV switch unattended (until he assures that the PORV is closed and there is no flow thru it).

REFERENCE
CR, OSIM, p V-14.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.10 (1.00)

a. LBPR retainer
b. Source retainer

REFERENCE
CR, FP-203 rev 17, p 9.

ANSWER 7.11 (3.00)

a. 1) ensure turbine runback (1.0)
   2) ensure RC pressure stable
b. ensure 1) affected MFP tripped (1.0)
   2) open FWV-28 (cross tie)
   3) closed FWV-29
   4) control rods inserting
c. i 55% (1.0)
   ii 55%
   iii 60%
   iv ~~70%~~ 75%

Reference: CR, STM-504, P. 12

ANSWER 7.12 (1.00)

a. notify plant personnel of the fire location over the PA twice.
b. depress the "fire alarm" pushbuttons.
c. ensure operation of automatic fire protection system.
d. establish continous monitoring of PL-1 and portable radios.
e. verify fire brigade is responding to notifications.

REFERENCE
CR, AP-880 R3, p 2.

ANSWER 7.13 (1.00)

OP-408, Nuclear Services Cooling System.

REFERENCE
CR, OP-408 R44, p 9.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.14 (1.00)

Notify the Aux building operator to ensure closed:
WDV-891, and 892.

REFERENCE
CR, AP-272 R0, p 2.

ANSWER 7.15 (2.00)

1. Announce over the PA system that the control room is being evacuated.
2. Depress 'reactor trip' push button.
3. Ensure the turbine trips
4. Actuate emergency feed flow
5. Assure OTSG levels are being controlled
6. Actuate main feed isolation
7. Actuate main steam isolation
8. Close MUV-49
9. Ensure power is available to all ES buses
10. Close RCV-11 (PORV block valve). (10 @ 0.20 ea)

REFERENCE
CR, AP-990 R01, pp 2,3.

ANSWER 7.16 (1.00)

Place the Tc load ratio control station in 'hand'.

REFERENCE
CR, OP-204, p19.

ANSWER 7.17 (2.00)

a. If subcooling margin is inadequate - >1500 psig 20 degF ;
=or<1500 psig 50 degF.
b. If all RCPs have not been stopped within two minutes, they must be kept running.

REFERENCE
CR, AP-380 R6, p 4.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.18 (1.00)

This is a core hydraulic lift consideration.

REFERENCE
CR, OP-202 R70, p 44a.(QB)

ANSWER 7.19 (1.00)

dele

This could result in an EFW actuation.

REFERENCE
CR, OP-203, (QB).

ANSWER 7.20 (1.00)

To prevent challenging the secondary safety valves.

REFERENCE
CR, EP-390, p 8, (QB).

ANSWER 7.21 (1.00)

a. lifting secondary safety valves
b. flooding the steam lines
c. excessive cooldown causing a PTS event

REFERENCE
CR, ATOG guidelines, (QB).

ANSWER 7.22 (1.00)

The additional weight and its distribution may negate the seismic design of the piping.

REFERENCE
CR, CP-113 R49, p 32.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 7.23 (1.00)

>1000 mr/hr - 1. flashing light
2. locked gate or guard

REFERENCE
CR, RSP-101 R5, p 17.

ANSWER 7.24 (2.00)

a. all
b. QRA
c. none
d. 5 hours

REFERENCE
CR, EM-202 R26, pp 44,45,50.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 8.01 (1.00)

(c)

REFERENCE
CR, TS 3.8.1.2, p 3/4 8-6.

ANSWER 8.02 (1.00)

(d)

REFERENCE
CR, FP-203, p14.

ANSWER 8.03 (1.00)

(c)

REFERENCE
CR, TS 3.4.5, p 3/4 4-6 and fig 3.4-5.

ANSWER 8.04 (1.00)

(b)

REFERENCE
CR, TS 3.2.4, p 3/4 2-8.

ANSWER 8.05 (1.00)

(a)

REFERENCE
CR, EM-202 R19, p 3.

ANSWER 8.06 (1.00)

(a)

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, TS bases figure 2.1, p B 2-8; CR, TS, pp B 3/4 2-2,3;

ANSWER 8.07 (1.00)

(b)

REFERENCE
CR, TS, pp 4-5, 1-16, 5-1, 1-14.

ANSWER 8.08 (1.00)

(d)

REFERENCE
CR, TS, p 3/4 0-1.

ANSWER 8.09 (2.00)

a. Must obtain a qualified relief operator at the controls.
b. He remains within the confines of the control center (.5) and maintains an unobstructed view of the operational control panels (.5).

REFERENCE
CR, AI-500, p 6.

ANSWER 8.10 (1.00)

0.3 gpm (+or- 0.1); up to one week (+or- 2 days)

REFERENCE
CR, OSIM R47, p VI-3.

ANSWER 8.11 (1.00)

1. Single line thru the incorrect entry
2. Enter correct information adjacent to or in a space available with reference to deleted entry
3. Individual making correction shall initial and date error correction.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

REFERENCE
CR, AI-500 R 53, p 9.

ANSWER 8.12 (1.00)

15% in 1 hour.

REFERENCE
CR, OP-204 R42, p 8.

ANSWER 8.13 (1.00)

Three; provided the RPS setpoints are lowered; to 67.5% RTP. (0.33 ea)

REFERENCE
CR, TS 3.7.1.1 R77, pp 3/4 7-1,2.

ANSWER 8.14 (1.00)

1. Turbine EH control system
2. 500 KV protective relaying
3. 4160V ES and unit protective relaying
4. Generator and exciter protective relaying
5. Steam line rupture matrix

REFERENCE
CR, OSIM R47, p VI-2.

ANSWER 8.15 (1.00)

1. NI-6 be placed in a tripped condition
2. QPT be monitored at least once per 12 hours.

REFERENCE
CR, TS 3.3.1.1, pp 3-3,4.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 8.16 (1.00)

a. Helium leak detection
b. It has greater sensitivity, allowing a lower limit to be the criteria for water box removal for tube repairs.

ANSWER 8.17 (1.00)

They are warranted if the recuction in individual dose expected to be achieved by carrying out the protective action is not offset by excessive risks to individual safety in taking the protective action.

REFERENCE
CR, RERP R5, p 4-2.

ANSWER 8.18 (2.00)

a. The clearance is to be issued for an unusual, non routine or abnormal evolution.
b. The clearance to be issued cannot meet the double valve protection guidelines of 500 psig and/or 200 degF and =or> 1/2 inch diameter opening.
c. The clearance to be issued cannot meet the ES train separation criteria.
d. The clearance to be issued cannot meet the limiting contitions for voluntarily entering a degraded mode of operation.

REFERENCE
CR, CP-115.

ANSWER 8.19 (3.00)

a. 1) If the SS declares the PORV inoperable @ 0200, then 0300. or
   2) If the SS does not declare the PORV inoperable @ 0200, then 0330.
b. Hot Standby within 7 hours from the time stated in part a.
c. Yes. Provisionss of 3.0.4 are not applicable.

REFERENCE
CR, TS 3.4.3.2 R77, p 3/4 4-4a.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 8.20 (2.00)

a. Yes - Note 2, Table 3.4-2, 2 gpm is less than 2.5 gpm 50% of band.
b. Note 3, Table 3.4-2, reduce to within limits within 4 hours or be in hot standby within the following 6 hours.

REFERENCE
CR, TS R4/20/81, pp 3/4 4-15,16,18a.

ANSWER 8.21 (2.00)

a. SOTA
Nuclear Operations Superintendent
Person on call
NRC (red phone)
NRC resident inspector

b. Completes steps 1 - 9.
Assigns next consecutive report number
Forwards it to the Nuclear Operations Superintendent for disposition.
Logs it in the shutdown log.

REFERENCE
CR, AI-500 R53, p 17.

ANSWER 8.22 (1.00)

a. Short term instructions are any miscellaneous instructions that may arise and shall be used for routine maintenance and personnel instruction where plant safety is not affected. (0.5)
b. 90 days (0.25)
c. Nuclear shift supervisor (0.25)

REFERENCE
CR, AI-500 R53, p 14.

ANSWER 8.23 (1.00)

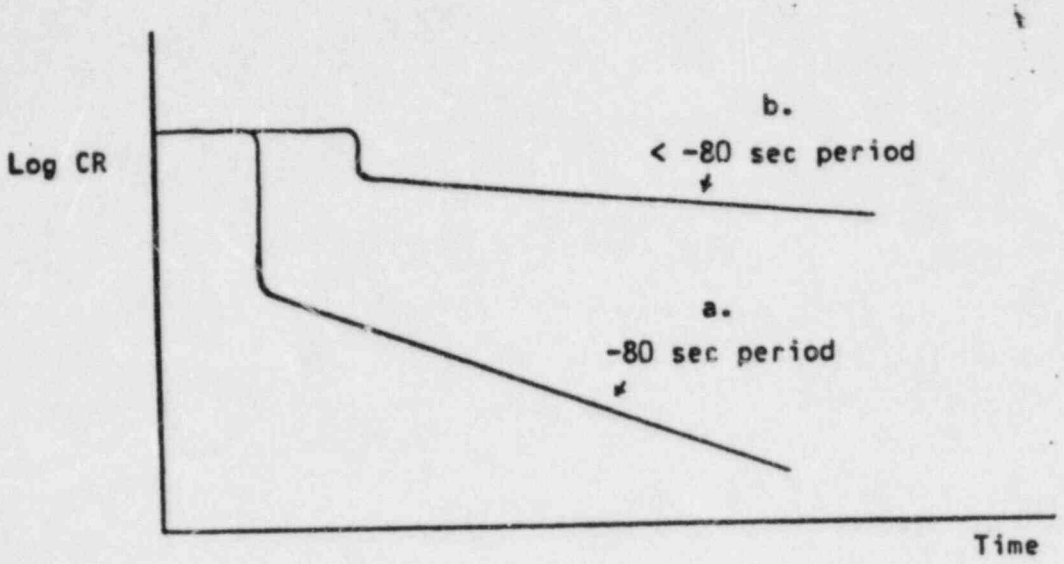
Immediate Temporary changes (ITCs) are normally of an urgent nature such that time and/or plant conditions necessitate implementation of changes prior to the time required by Interim Changes or Permanent revisions.

ANSWERS -- CRYSTAL RIVER -86/08/18-LAWYER, SANDY

ANSWER 8.24 (1.00)

a. Evacuate all people within a 2 mile radius, and
b. Shelter all people within 5 miles in the potentially affected sectors.

REFERENCE
CR, EM-202 R26, p 28.



Answer Figure 1055

FINAL MARKED UP MASTER

3

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

Master

FACILITY: CRYSTAL RIVER

REACTOR TYPE: PWR-B&W177

DATE ADMINISTERED: 86/08/19

EXAMINER: HUENEFELD, J.

CANDIDATE: ANSWER KEY

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
30.00	25.00			1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
30.00	25.00			2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
30.00	25.00			3.	INSTRUMENTS AND CONTROLS
30.00	25.00			4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
120.00		Final Grade			Totals

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

Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only on one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

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

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

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

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

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

QUESTION 1.01 (.50)

When at normal operating temperature, HOW many inches will PZR level change for one deg F change in T-ave? (0.5)

QUESTION 1.02 (1.50)

At higher RCS temperatures, will a GREATER or LOWER letdown volumetric flowrate be required to maintain pressurizer level for the same heatup rate? PROVIDE a one sentence explanation. (1.5)

QUESTION 1.03 (1.50)

If a Reactor Coolant Pump is secured, WHY won't the seal cooler system provide sufficient cooling? (1.5)

QUESTION 1.04 (2.00)

DESCRIBE and EXPLAIN the ICS response to fouling in one OTSG. SPECIFY the relative values of feedwater flow, T(c)'s, T(h)'s, and OTSG levels. (2.0)

QUESTION 1.05 (1.50)

The reactor is operating at 75% power with ICS when one RCP in the "A" loop trips. When the transient is over, WHAT fraction of feedwater flow will go to the "A" loop and WHAT fraction of the total flow will go to the "B" loop? (1.5)

QUESTION 1.06 (1.50)

STATE three (3) reasons why the initiation of Emergency Feedwater provides for an increased rate of heat transfer over the use of Main Feedwater. (1.5)

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

QUESTION 1.07 (1.00)

WHAT parameter is used by EFIC to determine the actual ramp rate for controlling the rate at which OTSG level is increased? (1.0)

QUESTION 1.08 (1.00)

The actual value of Reactor Coolant System pressure is decreasing rapidly. The actual values of Pressurizer Level and Makeup Tank Level are remaining the same. WHAT is the cause? (1.0)

QUESTION 1.09 (1.50)

IS imbalance normally kept on the positive side or the negative side of 0? WHY? (1.5)

QUESTION 1.10 (1.00)

Should a xenon oscillation start, WHICH one of the following is the preferred method for dampening the oscillation? (SELECT one.) (1.0)

(a.) Make a correction when the oscillation is at its average value by driving imbalance to one of the operational extremes.

(b.) Make a correction 1 to 2 hours before the peak value by driving imbalance toward its average value.

(c.) Make a correction 1 to 2 hours after the peak value by driving imbalance toward its average value.

(d.) Make corrections continuously to hold imbalance at "0".

QUESTION 1.11 (1.50)

DEFINE Shutdown Margin. (1.5)

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

QUESTION 1.12 (2.00)

STATE the four (4) criterion that are used in accordance with VP-580 to ensure that Natural Circulation is occurring. (2.0)

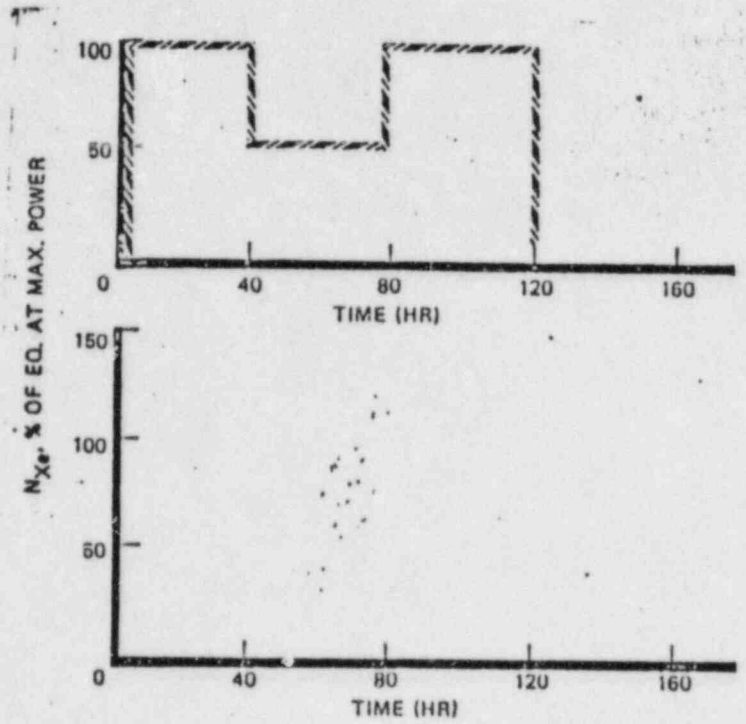
QUESTION 1.13 (1.50)

WHAT special and unique reactivity concern would be associated with an event involving an OTSG tube rupture in an OTSG that is experiencing a steam leak inside the reactor building? (1.5)

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

QUESTION 1.14 (3.00)

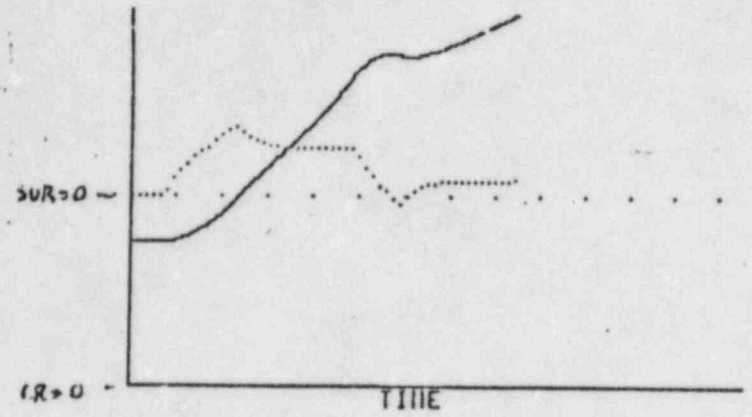
a. CONSTRUCT a plot of the concentration of xenon for the following power history. (2.0)



b. EXPLAIN the shape of the xenon trace you have drawn for the power reduction from 100% to 50%. (1.0)

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

QUESTION 1.15 (3.00)



Key: Dotted line is startup rate.
Solid line is neutron countrate.

Above is a graph of simulated reactor response to two (2) simple reactivity manipulations. The first is a rod withdrawal from criticality. The second is a rod insertion. Assuming no reactivity feedback and negligible source effects, ANSWER the following questions.

a. On the graph itself, INDICATE the periods of time and direction of rod motion. (1.0)

b. Are the amounts of reactivity inserted the same for both the insertion and the withdrawal? (0.5)

c. EXPLAIN the shape of the plot of startup rate. (1.5)

QUESTION 1.16 (1.00)

The reactor is made to be subcritical by a very small amount of reactivity (less than the value of beta). WILL the resultant stable negative startup rate approach -1/3 dpm? EXPLAIN. (1.0)

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

QUESTION 1.17 (1.00)

Over core life, the reactor becomes more responsive for a given reactivity change due to: (SELECT one) (1.0)

(a.) Pu-239 causing an increase in Beff.
(b.) Pu-239 causing a decrease in Beff.
(c.) Pu-240 causing an increase in Beff.
(d.) Pu-240 causing a decrease in Beff.

QUESTION 1.18 (1.00)

During fuel loading, WHICH of the following will have NO effect on the shape of a 1/M plot? (1.0)

(a.) The location of the neutron sources in the core.

(b.) The strength of the neutron sources in the core.

(c.) The location of the neutron detectors around the core.

(d.) The order of placement of fuel assemblies provided the proper enrichments are placed in their proper location.

QUESTION 1.19 (1.00)

OP-210, "Reactor Startup," requires that the critical rod position be taken at 10**-8 amps on the intermediate range. If, during a xenon free reactor startup at MOL, the operator "overshot" 10**-8 amps and instead leveled off at 10**-7 amps, WHICH of the following statements is CORRECT? (1.0)

(a.) At 10**-7 amps, there are little or no effects from nuclear heat but since the reactor is a decade higher in power, the critical rod position would be higher.

(b.) At 10**-7 amps, there are little or no effects from nuclear heat; therefore, the critical rod position should be the same as at 10**-8 amps.

(c.) At 10**-7 amps there are substantial effects from nuclear heat; therefore, the critical rod positions will be higher than at 10**-8 amps.

(d.) At 10**-7 amps, nuclear heat, xenon and the decade higher in power level will result in a higher critical rod position.

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

QUESTION 1.20 (1.00)

Concerning the behavior of samarium-149, in the reactor, WHICH of the following statements is CORRECT? (1.0)

(a.) Most of the Sm produced comes directly from fission.

(b.) Most of the removal of Sm is by radioactive decay.

(c.) Sm reactivity is independent of flux once it has reached equilibrium.

(d.) Equilibrium Sm is reached about 40 hours after the initial startup of the reactor.

QUESTION 1.21 (1.00)

WHICH of the following statements about pump Net Positive Suction Head (NPSH) is CORRECT? (1.0)

(a.) NPSH is the amount by which the saturation pressure is greater than the suction pressure for the water being pumped.

(b.) When a pump is started, the NPSH will decrease by the amount of the pressure drop in the suction piping.

(c.) NPSH is essential for operation of centrifugal pumps but not for positive displacement pumps.

(d.) NPSH can be calculated by subtracting the suction pressure from the discharge pressure.

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

QUESTION 2.01 (1.00)

During normal operations, about HOW MUCH of the pressurizer is full of liquid water: (SELECT one) (1.0)

(a.) 1/4
(b.) 1/3
(c.) 1/2
(d.) 3/4

QUESTION 2.02 (.50)

ANSWER TRUE or FALSE.

DHV-41, the Decay Heat Removal suction line containment isolation valve, is rated for full system temperature and pressure. (0.5)

QUESTION 2.03 (1.00)

WHAT is the potential inadvertent consequence of improper operation of the suction valves to the Decay Heat Removal pumps from the Reactor Building sump (DHV-42, and 43)? (1.0)

QUESTION 2.04 (1.00)

STATE the shut-off head for the LPI pumps. (1.0)

QUESTION 2.05 (1.00)

WHAT is the principle gas of concern present in the Low Pressure vent header? (1.0)

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

QUESTION 2.06 (1.50)

a. WHY must a minimum discharge pressure of the waste gas compressors be maintained? (1.0)

b. WHAT cooling water system provides cooling to the waste gas compressor heat exchangers? (0.5)

QUESTION 2.07 (.50)

ANSWER TRUE or FALSE.

When the Waste Gas Decay Tank Sequencer is used to manually shift waste gas tanks, the on-coming waste gas tank inlet valve will open before the off-going tank's inlet valve closes. (0.5)

QUESTION 2.08 (1.00)

The RCS Hot Leg vents contain orifices that limit flow through the vent lines to: (SELECT one) (1.0)

(a.) 59,000 lbm/sec saturated steam and 100,000 lbm/sec saturated liquid

(b.) 59,000 lbm/sec saturated liquid and 100,000 lbm/sec saturated steam

(c.) 59,000 lbm/hr saturated steam and 100,000 lbm/hr saturated liquid

(d.) 59,000 lbm/hr saturated liquid and 100,000 lbm/hr saturated steam

QUESTION 2.09 (.50)

WHAT is the design capacity of the PORV? (0.5)

QUESTION 2.10 (1.50)

STATE the normal and alternate cooling water supplies to each of the three (3) makeup pumps. (1.5)

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

QUESTION 2.11 (.50)

HOW MANY design start attempts will the diesel air start reservoirs support? (0.5)

QUESTION 2.12 (1.00)

STATE one (1) of the three (3) nameplate ratings for the diesel engine. (1.0)

QUESTION 2.13 (1.00)

WHAT two (2) things will have to be done to the EFW suction valves to the CST (EFV-3 and 4) in the event that they are to be operated to align the EFW system with the Hotwell? (1.0)

QUESTION 2.14 (1.00)

WHICH RCPs are supplied from WHICH 6900 VAC busses? (1.0)

QUESTION 2.15 (1.50)

WHAT do the Low Load control valves do when the Main Block valves open during a normal power escalation? WHY? (1.5)

QUESTION 2.16 (3.00)

a. The "B" makeup pump may be powered from either of the 4160 VAC safety features busses. Basically DESCRIBE the design features that make this transfer of power possible without electrically paralleling the two busses. (2.0)

b. If the "B" makeup pump is to be selected as an ES HPI pump, WHAT must the ES switch lineup be at the 4160 VAC busses? (1.0)

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

QUESTION 2.17 (1.00)

During normal operation, from WHERE does the power for the two (2) 4160 VAC busses come? (1.0)

QUESTION 2.18 (2.50)

LIST those Main Feedwater valves that will be closed by EFIC when a Main Steam Line Isolation occurs on one side. (2.5)

QUESTION 2.19 (1.50)

Each Main Steam Isolation valve has an external bypass assembly consisting of an exterior pipeline running from the underseat area of the valve body to the area underneath the bonnet with an in-line stop check valve. WHAT is the purpose of this bypass assembly? INCLUDE the stop check valve in your discussion. (1.5)

QUESTION 2.20 (1.00)

WHERE are the main steam line radiation monitors relative to the main steam safety valves and the branches to the atmospheric dump valves? (1.0)

QUESTION 2.21 (.50)

WHAT is the shutoff head of the feedwater booster pumps? (0.5)

QUESTION 2.22 (1.00)

There are two (2) "C" breakers and two (2) "D" breakers in the CRD system. WHAT do each supply? (1.0)

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

QUESTION 2.23 (1.00)

WHICH one of the following statements is CORRECT regarding the hazards of letting an OTSG boil dry? (1.0)

(a.) The shell becomes hotter than the tubes which can lead to tube buckling.

(b.) The shell becomes hotter than the tubes which can lead to exceeding yield stress in the tubes.

(c.) The tubes become hotter than the shell which can lead to tube buckling.

(d.) The tubes become hotter than the shell which can lead to exceeding yield stress in the tubes.

QUESTION 2.24 (1.00)

WHICH one of the following components of the EHC control oil system are provided to maintain system pressure at approximately 1250 psi? (1.0)

(a.) unloader valves
(b.) relief valves
(c.) high pressure accumulators
(d.) pressure switches

QUESTION 2.25 (1.00)

WHICH one of the following plant ventilation fans is operated from its local control station (as opposed to operation from the control room)? (1.0)

(a.) turbine building ventilation supply fan (AHF-25A)
(b.) steam generator compartment fan (AHF-4A)
(c.) spent fuel pool supply fan (AHF-23A)
(d.) intermediate building ventilation exhaust fan (AHF-29A)

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

QUESTION 2.26 (1.00)

WHICH one of the following makeup pump lube and gear oil system pumps has NO auto start provision? (1.0)

(a.) main lube oil pump
(b.) main gear oil pump
(c.) backup gear oil pump
(d.) backup lube oil pump

QUESTION 2.27 (1.00)

WHICH of the following trip conditions is common to both a main feedwater pump and a feedwater booster pump? (Remember: trip condition, not signal.) (1.0)

(a.) overspeed
(b.) low deaerated level
(c.) suction valves not full open
(d.) main steam line rupture matrix actuation

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

QUESTION 3.01 (.50)

ANSWER TRUE or FALSE.

The pressurizer spray valve may be controlled, in the manual mode, from its MCC. (0.5)

QUESTION 3.02 (1.00)

The pressurizer heaters are interlocked to deenergize upon reaching WHAT level setpoint: (SELECT one) (1.0)

(a.) 100 inches
(b.) 80 inches
(c.) 40 inches
(d.) 20 inches

QUESTION 3.03 (1.50)

STATE five (5) of the seven (7) RCP interlocks. Setpoints are NOT required. (1.5)

QUESTION 3.04 (1.50)

a. WHAT action does the Decay Heat Removal System Automatic Closure Initiation cause? (1.0)

b. HOW may it be bypassed? (0.5)

QUESTION 3.05 (1.00)

GIVE a basic (two sentence) description of the principle of operation of the RCS High Point Vent flow detector. (1.0)

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

QUESTION 3.06 (1.00)

WHICH, if any, of the following switches are NOT spring returned to the automatic or normal position: (SELECT the appropriate answer(s) or answer "none".) (1.0)

(a.) The PORV control switch
(b.) The pressurizer spray block valve control switch
(c.) The pressurizer spray valve control switch
(d.) The Decay Heat Spray line isolation valve control switch.

QUESTION 3.07 (2.00)

STATE the four (4) ICS runbacks, their rates and their limits. (2.0)

QUESTION 3.08 (1.00)

WHAT three (3) conditions will prevent feedwater from taking T-ave control when reactor demand is taken to hand? (1.0)

QUESTION 3.09 (1.00)

WHICH of the following conditions will cause a reactor trip? (SELECT one.) (1.0)

(a.) One RPS channel trips, another is in channel bypass

(b.) One RPS channel trips on high RCS pressure, another trips on high RCS temperature

(c.) One RPS cabinet is deenergized

(d.) MFP "A" and MFP "B" test switches are both placed in test for RPS channel "A"

QUESTION 3.10 (.50)

A reactor trip on high temperature occurs. After the reactor trip, RCS temperature rapidly drops below the trip setpoint. When the operator looks inside the RPS cabinet at the high temperature trip modules, WHAT lights will be brightly lit on that module? (0.5)

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

QUESTION 3.11 (1.50)

When the shutdown bypass switch is activated, WHICH trips are bypassed and WHICH single trip is substituted? (1.5)

QUESTION 3.12 (1.00)

WHAT happens if an HPI auto or manual actuation signal were to occur while in a degraded voltage condition? (1.0)

QUESTION 3.13 (1.00)

ABOUT HOW long after the onset of a degraded voltage condition does it take before the Emergency Diesel Generator output breaker closes, reenergizing the safeguards busses? (SELECT one.) (1.0)

(a.) 3 seconds
(b.) 10 seconds
(c.) 25 seconds
(d.) 50 seconds

QUESTION 3.14 (2.00)

Besides miscellaneous valves, WHAT components are included in "Block One"? (2.0)

QUESTION 3.15 (1.00)

Under normal standby conditions HOW should the diesel governor speed droop be set? WHY? (1.0)

QUESTION 3.16 (1.00)

STATE two (2) ways that the EDG may be stopped locally, even with an ES actuation present. (1.0)

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

QUESTION 3.17 (1.50)

a. WHAT fault actuates the EDG 86 Lockout? (1.0)

b. WHERE must this lockout be reset? (0.5)

QUESTION 3.18 (1.50)

WHAT five (5) conditions will cause the EFIC system to initiate Emergency Feedwater? (1.5)

QUESTION 3.19 (1.00)

WHY should you place the EFW control valves in "Hand" prior to resetting the EFIC logic? (1.0)

QUESTION 3.20 (1.00)

WHAT are the automatic actions that occur in the event that setpoint is reached on RMA-11 (Waste gas)? (1.0)

QUESTION 3.21 (.50)

At WHICH alarm level, ALERT or HIGH, will the interlocks for the Radiation Monitoring system activate? (0.5)

QUESTION 3.22 (1.00)

WHAT happens to the main feedwater block valves if the main feedwater crossconnect (FWV-28) is opened while they are open? (1.0)

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

QUESTION 3.23 (1.00)

If both of the lights on a Bailey meter hand/auto control station are lit: (1.0)

(a.) the station will control in either auto or manual, whichever was last selected.

(b.) the station will not control in either auto or manual.

(c.) the station will control in auto since auto overrides when both are selected.

(d.) the station will control in manual since manual overrides when both are selected.

QUESTION 3.24 (1.00)

WHICH one of the following statements concerning the Control Rod Drive Position Indication System is CORRECT? (1.0)

(a.) The zero (0) percent switch is located 1.5 inches above the in-limit switch.

(b.) The 100 percent switch is located 1.5 inches above the out-limit switch.

(c.) The first rod in any group to reach the 100 percent switch will stop further travel of all rods in that group.

(d.) When actuated, the out-limit switch will generate an out-inhibit condition on the Diamond Panel.

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

QUESTION 3.25 (1.00)

A synchroscope moving slowly in the SLOW direct (counter-clockwise) indicates WHICH of the following? (1.0)

(a.) Machine frequency higher than bus frequency, phases matched.

(b.) Machine frequency lower than bus frequency, phases not matched.

(c.) Machine voltage higher than bus voltage, currents not in phase.

(d.) Machine voltate lower than bus voltage, currents not in phase.

QUESTION 3.26 (1.00)

During a "rapid bus transfer," WHICH one of the following feeder circuit breaker operations will occur (within 6 cycles)? (1.0)

(a.) both the outgoing and the incoming will close

(b.) both the outgoing and the incoming will trip

(c.) the outgoing will trip and the incoming will close simultaneously

(d.) the outgoing will trip before the incoming will close

(e.) the outgoing will trip after the incoming closes

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

QUESTION 3.27 (1.00)

WHICH one of the following is CORRECT concerning the "Sequence - Inhibit lamp (amber)"? (1.0)

(a.) When it comes on, it also generates an "Out-Inhibit" signal.

(b.) This indication will be on until all safety groups are withdrawn to the out-limit.

(c.) Sequence monitor number one (1) provides a fault indication when the groups are inserting or withdrawing out of sequence in the manual mode.

(d.) This lamp is controlled by two sequence monitors, utilizing Groups 5, 6 and 7 Absolute Position Indication (API) average signals.

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

QUESTION 4.01 (1.00)

WHAT administrative controls are applied to operating the DHR pumps in the recirculation mode? (1.0)

QUESTION 4.02 (1.00)

Whenever the reactor vessel head is removed, WHAT is done with DHV-3, DHV-4, and DHV-41? (1.0)

QUESTION 4.03 (2.00)

WHAT five (5) actions must the operator take to feed from the BAST to the MUT? (2.0)

QUESTION 4.04 (.50)

Both the "A" low load block valve and the "A" startup valve are in hand. The "A" load block valve is shut. WHICH of these stations must be placed into auto first? (0.5)

QUESTION 4.05 (1.00)

Some facilities have experienced Rx trips caused by improper switching of the main lube oil coolers. Basically, HOW should this switch be accomplished? (1.0)

QUESTION 4.06 (1.00)

The OSIM states two (2) criteria for determining whether or not it is permissible to utilize the PORV to control high pressure during an emergency. WHAT are those two (2) criteria? (1.0)

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.07 (1.00)

STATE the two (2) administrative radiation dose limits for an individual who does NOT have prior authorization from the Nuclear Plant Manager. (1.0)

QUESTION 4.08 (1.00)

WHICH one of the following conditions does NOT constitute grounds for an immediate manual reactor trip: (SELECT one) (1.0)

(a.) Two (2) main steam isolation valves on different loops have been inadvertently shut.

(b.) Reactor power is <15% and main feedwater is lost.

(c.) Pressurizer level is 295 inches and decreasing.

(d.) All four safety groups drop into the core while at 100% power.

QUESTION 4.09 (.50)

ANSWER TRUE or FALSE.

The Diamond station must be in Auto prior to placing the Reactor Demand in Auto. (0.5)

QUESTION 4.10 (1.00)

WHAT parameter are you procedurally directed to observe to independently verify that generator output voltage is, in fact, 22 kV? (1.0)

QUESTION 4.11 (1.50)

The Runback Verification VP-540 states six (6) parameters that should be observed to check for increased RCS leakage. LIST those six (6) parameters. (1.5)

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.12 (1.00)

According to the Plant Safety Verification Procedure (VP-580), WHAT constitutes adequate subcooling margin? (1.0)

QUESTION 4.13 (2.00)

STATE the required OTSG levels for the following situations as specified in VP-580:

a. RCPs operating. (0.5)
b. No RCPs, adequate subcooling. (0.5)
c. Less than required subcooling. (0.5)
d. Less than 2 HPI pumps. (0.5)

QUESTION 4.14 (2.50)

a. STATE the emergency cooldown limits to be used in the event of an OTSG tube rupture, including the OTSG tube-to-shell limits. (2.0)

b. ARE you required to maintain the fuel pins in compression limits during this emergency? (0.5)

QUESTION 4.15 (1.00)

a. At WHAT flowrate must HPI recirc be established? (0.5)

b. WHAT is the maximum allowable flow for an HPI pump? (0.5)

QUESTION 4.16 (1.00)

HOW is tube-to-shell delta T calculated? (1.0)

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.17 (3.00)

Subcooling margin is lost as a result of a small break LOCA. STATE the three (3) major actions, automatic or manual that must be initiated. (3.0)

QUESTION 4.18 (3.00)

a. WHAT condition must be satisfied prior to throttling HPI subsequent to a valid manual or automatic initiation? (1.0)

b. WHAT conditions allow securing HPI subsequent to a valid manual or automatic initiation? (2.0)

QUESTION 4.19 (1.00)

WHICH of the following is an immediate action required in AP-320, "Loose Parts monitoring system." (1.0)

(a.) Select "DISABLE" on "HIGH ALARM" toggle switch OR "Lo ALARM" toggle switch.

(b.) Notify I&C technician to remove the LPMS tape deck.

(c.) Adjust "FS range" switch on affected channel signal amplifier until alarm clears.

(d.) Select the alarming channels to "audio matrix" position.

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.20 (1.00)

The nuclear services cooling water to the CRD stators should be secured under WHICH of the following conditions. (1.0)

(a.) Less than three stators are energized and the reactor is not critical.

(b.) RC system temperature is between 200 degrees F and 300 degrees F.

(c.) Air temperature around the drives in the service structure is less than 150 degrees F.

(d.) Any time all CRDs are deenergized for an extended period of time.

QUESTION 4.21 (1.00)

WHICH one (1) of the following is an appropriate "immediate" action according to EP-120, "Inadequate Shutdown Valve?" (1.0)

(a.) Stop cleanup.
(b.) Establish letdown flow to MUT greater than 40 gpm.
(c.) Start boric acid pump CAP-3A or 3B.
(d.) Verify reactor trip, go to VP-580.

QUESTION 4.22 (1.00)

WHICH one of the following provisions is the responsibility of a reactor operator leaving the 95 inch elevation control complex RCA as part of the first step in his whole body frisk? (1.0)

(a.) Ensure the equipment is turned on and operating on the highest scale.

(b.) Ensure proper operation of the instrument by noting that the instrument has been source checked.

(c.) The background reading should be less than 300 dpm/100 cm**2.

(d.) Ensure the beta window control is in the open position.

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.23 (1.00)

According to EP-290, "Inadequate Core Cooling," the hot leg vents should be used under two (2) separate conditions. WHICH of the following choices states those conditions? (See attached Figure 4.23.) (1.0)

(a.) Pressurizer press greater than 1500 psig; press and temperature in Region 2.

(b.) Pressurizer press greater than 1500 psig; subcooling margin less than 50 degrees F.

(c.) Pressurizer press greater than 1500 psig; press and temperature in Region 3.

(d.) Pressurizer press greater than 2300 psig; subcooling margin less than 50 degrees F.

(e.) Pressurizer press greater than 2300 psig; press and temperature in Region 3.

(***** END OF CATEGORY 04 *****)
(********** END OF EXAMINATION **********)

QUESTION 4.23 (contd)

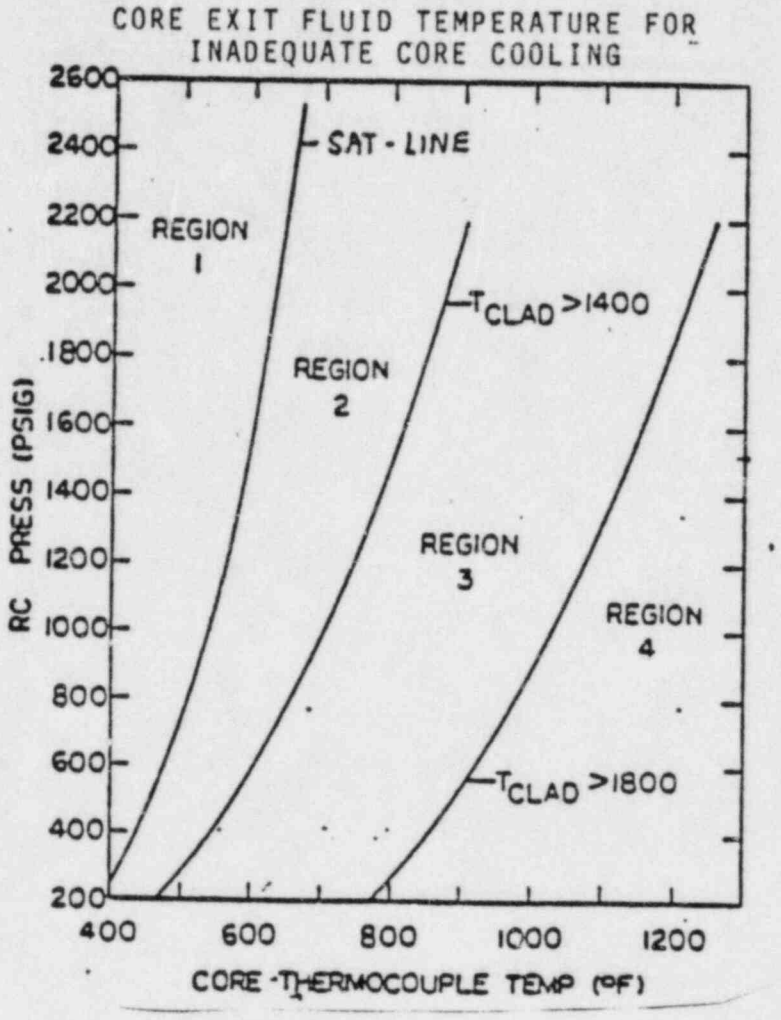


FIGURE 4.23

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.01 (.50)

5 inches [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 15.

ANSWER 1.02 (1.50)

Greater [+0.5]. This is due to the increase in the expansion rate of water at increased temperatures. [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 45.

ANSWER 1.03 (1.50)

Because, with the RCP secured, the recirculation impeller will no longer be supplying any flow through the Seal Cooling heat exchanger. [+1.5]

REFERENCE

1. Crystal River: STM, Ch. 419. Figure 1.4-6.

ANSWER 1.04 (2.00)

The ICS Delta T(c) circuit will carry out its function to maintain T(c)'s in both loops equal. Since both T(h)'s are equal, and RCS flow has not been affected, the amount of energy being transferred by both OTSG's must be equal. This implies equal feed flow to both OTSG's. But with one of the OTSG's fouled, there must be a compensation to ensure equal heat transfer. That compensation is produced by the Delta T(c) circuit that allows transient reratioing of feedwater to create and maintain a proportionate difference in OTSG levels. [+2.0]

REFERENCE

1. Crystal River: STM, Ch. 504, p. 22.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.05 (1.50)

In the RCS, the flows redistribute such that there is about 42% flow in the "A" loop and 105% in the "B" loop. ~~This creates the need to ratio feedwater flow in direct proportion. In the steady state, about 40% of the required flow will go to the "A" side and 60% to the "B" side. At 75% power this would be about 30% total feedwater demand to the "A" side and 45% total feedwater demand to the "B" side.~~ [+1.5] Feedwater flow behaves in accordance with the following relationships: $\frac{A_{sec}}{A_{pri}} = \frac{B_{sec}}{B_{pri}}$ and $A_{sec} + B_{sec} = .75$ $A_{sec} = 21.4\%$ $B_{sec} = 53.6\%$

REFERENCE

1. Crystal River: STM, Ch. 504, p. 24.

ANSWER 1.06 (1.50)

1. The initiation of EFW lowers the saturation pressure of the OTSG, and therefore the saturation temperature. [+0.5]

2. The EFW is sprayed directly on the OTSG tubes high in the steam generator, therefore increasing the effective area for heat transfer. [+0.5]

3. The EFW is essentially at ambient temperature, as compared to main feedwater which has been heated. [+0.5]

REFERENCE

1. Crystal River: ROT-4-15.

ANSWER 1.07 (1.00)

OTSG outlet pressure [+1.0]

REFERENCE

1. Crystal River: ROT-4-15, p. 15.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.08 (1.00)

The pressurizer spray valve is open. [+1.0]

REFERENCE

1. Crystal River: Thermodynamics and Heat Transfer Training Material.

ANSWER 1.09 (1.50)

Negative side. [+0.5] There is more operational latitude with imbalance negative. This is largely due to the greater DNBR in the lower regions of the core. [+1.0]

REFERENCE

1. Crystal River: OP-204, p. 17.

ANSWER 1.10 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: OP-204, p. 17.

ANSWER 1.11 (1.50)

Shutdown Margin - the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

No change in axial power shaping rod position and all control rod assemblies (safety and regulating) are fully inserted except for the single rod assembly of highest reactivity worth which is assumed to be fully withdrawn. [+1.5]

REFERENCE

1. Crystal River: Technical Specifications, p. 1-3.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.12 (2.00)

1. Tc is approaching T-sat of its OTSG
2. Core delta T develops and stabilizes
3. AVG of 5 highest incore thermocouples follows Th within 10 deg F
4. When OTSG pressure is lowered, then Th, Tc and incore thermocouples lower

[+0.5] each

REFERENCE

1. Crystal River: VP-580, p. 7.

ANSWER 1.13 (1.50)

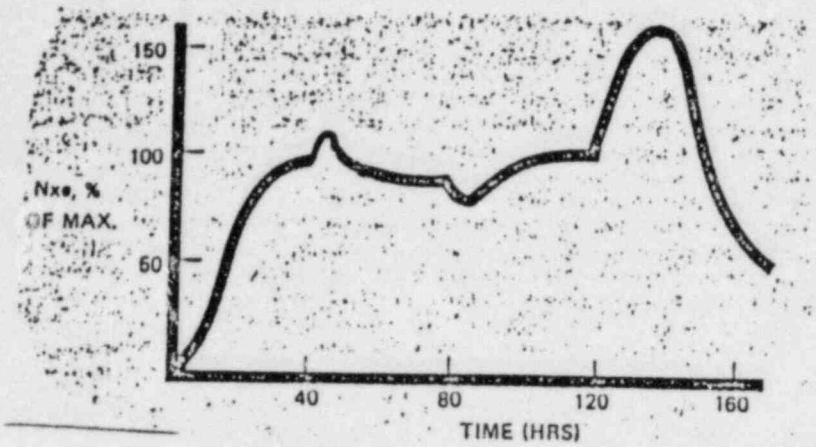
The RCS will be losing borated water to the OTSG. The steam escaping from the OTSG will be relatively boron free. This will end up causing a dilution of the RCS water in the RB sump as this steam is condensed. [+1.5]

REFERENCE

1. Crystal River: EP-390, General Effects.

ANSWER 1.14 (3.00)

a.



[+2.0]

b. When the power level is reduced to 50%, the Xe-135 burnout is reduced by a factor of 2 while the formation from the decay of I-135 is at the 100% power value. This causes a peak as shown and then decay and burnout down to the new equilibrium N(Xe) for 50% power. [+1.0]

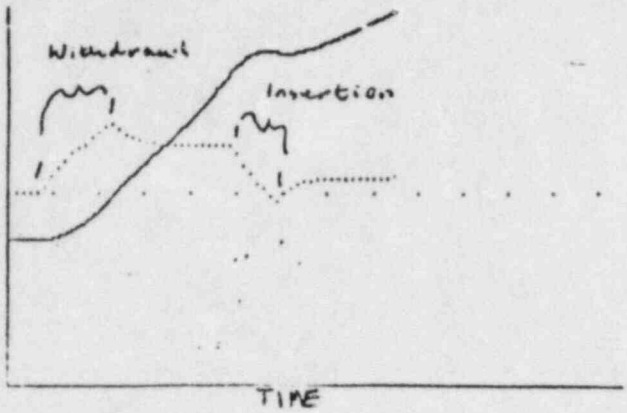
REFERENCE

1. NUS Training Manual, Module 3, Ch. 10.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.15 (3.00)

a.



[+1.0]

b. No (the insertion leaves the reactor on a stable positive period). [+0.5]

c. During the withdrawal there is a pronounced response due to prompt neutrons. When the withdrawal stops, the response of prompt neutrons to the reactivity insertion quickly dies off, leaving the reactor ~~on a constant positive period~~ with a constant negative slope governed by delayed neutrons. The rod insertion again causes a pronounced response due to prompt neutrons. The prompt negative response overcomes the positive effect of delayed neutrons. When the insertion stops, the period increases slightly as the delayed neutron population comes to a new equilibrium at the new reactivity. [+1.5]

REFERENCE

1. NUS Reactor Kinetics, Unit 6.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.16 (1.00)

No, it won't. Delayed neutrons behave as a source themselves. When a subcritical reactor has sufficient reactivity, the subcritical multiplication of neutrons becomes significant. The large number of generations associated with this multiplication effectively holds up the decay rate. The negative SUR becomes >- 1/3 dpm. [+1.0]

REFERENCE

1. NUS Reactor Kinetics, Unit 6.

ANSWER 1.17 (1.00)

(b.) [+1.0]

REFERENCE

1. NETRO 11.4-3.

ANSWER 1.18 (1.00)

(b.) [+1.0]

REFERENCE

1. Duke Power Company, FNRE; pp. 126-128.

ANSWER 1.19 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: OP-210, Rev. 16, p. 8.
2. NUS, NETRO, Unit 6.
3. Westinghouse Reactor Physics, Section 3 and 5.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 1.20 (1.00)

(c.) [+1.0]

REFERENCE

1. Westinghouse NTO, p. I-5.77.
2. NETRO, 10.5-2.
3. Duke Power Company, FNRE, p. 169.

ANSWER 1.21 (1.00)

(b.) [+1.0]

REFERENCE

1. NETPP, pp. 6.5-1 to 6.5-3.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 2.01 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: Lesson No. ROT-4-1, p. 15.

ANSWER 2.02 (.50)

False [+0.5]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, p. 4.

ANSWER 2.03 (1.00)

Draining of the BWST to the RB sump. [+1.0]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, p. 4.

ANSWER 2.04 (1.00)

About 200 psig. [+1.0]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, Figure 6-9.

ANSWER 2.05 (1.00)

hydrogen [+1.0]
or, oxygen if hydrogen is present.
REFERENCE

1. Crystal River: System Training Manual, Ch. 412, p. 9.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 2.06 (1.50)

a. The minimum pressure ensures that there will be sufficient seal water flow through the compressor heat exchanger and back to the compressor suction for cooling and lubrication. [+1.0]

b. Nuclear Services Closed Cycle Cooling. [+0.5]

REFERENCE

1. Crystal River: System Training Manual, Ch. 412, p. 40.

ANSWER 2.07 (.50)

True [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 412, p. 51.

ANSWER 2.08 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 8.

ANSWER 2.09 (.50)

100,000 lbm/hr [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 13.

ANSWER 2.10 (1.50)

MUP 3A - SW (normal) DC-A (alternate) [+0.5]

MUP 3B - SW only [+0.5]
MUP 3C - DC-B (normal) SW (alternate) [+0.5]

REFERENCE

1. Crystal River: ROT-4-1, p. 53.

ANSWER 2.11 (.50)

They will support six starting attempts. [+0.5]

REFERENCE

1. Crystal River: ROT-4-6, p. 7.

ANSWER 2.12 (1.00)

1. 2750 kW at 0.8 power factor w/maintenance periods
2. 3000 kW at 0.8 power factor - 2000 hours no maintenance
3. 3300 kW at 0.8 power factor - not more than 30 minutes
4. 3250 KW - 168 hr maintenance interval
5. 12,443 cu. in.

Any one (1) [+1.0]

REFERENCE

1. Crystal River: ROT-4-6, p. 14.

ANSWER 2.13 (1.00)

They will have to be unlocked [+0.5] and manually [+0.5] shut.

REFERENCE

1. Crystal River: ROT-4-15, p. 6.

ANSWER 2.14 (1.00)

3A1 and ~~3A2~~ are powered from Aux Bus 3A [+0.5]
~~3B1~~ and 3B2 are powered from Aux Bus 3B [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 420, p. 17.

ANSWER 2.15 (1.50)

They "freeze" in position [+0.5]. This provides a relatively accurate starting point when a power decrease reaches the point where the main block valves go closed [+1.0].

REFERENCE

1. Crystal River: STM, Ch. 504, p. 104.

ANSWER 2.16 (3.00)

a. There is a breaker cubical for the "B" MUP in both safeguards busses. There is, however, only one breaker. The breaker may be transferred between the two busses. Additionally, there is a disconnect switch at the pump for selecting which buss will supply power. There is an elaborate system of kirk-key interlocks that prevent inadvertently operating the disconnect under load, or paralleling the two ES busses. [+2.0]

b. The selector switch on the "A" MUP breaker should be selected to "Pump 3A" and the selector switch on the "C" MUP breaker should be selected to "Pump 3B." [+1.0]

REFERENCE

1. Crystal River: ROT-4-1, p. 57.

ANSWER 2.17 (1.00)

From the 230 kV transmission circuits through the Unit 3 startup transformer. [+1.0]

REFERENCE

1. Crystal River: STM-15-3.

ANSWER 2.18 (2.50)

main block valve
startup block valve
low load block valve
MFWP suction valve
MFW cross connect valve

[+0.5] each

REFERENCE

1. Crystal River: ROT-4-15, p. 22.

ANSWER 2.19 (1.50)

This bypass vents the valve bonnet to the downstream side of the valve, therefore minimizing the pressure needed to maintain valve position [+0.75]. The check valve prevents leakage past the valve

disk piston rings from being allowed to flow directly from the bonnet to the underseat area [+0.75].

REFERENCE

1. Crystal River: NAO-83, p. 6.

ANSWER 2.20 (1.00)

The monitors are installed on each main steam line and are located in the intermediate building just outside of the reactor building penetrations. All steam flowing out of the atmospheric dump valves or the main steam safeties would pass by these monitors.

REFERENCE

1. Crystal River: NAO-83, p. 13.

ANSWER 2.21 (.50)

About (+- 50 psi) ~~275~~ 330 psig. [+0.5]

REFERENCE

1. Crystal River: NAO-96, p. 4.

ANSWER 2.22 (1.00)

One "C" breaker and one "D" breaker supply power to groups 1 and 2.
One "C" breaker and one "D" breaker supply power to groups 3 and 4.

[+0.5] each

REFERENCE

1. Crystal River: STM, Ch. 510, Figure 9.

ANSWER 2.23 (1.00)

(c.) [+1.0]

REFERENCE

1. STM2-11.

ANSWER 2.24 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: STM 28-4.

ANSWER 2.25 (1.00)

(a.) [+1.0]

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

REFERENCE

1. Crystal River: STM 22-1 and 44.

ANSWER 2.26 (1.00)

(a.) [+1.0]

REFERENCE

1. Crystal River: STM 17-10 and 12.

ANSWER 2.27 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: OP-605, Rev. 28, pp. 5 and 6.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.01 (.50)

True [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 30.

ANSWER 3.02 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 34.

ANSWER 3.03 (1.50)

1. Lift oil pressure
2. SW flow
3. Reservoir oil level
4. Seal injection flow
5. Reactor power
6. Fourth pump only
7. Controlled bleedoff valve open

Any five (5) [+0.3] each, +1.5 maximum

REFERENCE

1. Crystal River: STM, Ch. 420, p. 16.

ANSWER 3.04 (1.50)

a. It automatically isolates the Decay Heat dropline by shutting DHV-3 and 4. [+1.0]

b. By using key operated switches located in the ES Test Cabinets. [+0.5]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, p. 9.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.05 (1.00)

The flow is passed over two RTDs, one with an attached low power heating element. When the two RTDs are indicating a no temperature difference, that is an indication of flow. [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 419, p. 26.

ANSWER 3.06 (1.00)

(a.) and (d.) [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 419, pp. 30-33.

ANSWER 3.07 (2.00)

RCS flow	20%/min	1.1 x flow
RCP's	50%/min	75/45%
FWP's/FWBP's	50%/min	55%
Assym. rod	30%/min	60%

[+0.3] for runback, [+0.1] for rate, [+0.1] for limit

REFERENCE

1. Crystal River: STM, Ch. 504, p. 12.

ANSWER 3.08 (1.00)

1. BTU limit
2. both OTSGs on level limit
3. both feedwater loop demands in manual

[+0.33] each

REFERENCE

1. Crystal River: STM, Ch. 504, p. 84.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.09 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: STM, Ch. 510.

ANSWER 3.10 (.50)

Both the output state lamp and the memory lamp. [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 510, p. 23.

ANSWER 3.11 (1.50)

Bypassed--power/imbalance/flow, RCPPM, low pressure, and variable low pressure. [+1.0]

Substituted--a reduced low pressure trip. [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 510, p. 46 and Figure 2.

ANSWER 3.12 (1.00)

The normal bus undervoltage relays will immediately actuate (no time delay) leaving only the ES Block one load's breakers shut, the

bus will be stripped and following a 3-second time delay, the EDG output breaker will be enabled to close. [+1.0]

REFERENCE

1. Crystal River: ES Electrical Distribution, Bus Relaying and Feeder Breaker Interlocks, p. 14.

ANSWER 3.13 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: Attached figure from ES Electrical Distribution, STM.

ANSWER 3.14 (2.00)

HPI pump
DHR pump
emergency lighting
inverters
control complex lighting
battery chargers

[+0.33] each

REFERENCE

1. Crystal River: Electrical Systems training manual, ROT-4-1,3,6,10, p. 8-29.

ANSWER 3.15 (1.00)

The speed droop control will be set to "0". This is done to ensure highly regulated speed control regardless of load. [+1.0]

REFERENCE

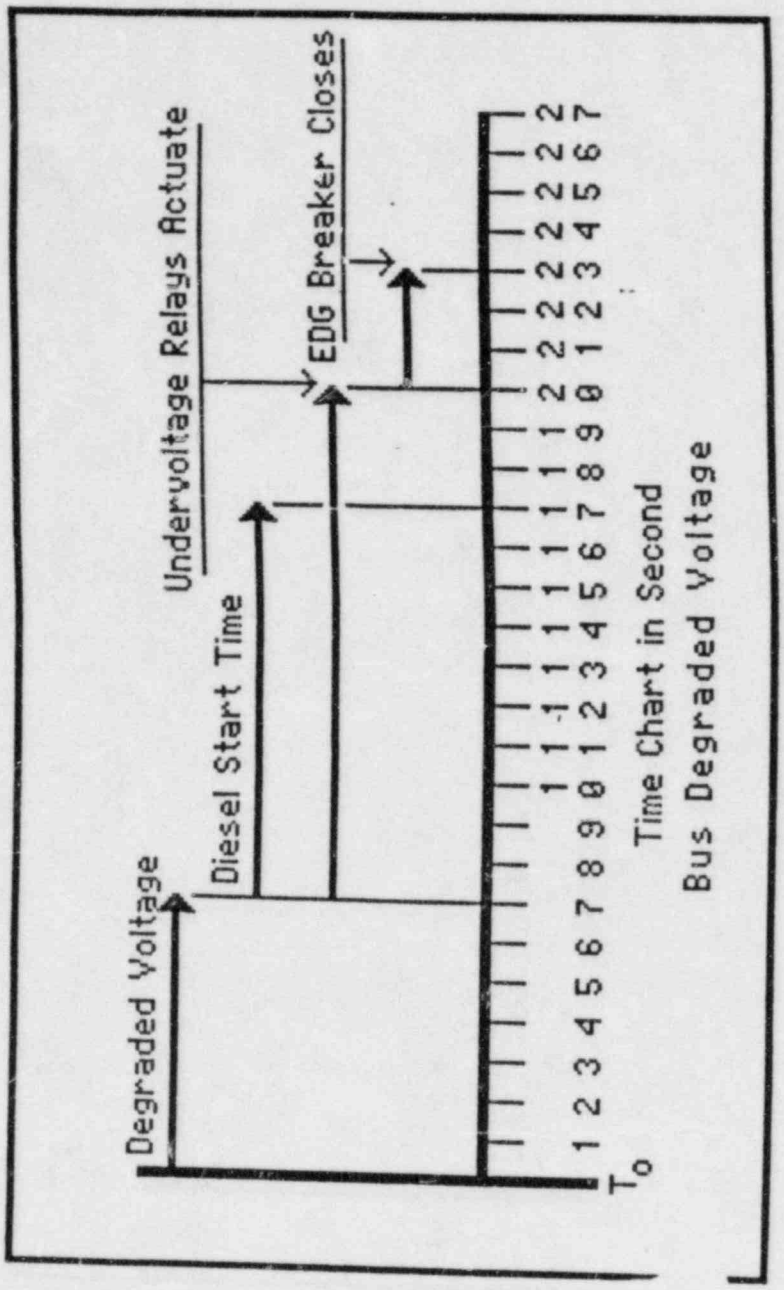
1. Crystal River: ROT-4-6, p. 19.

ANSWER 3.16 (1.00)

Pressing the Emergency Stop push button. [+0.5]
Tripping the fuel racks. [+0.5]

REFERENCE

1. Crystal River: ROT-4-6, p. 29.



REFERENCE 3.13: Figure from ES Electrical Distribution STM

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.17 (1.50)

a. differential current [+1.0]
b. at the local generator control panel [+0.5]

REFERENCE

1. Crystal River: ROT-4-6, Figure 5.

ANSWER 3.18 (1.50)

1. Loss of both main feedwater pumps and reactor power >20%
2. Low level (<6") in either OTSG
3. Loss of all RCPs
4. Low pressure (<600 psig) in either OTSG
5. HPI actuation on Both A and B ESAS channels

[+0.3] each

REFERENCE

1. Crystal River: ROT-4-15, p. 14.

ANSWER 3.19 (1.00)

Because hitting the RESET button causes all of the EFW control valves to come open if they are in ~~hand~~ "Auto". [+1.0]

REFERENCE

1. Crystal River: ROT-4-15, p. 19.

ANSWER 3.20 (1.00)

The recycle isolation valves shut. [+0.5]
The Waste gas release isolation valve shuts. [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 505, Table 5.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.21 (.50)

The HIGH alarm level. [+0.5]

REFERENCE

1. Crystal River: STM, Ch. 505, p. 34.

ANSWER 3.22 (1.00)

The main feedwater block valves are interlocked to close. [+1.0]

REFERENCE

1. Crystal River: NAO-96, p. 18.

ANSWER 3.23 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: STM 13-2.

ANSWER 3.24 (1.00)

(a.) [+1.0]

REFERENCE

1. Crystal River: STM 12-11.
2. Crystal River: STM 12-13.

ANSWER 3.25 (1.00)

(b.) [+1.0]

REFERENCE

1. Power Systems Operation, R.H. Miller, pp. 22-24.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 3.26 (1.00)

(c.) [+1.0]

REFERENCE

1. Crystal River: STM 15-10.

ANSWER 3.27 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: STM 12-14.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 4.01 (1.00)

Both continuous and cumulative run time are restricted. (To ensure that limits are not exceeded, run time in this mode is carefully logged by the reactor operator.) [+1.0]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, p. 14.

ANSWER 4.02 (1.00)

They are to be locked out (to prevent an isolation of the D' ystem upon spurious ACI). [+1.0]

REFERENCE

1. Crystal River: System Training Manual, Ch. 404, p. 15.

ANSWER 4.03 (2.00)

1. select the flow path on the Feed Select Switch
2. ensure that the number on the batch size thumbwheels is larger than the number on the totalizer. (MU&P Feed Permit)
3. manually open CAV-57 the supply valve to the MU&P system (complete the WD Feed Permit)
4. < Open MUV-103
5. manually start the boric acid pump
6. (control feed flow rate with the valve knob on the batch controller)

[+0.4] each

REFERENCE

1. Crystal River: OP-403.
2. Crystal River: ROT-4-1, p. 67.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 4.04 (.50)

The startup station must be placed into auto first. [+0.5]

REFERENCE

1. Crystal River: OP-504, p. 15.

ANSWER 4.05 (1.00)

First the standby cooler must be verified to be supplied with cooling water and full of oil. It is verified full of oil by opening the interchange valve and observing flow at the sight glass at the top of the reservoir. Then the swap is accomplished using the transfer valve. [+1.0]

REFERENCE

1. Crystal River: OP-602, p. 11.

ANSWER 4.06 (1.00)

1. The PORV block valve must be operable. [+0.5]

2. The operator on the switch does not leave the PORV switch unattended until he assures that the PORV is closed and there is no flow through it. [+0.5]

REFERENCE

1. Crystal River: OSIM, p. V-14.

ANSWER 4.07 (1.00)

200 mrem/week, but not to exceed 1250 mrem/quarter. [+1.0]

REFERENCE up to 1000 mrem/week

1. Crystal River: RSP-101, p. 3.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 4.08 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: OP-203, p. 3.
2. Crystal River: OP-502, p. 4.

ANSWER 4.09 (.50)

True [+0.5]

REFERENCE

1. Crystal River: OP-203, p. 12.

ANSWER 4.10 (1.00)

Exciter current. [+1.0]

REFERENCE

1. Crystal River: OP-203, p. 20.

ANSWER 4.11 (1.50)

1. RCP seals and dumpsters
2. PZR level
3. RCDT
4. MUT
5. RB sump
6. Relief valve tailpipe TEMP

[+0.25] each Credit given for one (1) common sense substitutions that make good engineering sense, e.g., Aux building sump, and RMA-6.

REFERENCE

1. Crystal River: VP-540, p. 4.

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

ANSWER 4.12 (1.00)

1. > 1500 psig-20 deg F [+0.5]
2. < or = 1500 psig--50 deg F [+0.5]

REFERENCE

1. Crystal River: VP-580, p. 5.

ANSWER 4.13 (2.00)

a. LLL
b. 50% on the OR or 65% by EFIC
c. 95% on the OR
d. 95% on the OR

[+0.5] each

REFERENCE

1. Crystal River: VP-580, p. 6.

ANSWER 4.14 (2.50)

a. When RC TEMP > 500 deg F--cooldown at < or = 240 deg F/hr. [+0.5]
When RC TEMP < or = 500 deg F--cooldown at < or = 100 deg F/hr. [+0.5]

Maintain tube-to-shell delta T < or = 150 deg F/hr. [+1.0]

b. No. [+0.5]

REFERENCE

1. Crystal River: EP-390, p. 6.

ANSWER 4.15 (1.00)

a. When total flow is < or = 100 gpm. [+0.5]
b. 540 gpm. [+0.5]

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

REFERENCE

1. Crystal River: AP-380, p. 7.

ANSWER 4.16 (1.00)

tube-to-shell delta T = AVG of 5 shell TCs - Tc [+1.0]

REFERENCE

1. Crystal River: AP-380, p. 17.

ANSWER 4.17 (3.00)

1. Initiate full HPI.
2. Stop all Reactor Coolant Pumps.
3. Feed up OTSG's to 95% on the OR.

[+1.0] each

REFERENCE

1. Crystal River: AP-380, Babcock and Wilcox Technical Bases Document.

ANSWER 4.18 (3.00)

a. Adequate subcooling margin must exist. [+1.0]

b. Adequate subcooling margin, AND PZR level > 50 inches with normal makeup, AND secondary heat transfer is established [+1.0], OR LPI flow > 1000 gpm in each train for > 20 minutes [+1.0].

REFERENCE

1. Crystal River: AP-380, pp. 7, 12, and 16.

ANSWER 4.19 (1.00)

(a.) [+1.0]

ANSWERS -- CRYSTAL RIVER -86/08/19-HUENEFELD, J.

REFERENCE

1. Crystal River: AP-320, Rev. 00, p. 2.

ANSWER 4.20 (1.00)

(d.) [+1.0]

REFERENCE

1. Crystal River: OP-502, Rev. 13, p. 4.

ANSWER 4.21 (1.00)

(a.) [+1.0]

REFERENCE

1. Crystal River: EP-120, Rev. 00, p. 2.

ANSWER 4.22 (1.00)

(b.) [+1.0]

REFERENCE

1. Crystal River: RP-101, Rev. 19, p. 23.

ANSWER 4.23 (1.00)

(e.) [+1.0]

REFERENCE

1. Crystal River: EP-290, Rev. 02.

EQUATION SHEET

Where $\dot{m}_1 = \dot{m}_2$

$(\text{density})_1(\text{velocity})_1(\text{area})_1 = (\text{density})_2(\text{velocity})_2(\text{area})_2$

$KE = \frac{mv^2}{2}$ $\quad PE = mgh$ $\quad PE_1 + KE_1 + P_1V_1 = PE_2 + KE_2 + P_2V_2$ where V = specific volume, P = Pressure

$Q = \dot{m}c_p(T_{out} - T_{in})$ $\quad Q = UA\,(T_{ave} - T_{stm})$ $\quad Q = \dot{m}(h_1 - h_2)$

$P = P_o 10^{(SUR)(t)}$ $\quad P = P_o e^{t/T}$ $\quad SUR = \frac{26.06}{T}$ $\quad T = \frac{(B-p)t}{p}$

delta $K = (K_{eff} - 1)$ $\quad CR_1(1-K_{eff1}) = CR_2(1-K_{eff2})$ $\quad CR = S/(1-K_{eff})$

$M = \frac{(1-K_{eff1})}{(1-K_{eff2})}$ $\quad SDM = \frac{(1-K_{eff}) \times 100\%}{K_{eff}}$

decay constant $= \frac{\ln(2)}{t_{1/2}} = \frac{0.693}{t_{1/2}}$ $\quad A_1 = A_o e^{-(\text{decay constant}) \times (t)}$

Water Parameters

1 gallon = 8.345 lbs
1 gallon = 3.78 liters

1 ft^3 = 7.48 gallons

Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3

Heat of Vaporization = 970 Btu/lbm
Heat of Fusion = 144 Btu/lbm
1 Atm = 14.7 psia = 29.9 in Hg

Miscellaneous Conversions

1 Curie = 3.7×10^{10} dps
1 kg = 2.21 lbs

1 hp = 2.54×10^3 Btu/hr

1 MW = 3.41×10^6 Btu/hr
1 Btu = 778 ft-lbf

Degrees F = (1.8 x Degrees C) + 32
1 inch = 2.54 centimeters
g = 32.174 $ft\text{-}lbm/lbf\text{-}sec^2$