ENCLOSURE 1

EXAMINATION REPORT - 50-302/OL-85-01

Facility Licensee: Florida Power Corporation
P. O. Box 14042, M.A.C. H-2
St. Petersburg, FL 33733

Facility Name: Crystal River Unit 3

Facility Docket No. 50-302

Requalification examinations were administered at Crystal River Nuclear Plant near Crystal River, FL.

Chief Examiner: Sandy Lawyer — Sandy Lawyer — 5/17/85 Date Signed

Approved by: Bruce A. Wilson — Bruce A. Wilson, Section Chief — 5/17/85 Date Signed

Summary:

Requalification examinations on March 4-7, 1985

Written and oral requalification examinations were administered to ten SROs and seven ROs; three of the SROs and two of the ROs passed these examinations.

The performance on the requalification examinations (29.4% pass rate) has resulted in a determination that Crystal River's requalification training program is unsatisfactory as of March 1985. Corrective actions are addressed under separate cover.

REPORT DETAILS

1. Facility Employees Contacted:

J. Alberdi, Manager Site Nuclear Operations and Technical Services, (E)
J. F. Belzer, Nuclear Operations Training Supervisor, (E)
R. C. Zareck, Nuclear Operations Instructor, (R/E)
V. R. Roppel, Manager Plant Engineering and Technical Services, (E)
L. C. Kelley, Manager Nuclear Operations Training, (E)
E. M. Howard, Director, Site Nuclear Operations, (E)
P. F. McKee, Plant Manager, (E)
G. L. Boldt, Plant Operations Manager, (E)
W. S. Wilgus, Vice President, Nuclear Operations, (E)
P. G. Haines, Licensing Engineer, (E)
W. L. Giles, Nuclear Training Instructor, (R)
J. P. Haerle, Nuclear Operator Instructor, (R)
C. D. Arbuthnot, Nuclear Operator Instructor, (R)

NOTE: "R" indicates present at examination review
"E" indicates present at exit meeting

2. Examiners:

B. A. Wilson, NRC
N. F. Dudley, NRC
S. Lawyer, NRC*
B. F. Gore, PNL
J. C. Huenefeld, PNL

*Chief Examiner

3. Examination Review Meeting

At the conclusion of the written examination, the examiners met with facility representatives (identified in 1. above) to review the written examinations and answer keys. Specific facility comments and associated NRC resolution of those comments follow:

NOTE: Comments on questions duplicated between exams are only detailed once.

a. SRO Exam

(1) Question 6.3

Facility Comment - This question is poorly worded. It could very logically be read such that any of the answers are correct.

NRC Resolution - Review of the question in light of this comment revealed that the facility comment was accurate. The question was deleted.

(2) Question 6.4

Facility Comment - The facility reviewers were advised that a review of the exam key after final typing, but prior to administering the examination, revealed that the answer to 6.4 had to be changed from d to a.

NRC Resolution - The answer key was changed accordingly.

(3) Question 6.13

Facility Comment - The facility reviewers were advised that a review of the examination during its administration revealed that this question was ambiguous in that the cooling supply could be for the pump or motor. The same ambiguity exists in Crystal River operating procedure OP-605.

NRC resolution - The reviewers verified while onsite that the pump and motor cooling supplies are different. Answers a or d were accepted.

(4) Question 6.19

Facility Comment - The facility reviewers were advised that a review of the examination prior to its administration revealed that both answers b and c were correct.

NRC resolution - Both answers b and c were accepted.

b. RO Exam

(1) Question 2.14 - This is the same question as 6.13 addressed above.

(2) Question 3.9

Facility Comment - None

NRC resolution - It was discovered during grading that the answer key contained a typo. The correct answer supported by the referenced material was d. The answer key was changed to indicate d as the correct answer.

(3) Question 4.15

Facility comment - The facility reviewers were advised that a review of the examination key prior to administration of the examination revealed the key was in error due to a typo.

NRC resolution - The answer key was changed.

4. Exit Meeting

At the conclusion of the site visit, the examiners met with representatives of the plant staff to discuss the results of the examinations. Those individuals who clearly passed the oral examination were identified.

The following generic weaknesses were noted by the examiners during the oral examinations:

- System descriptions and control room reference material are inadequate in some areas.

- Some non-operating shift personnel did not demonstrate as much familiarity with control room facilities as was desired.

- Problems were identified in the knowledge of and ability to apply the required actions of abnormal and emergency procedures.

The cooperation extended to the examination team by the Operations Department was noted and appreciated. These assistances were conveyed to facility representatives at the exit meeting.

5. On April 3, 1985, a meeting was held in the Region II office to discuss the written examination and the examination results. A summary of this meeting was issued by Region II on April 19, 1985. During the meeting, Florida Power Corporation (FPC) representatives noted that although they had concerns on a number of questions on each of the written examinations (approximately 15% of the questions) favorable resolution of those comments would not significantly change the overall pass/fail results. The following is a question by question commentary of the examinations with accompanying NRC resolutions. Most of the facility comments are stated verbatim from the April 3, 1985 meeting.

   a. RO Exam

      (1) Question 1.9

      Facility Comment - The utility raised a concern that although the question and answer were technically correct, the initial conditions were not specified and several answers would be logical depending on assumptions made by the candidate.

      NRC Resolution - We concur with this finding and the question was deleted.

(2) Question 2.16

Facility Comment - This question is asking for information which is, in my opinion, beyond what is normally committed to memory by an operator. I do not feel operators should be expected to recall from memory the power supplies to all plant components. It has been accepted that licensed operators be able to name the power supplies to 6900 V and 4160 V components, but trying to recall all loads on MCC's and VBDP's is not reasonable. All major components on the main control board are labled as to their power supplies and a procedure is readily available for determining the distribution panel and breaker number of every component in the plant. By requiring operators to memorize power supplies we are encouraging them to work from memory rather than procedure. This question also uses unfamiliar terminology. Our vital buses are not numbered 3A, 3B, etc., they are numbered VBDP-1----->VBDP-7.

NRC Resolution - Each distractor and the correct answer, d, were chosen for a reason, e.g., in distractor b the DC buses are supplied by separate 480V MCC's. Thus, different concepts were asked for and not memorization. The terminology used in the questions was consistent with the information supplied to the NRC. No change to question or grading.

(3) Question 2.18

Facility Comment - The correct answer to this question per the answer key is c. By design that is the correct answer; however, over the past year we have been using the aux steam system as the normal steam source to the Gland Steam System. If the examinee answered this question from experience, he may have selected one of the other possible answers.

NRC Resolution - Although three of seven candidates answered this question incorrectly, the question and answer will remain unchanged for the following reasons: c is the correct answer by facility supplied design information, no candidates voiced a concern during the examination, and the utility comment was not supported by any reference material.

(4) Question 2.19

Facility Comment - There is no correct answer to this question. Answer "C" is the correct response per the answer key, but this is based on an erroneous statement on page 38-3 of the STM. The STM states the charcoal plenums in the Aux Building are manually actuated only. This is incorrect, lesson plans ANAO-39 correctly states that these valves will automatically actuate if two temperature detectors sense high temperature. This error was our fault, it should have been caught when we reviewed the STM's prior to sending them to the NRC. See Enclosure 1, Lesson plan ANAO-39, Pg. 14 & 15.

NRC Resolution - Question was deleted due to erroneous information in facility supplied System Training Manual.

(5) Question 3.2

Facility Comment - There are two correct answers to this question. The answer key identified d as the correct response. Answer a is also correct. The ICS field power ABT is powered from VBDP-2 and VBDP-4. See Enclosure 2, STM chapter 504, Pg. 41.

NRC Resolution - Answer key changed to accept d and a. Additional reference OP-700D, "120 Volt AC Vital Buses," supports answer a.

(6) Question 3.3

Facility Comment - There are two correct answers to this question. The examiner drew this question from a sentence found in page 43-13 of the STM. Based on that sentence, answer c is correct. A consideration of pages 43-12, and 43-15 will prove answer a to be correct as well. See Enclosure 3, STM-43-12, 43-13, 43-15.

NRC Resolution - Answer key changed to accept c and a based on additional information in STM-43.

(7) Question 3.5

No facility comment.

NRC Resolution - This question was deleted. Post-exam analysis with NRC Test writing experts showed this question to violate several principles of correct multiple choice writing guidelines.

(8) Question 3.10

Facility Comment - The intent of this question is good, the way it is asked is unsatisfactory. The intent of the question is to determine if the operator can discriminate the Crank, Ready, and Run lights on the SSF section of the main control board. These indicators are required knowledge of all control room operators, they have not, however, been required to learn them by color. We require an operator to learn indicator colors only when the color is utilized as an indication. Some examples of indicators that require color recognition are the green/red lights on control switches, and the blue/amber lights on the ES status board. The color of the Crank, Ready, and Run lights have no meaning, the fact that they are illuminated is what provide the operator his required indication.

If we deal with this question as written, answers a, b, and c are all correct. Answer a is correct per the answer key. Answer b is also correct, if you close a diesel output breaker, an amber light comes on indicating crosstie blocking is in effect on the other diesel's output breaker.

Answer c is correct because when you close the diesel output breaker a white light is lit at ANN window P-2-4 indicating "4 KV ES Bus 3A/3B Paralleled."

NRC Resolution - This question was deleted. The color of the lights in this case were determined to not be the sufficient indicator of equipment status.

(9) Question 3.19

Facility Comment - All answers could be construed as incorrect. Answer b is the required response per the answer key. Answer a discusses something called "safeguards control center starters." We have no component that fits that description. Answer c could be considered incorrect because the running make-up pump (HPI Pump) is tripped on a loss of voltage. Note that this assumption is encouraged by the use of the singular "it" in response c "until the generator comes up to speed it (indicating one pump) is not connected to the bus." Answer d is incorrect because a RB Spray pump requires both a HPI block 4 start permit, and >30 psi on 2 out of 3 RB pressure switches.

NRC Resolution - The terminology, "safeguards control center starters" is contained in STM-15, page 6. Distractors c and d can be interpreted as being incorrect, only if the examinee makes assumptions that are not indicated in the question. Choice b is clearly incorrect without making any assumptions. No change to question or answer key.

(10) Question 3.20

Facility Comment - This question and answer are valid; however, it is not a common practice to require an operator to recall every start permit on every component in the plant. The control switches for the RB Purge fans are fitted with indicating lights that indicate the status of each of the fan start permits. The operator, by procedure, simply verifies that all permits are satisfied prior to starting the fan.

NRC Resolution - The RB Purge System is a system designed to limit the release of radioactive materials during all modes of facility operations. We recognize, subsequent to the exam, that the Purge system at Crystal River is now only used in Modes 5 and 6. However, the NRC Draft NUREG-1122, "Knowledges and Abilities

Required of Nuclear Power Plant Operators: Pressurized Water Reactors," considers the RB Purge System relatively important for both RO and SRO (distractor importance ratings generally between 2.5 and 3.5). No change to question or answer key.

(11) Question 3.23

Facility Comment - This question requires an operator to memorize detailed steps of a operating procedure. When shifting rods or rod groups, operators utilize a detailed procedure which lists each step and expected response. It is unreasonable to expect these steps to be commmitted to memory.

NRC Resolution - We disagree. This question is intended to test knowledge of the Control Rod System design features and interlocks. This particular K/A has a relatively high Importance Factor in Draft NUREG-1122. No change to question or answer key.

(12) Question 3.24

Facility Comment - This question goes beyond the knowledge requirements of a control room operator. There is no reason why an operator should commit to memory the types of detectors utilized by the RDS. At CR-3 an operator is expected to be familiar with the function and operation of the RDS. He should be able to perform the required surveillance on the system and response to alarms per AP-320 "Loose Parts Monitoring Systems." None of these responsibilities require a knowledge of detector types.

NRC Resolution - This question was written from a recently developed Lesson Plan on the RDS. This Lesson Plan had apparently not been distributed to, nor read by licensed personnel. This question revealed a fundamental weakness in the Requal Program in that recently developed (or improved) training materials are not disseminated to licensed personnel until the subject is taught when these personnel are assigned to Requal training.

No change to question or answer key.

(13) Question 4.1

Facility Comment - This answer is extremely misleading. The initiating event in this question puts the operator in EP-220, "Pressurized Thermal Shock." The Immediate Action of this procedure is to "stabilize existing RC pressure and temperature conditions" while the remedial action is to "reduce subcooling margin to minimum." Nowhere does it say to "reduce RC pressure to 1000 psig". The question indicated that one of the answers would state the immediate or remedial action per the EP and it did not. I agree that answer a does meet the requirements of the remedial action, but it doesn't indicate the operators ability to handle a

PTS event. In fact, depressurizing would be in violation of the procedure since the RCS pressure/temperature combination fall within the thermal shock operating region. Based on conditions given, the proper procedure would be:

1. Stabilize "existing RC pressure and temperature."
2. Determine cooldown rate.
3. If rate was >100°F/hr. "maintain RC pressure and temperature at that point for >3 hours."

NRC Resolution - It was incorrect to assume that one of the choices would state the immediate or remedial actions per the EP. The question asked what action should be taken. The question also assumed that the examinee would be knowledgeable of which EP to use based on the Entry Symptom (Tc <500°F). It was not apparent they knew which procedure to use. The facility comment seems to indicate that the procedure is deficient. No change to question or answer key.

(15) Question 4.13

Facility Comment - This question lists four valid methods of determining which OTSG has suffered a tube failure and then requires the operator to state which one was omitted on the sixth page of follow up actions in EP-390. This is an unreasonable requirement, especially since all four choices are valid methods of making this determination.

NRC Resolution - While a candidate need not memorize steps of a procedure which are not immediate actions, the candidate must be able to describe conceptually the objectives and methods used to achieve those objectives for all emergency and off-normal procedures. Here, one method is conceptually in stark contrast to the other three in that the time it takes to get information is unreasonably long.

No change to question or answer key.

(16) Question 4.14

No facility comment.

NRC Resolution - Post exam review revealed the question to be confusing in that the stem of the question together with the correct answer utilized three negatives ("not" statements). Question was deleted.

(17) Question 4.16

Facility Comment - This question requires the operator to recall the step, setpoints, and breaker numbers of a very infrequently performed operating procedure. The procedure in question is required to be signed off step by step as it is performed, and it is then verified by the shift supervisor. It is ridiculous to expect this level of memorization on a procedure that must be signed off step by step.

NRC Resolution - The correct answer was not intended to test memorization but a concept, i.e., the pressurizer venting was via the Nuclear sample room sink hood or the MUT gas space. A previous step in the procedure went unnoticed which rendered answer d incorrect. Since there was no correct answer, question was deleted.

(18) Question 4.19

Facility Comment - This question is invalid. Following a trip the method of determining cooldown rate is not specified. The steps listed in question 4.19 deal with EP-390 and the calculation of cool down rate following an overcooling event when Tc is <500°F.

NRC Resolution - Since incore thermocouple readings are not continuously recorded, it would be highly unlikely that the information in choice b would be available following a trip. Therefore, choice b was clearly the correct answer regardless of the procedure used. No change to question or answer key.

(19) Question 4.20

No facility comment.

NRC Resolution - This question was deleted. The usage of the double negatives "except" and "incorrect" in the stem may have led to candidate confusion.

b. SRO Exam

(1) Question 5.2

Facility Comment - This question is well written and concise, however, the answer on the answer key is incorrect. The answer key required d as the correct response when in reality a is the correct answer.

NRC Resolution - Question was deleted since neither answer a or d could be adequately supported by available references.

(2) Question 5.15

Same comment as on RO Exam, Question 1.9

NRC Resolution - Question deleted.

(3) Question 5.20

Facility Comment - The correct answer to this question per the answer key is c, "Low quality steam." I can find no text book that defines the point at which steam quality changes from high to low. A far better choice could have been "wet saturated steam" or "wet/saturated vapor."

NRC Resolution - We agree that the term "low quality steam" could be better defined. However, it is the only logical choice since none of the other choices could be interpreted as steam that contains some quantity of moisture.

(4) Question 6.5

Facility Comment - The manual operation of an atmospheric dump valve is not considered a normal operator function at Crystal River Unit 3. In our seven plus years of operation we have not yet had to utilize this method. Our procedure AP-990 "Shutdown from Outside Control Room" directs the Nuclear Operator to "obtain an available staff member" to perform this operation, therefore instructions on how to manually operate these valves have been provided at each valve. It is not reasonable to expect an operator to recall the specific steps of an operation he has never, and possibly will never perform when the steps are provided on a permanent instruction plate located at each valve.

NRC Resolution - Manual operation of the atmospheric relief valves is a required "follow-up" action to AP-990, "Shutdown From Outside Control Room". This action will probably be performed by an unlicensed staff member at the direction of a licensed staff member. 10 CFR 50.54(j) requires that when operating apparatus and mechanisms (such as atmospheric relief valves) it be done only with the knowledge and consent of a licensed person. We therefore, believe it is reasonable to expect licensed personnel to be able to direct manual operation of these valves. No change to question or answer key.

(5) Question 6.7

Facility Comment - There is no correct answer to this question. The ES system does not block load the battery chargers. If the breakers feeding the battery chargers were open, they would remain open. The battery charger is simply a load on an ES MCC.

NRC Resolution - Comment accepted. Terminology used in question was not appropriate. Question deleted.

(6) Question 6.11

Facility Comment - Answer a is the correct response, however, c could also be construed as being correct if the examinee assumed the statement to infer that each RPS channel is powered from a separate vital bus.

NRC Resolution - We disagree. Distractor c, in the context of distractors a and b should preclude making this assumption.

(7) Question 6.17

Same comment as RO Question 3.20.

NRC Resolution - Same as RO Question 3.20.

(8) Question 6.19

Facility Comment - Answers b, c, and d are incorrect. Answers b and c were identified as acceptable on the answer key. Response d should also be accepted for the following reason. Answer d states "The RB spray pumps are not connected to the 4160 V ES bus until about 15 seconds after block loading begins." In reality, after 15 seconds (HPI block 4) an RB spray actuation <u>permit</u> is set. In order to load the RB spray pump, RB pressure must exceed 30 psig on 2 out of 3 pressure switches.

NRC Resolution - We disagree. It would be unreasonable to make this assumption considering the acceptability of answers b and c.

(9) Question 7.3

Facility Comment - This question is totally unreasonable. It asks the examinee to recall which item out of a list of four items listed in OP-202 is not a requirement for escalating from mode 4 to mode 5. In a quick review of this section of OP-202 (section 6.4), I have identified no less than 21 items which must be completed prior to making this mode change. An operator should not be expected to recall from memory every required step of every operating procedure, especially when the procedure is required to be signed off step by step by the operator, and then verified by the shift supervisor prior to making the mode change. See OP-202, section 6.4.

NRC Resolution - On the surface it appears the question demands an unreasonable amount of memorization. The correct answer simply asks for an understanding of a concept, i.e., degassification cannot be completed while the RCS is still "cold". No change to question or answer key.

(10) Question 7.11

Facility Comment - In reality, if there was an uncontrolled decrease in refueling canal water level, the level would probably stabilize at the seal plate. Therefore, choices a and c are only testing whether components should be stored 4 feet or 5 feet below the water level.

NRC Resolution - Comment accepted. This was not the intent of the question and the distractors were not sufficiently considered. Question was deleted.

(11) Question 7.12

Facility Comment - This question requires an unreasonable level of recollection. The condition stated has never, to my knowledge, occurred at CR-3. In the event it does, it most certainly would be corrected by use of a detailed procedure, not by memorized limits. To require an operator to recall every possible limit in every procedure is not realistic.

NRC Resolution - We disagree. The frequency of occurrence is not sole criteria upon which subject matter for questions can be judged. The event postulated in the question is covered by a Note or Caution statement in the Fuel Handling Procedure, FP-601, and would not be corrected by use of a detailed procedure.

(12) Question 8.1

No facility comment.

NRC Resolution - Post-examination grading revealed that none of the four situations caused a Technical Specification action statement to be initiated within one hour. Question was deleted.

(13) Question 8.9

Facility Comment - Answer d was identified as the correct response on the answer key. In reality, since two makeup pumps are inoperable, and no mention is made as to why they are inoperable or when they will be returned to operability, answer b more nearly reflects the intent of the OSIM requirement. I feel that answer b or c should be considered correct since the initial conditions are not specific and are therefore open to interpretation by the examinee. See enclosure 2 "Policy Statement 84-1."

NRC Response - We disagree. Answer d is directly from the OSIM and does not infer intent or assumptions as does distractor b.

(14) Question 8.15

Facility Comment - This question requires the operator to recall a Tech Spec action statement. This is a totally unreasonable requirement. Our operators are required to recall those items that are covered by Tech Spec LCO's and then given a copy of Tech Specs, be able to correctly interpret the required actions. By requiring an operator to recall this action statement you are in essence forcing us to memorize all action statements.

NRC Resolution - We believe this question is appropriate for several reasons:

1. At the time of the examinations the plant was beginning an extended outage where the postulated situation was most realistic.

2. There is no time limit specified in the action statement which infers that the action be taken immediately.

3. A familiarity of three separate Tech Specs (3.0.3, 3.8.1 and 3.9) would lead to the correct answer.

(15) Question 8.16

Facility Comment - This question requires the operator to recall Tech Spec action statements. See comments on questions 8.15.

NRC Resolution - A knowledge of operator actions required within 1 hour by Technical Specifications will be a continuing requirement.

(16) Question 8.21

Facility Comment - This question asked the examinee to state which of one of four listed operations did not meet the Tech Spec definition of a Core Alteration. The answer is based on a letter of clarification dated April 1, 1983. This letter was not reevaluated by the PRC and rereleased until March 18, 1985, approximately two weeks after the NRC exam was administered. See enclosure 3, interoffice correspondence dated March 18, 1985.

NRC Resolution - We agree with the situation as stated above. The subject memo (4/1/83) was in effect at the time of the examination. It states "The following ... clarification of the refueling Technical Specifications will apply to Refuel IV and future refuelings/outages...". The fact that it was reviewed and reaffirmed by PRC just prior to head removal for Refuel V does not mean it had been rejected or had "expired". No change to question or answer key.

(17) Question 8.24

Facility Comment - STS requires a maximum level in the OTSG based on degrees of superheat. The absolute maximum level allowed is 96% on the operate range (answer c). A more correct answer would be "per table 3.4-5, Maximum Allowable Steam Generator Level." See enclosure 4 STS table 3.4-5.

NRC Response - The enclosure was the material upon which the question was based. While the quoted statement may or may not be a "better" answer, it was not one of the choices. Had it been utilized as the correct answer, there would have been serious objection to the question on other grounds. The question and cited answer are valid and appropriate.

MASTER

U. S. NUCLEAR REGULATORY COMMISSION

REACTOR OPERATOR REQUALIFICATION EXAMINATION

Facility: Crystal River - 3

Reactor Type: Babcock & Wilcox

Date Administered: March 5, 1985

Examiner: B.F. GORE

Candidate: KEY

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up four (4) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
24 ~~25~~	25			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
24 ~~25~~	25			2. Plant Design Including Safety and Emergency Systems
23 ~~25~~	25			3. Instruments and Controls
22 ~~25~~	25			4. Procedures: Normal, Abnormal, Emergency, and Radiological Control
BAW 93 ~~100~~				TOTALS

Final Grade ________ %

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

Candidate's Signature

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

1.1 d - Fuel heats up first
Ref: NUS Module 3, Sec's 8.3-8.5

1.2 d
Ref: NUS Module 3, Sec's 5.3 and 6.7

1.3 a - Pu build in reduces β_{eff}; does not change ^{235}U delayed neutrons
Ref: NUS Module 3, Sec 5.3; OP-103, Rev. 38, p. 12

1.4 c
Ref: NUS Module 3, Sec 10.1

1.5 a
Ref: NUS Module 3, Sec 10.3

1.6 c - Warmer water in downcomer and core bottom; less power differential along core axis; more n leakage makes NIs read high
Ref: NUS Module 2, Sec 16.5
NUS Module 3, Sec 8.4

1.7 c - Sm is stable (a); Sm burns out (b); independent of power level (d)
Ref: NUS Module 3, Sec 10.5

1.8 d - Restricting exit flow reduces head loss in the inlet piping, increasing pump suction pressure and NPSH
Ref: NUS Module 4, Sec 6.5

delete

1.9 a - T_{ave} increases, increasing PZR level and pressure, PZR spray turns pressure before level increase stops
Ref: STM-419, p. 30

1.10 d - Ref: AP-530, p. 4

1.11 c
Ref: STM-419, p. 15

1.12 b - Steam flow can entrain or push the water.
Ref: CR Fluids and Mechanics Lesson, p. 47

1.13 b - $Rho_1 = -0.05263$; $Rho_2 = -0.02669$
Delta Rho = 0.02594
Final Rho = -0.02669 + 0.02594 = -0.00075
Ref: NUS Module 3, Sec 6.1

1.14 b - $Rho_1 = -0.050$ $k_1 = 0.952$
$Rho_2 = -0.030$ $k_2 = 0.971$
$CR_2 = 50 \times (1 - 0.952)/(1 - 0.971) = 50 \times 1.67 = 83$
Ref: NUS Module 3, Sec 12.1

1.15 a
Ref: OP-103, plant curves 3.2 A&B

1.16 c
Ref: SP-0312
STM-420

1.17 b
Ref: CR Lesson RQ-84-7E
Degraded Core Recognition and Mitigation

1.18 a - 420,000 scf; 26,000 scf(b); 140 scf(c); 1,320 scf(d)
Ref: C. R. Lesson Fundamentals of Natural Circulation

1.19 a - Neutrons travel further with reduced water density
Ref: NUS Module 3, Sec's 9.4, 9.5

1.20 c - Would lead to similarity , not difference
Ref: NUS Module 3, Sec's 7.2-7.5
STM-1, pp. 21-28

1.21 a - Doppler is a ^{238}U cross section effect
Ref: NUS Module 3, Sec's 8.2, 11.3

1.22 d - Super heat region larger, plus 50% FP is closer to 15% FP (low level limits) than 100% FP.
Ref: STM-24, p. 4

1.23 a - Rotameter is not based on Bernouli's principle.
Ref: CR Fluids and Mechanics Lesson, pp. 50-53

1.24 1) T, 2) F, 3) T, 4) F
Ref: CR Core Power Distribution Handout

CATEGORY 2. PLANT DESIGN, INCLUDING SAFETY AND EMERGENCY SYSTEMS

2.1 d - Elevated temperature (a); trip is lo p, not hi T (b); only closure to 60% open trips FWP (c)
Ref: STM-27, pp. 3, 7, 14, 43

2.2 a - 6 starts max. (b); 3 hr supply in day tank (c); air operated booster piston supplies oil (d)
Ref: STM-10, pp. 1-8

2.3 b - Injection after blowout, before rapid clad T increase is most effective timing
Ref: STM-4, p. 6

2.4 b - 7 gpm enters RCS (a); pressure equally divided between 3 seals (c); computer alarm at 970 psid (d)
Ref: STM-420, pp. 1-3, 16

2.5 b - $Li\text{-}7(n,n')\alpha,T$
Ref: C.R. Letter TRA 85-0013, 1/29/85

2.6 c
Ref: STM-4, p. 8

2.7 d
Ref: STM-23, p. 11

2.8 d
Ref: STM-4, p. 11

2.9 b - MFWPs supply EFW nozzles
Ref: C.R. letter TRA 85-0013, 1/29/85

2.10 c
Ref: OP-403, Sec 4.7.10, p. 4

2.11 d - 80 hours total (c)
Ref: STM-4, p. 16; OP-404

2.12 c
Ref: CR Main Steam Requal Lesson, pp. 20, 69, 72, 69.9.1

2.13 c
Ref: OP-202, pp 3, 22
FP-302-661, sheet 3 of 4

2.14 a or d)
Ref: OP-605, p. 29

2.15 b
Ref: TS B 3/4 7-2

2.16 d
Ref: OP-703, p. 9
Drawing EC-206-017

2.17 b - High heater level does not require more extraction steam
Ref: C.R. Letter TRA 85-0013, 1/29/85

2.18 c - Main steam is normal supply to Gland Steam System
Ref: STM-39, p. 4

delete 2.19 c - Deluge must be manually operated
Ref: STM-38, p. 3

2.20 a - Indicates operation with <10 psig pressure, too low; delta p alarm is 20 psi, OK (b); indicates control oil p > 80 psig, OK (c); 110 psig is normal p (d)
Ref: STM-27, pp. 22, 23

2.21 c - Separate pump during startup
Ref: STM-420, pp. 6-12

2.22 d
Ref: STM-18, p. 1

2.23 b - A float trap automatically drains tank
Ref: STM-23, p. 5, 6

2.24 1) F, 2) F, 3) T, 4) F
Ref: STM-4; OP-401 p. 2110

CATEGORY 3. INSTRUMENTS AND CONTROLS

3.1 b - Sodium thiosulfate no longer opens
Ref: STM-3, p. 3

3.2 d +a VBDP-2 is preferred source (a); ABT is used for field, not +24 VDC supply (b); lamp lights if S-1 and S-2 fail (c)
Ref: STM-504, pp. 40,41

3.3 c +a - Particulate, I, gas (a); gas only (with filters) (b); gas only (d)
Ref: STM-43, pp. 12-14

3.4 d - Lamps light only if bistable is reset (a); LPI is still bypassed (auto reset is at 900 psi) (b); bistables trip at 500 psig, and LPI initiates when reset (c)
Ref: STM-11, pp. 24,25

delete

3.5 a - Only 5 groups of tested equipment (b); 8 valves are part-stroke tested (c); auto test switch selects one test group only (d)
Ref: STM-11, pp. 19-21

3.6 c - Channel bypass causes 2 out of 3 logic (a); only the trip string contact has opened (b); all four channels may be placed into "Shutdown Bypass" when administrative requirements are met (d)
Ref: STM-510, pp. 45-48

3.7 c - Speed depends on overcurrent (a); blocking is electrical, not mechanical (b); differential current protection is <u>more</u> sensitive due to normal zero current (d)
Ref: STM-15, pp. 18-19, 29

3.8 d - Both IRNI channels required (a); gammas are detected (b); requires NI-5 or 6 and NI-7 or 8 (c)
Ref: STM-6, p. 10

3.9 ~~a~~ d
Ref: OP-202, Sec 6.1.29, p. 12

delete

3.10 a
Ref: STM-10, p. 42

3.11 c - False low-level indication; high-level indication would cause (a), (b) and (d)
Ref: OP-203, p 3

3.12 d
Ref: CR Transient Assessment

3.13 c - Only two channels (a); by pass allowed below 725 psig, is not automatic (b); reset above 600 psig is manual (d)
Ref: STM-27, pp. 63-65

3.14 d - Fault reset resets faults and inhibits after faults are cleared
Ref: STM-12, Sec. 2

3.15 c - Thermocouples are smaller and faster
Ref: STM-7, pp. 2-7

3.16 a
Ref: STM-420, p. 15

3.17 b - Turbine reset is not required
Ref: STM-27; C.R. Letter TRA 85-0013, 1/29/85

3.18 d - Track requires both FW controls in manual
Ref: STM-504, p. 77

3.19 b - Battery charger feeder breakers stay closed
Ref: STM-15, pp. 6, 35

3.20 a - Exhaust fans must operate before start of supply fans
Ref: STM-22, pp. 22-25

3.21 c - Signal is higher of ave of 5&6 or 7&8; hi flux, flux/delta flux/flow, power/pumps (a)
Ref: STM-6, pp. 20, 21

3.22 c
Ref: OP-204, p. 11

3.23 d - SEQ lamp stays on
Ref: OP-502, pp. 7, 9, 16, 33

3.24 1) E, 2) A and E, 3) E, 4) B
Ref: CR Reactor Diagnostic System Lesson

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

4.1 a - This is 50°F subcooled, as required.
Ref: EP-220, p. 2

4.2 b
Ref: OP-210, Sec 6.3.5, p. 11

4.3 d - One SG lo level limited will not prevent (b); incorrect statement (c).
Ref: OP-204, p. 20

4.4 c
Ref: AP-530, pp. 2, 3

4.5 d - Subcooling margin is normally less than 50°F during power operations (b); not required by TS 3.1.1.1.1 (c)
Ref: OP-204, p. 7

4.6 b
Ref: RP-101, Rev. 20, p. 17

4.7 c
Ref: RP-101, Rev. 20, p. 23

4.8 a
Ref: OSIM, V-22

4.9 See attached pages
Ref: AP-580

4.10 See attached pages
Ref: EP-290

4.11 See attached pages
Ref: AP-380

4.12 See attached pages
Ref: EP-140

4.13 d - Not required--takes longer than others.
Ref: EP-390, p. 6

deleted 4.14 d - May move either in or out.
Ref: OP-502, pp. 28-30

4.15 ~~a~~ b)
Ref: OP-209

delete 4.16 d - Final venting is by gas space sample lines.
Ref: OP-202, pp. 18-20

4.17 b
Ref: AP-542, p. 2

4.18 d
Ref: AP-245

4.19 b - Only T_c is used.
Ref: EP-220, p. 3

deleted 4.20 b
Ref: OP-209, Sec 4.12, p. 4

4.21 c
Ref: OP-302, Sec 4.14, p. 5
OP-204, Sec 4.2.2, p. 5
OP-210, Sec 4.14, p. 3

4.9 Key

8 [illegible] (0.25 each)

ACTIONS

IMMEDIATE	REMEDIAL
1. Ensure GRP 1-7 rods inserted: (.09) • Depress "Reactor Trip" pushbutton (.08) • Observe "TRIP CONF" light lit on diamond panel. (.08)	1. Open 480V BKRs - 3305 - 3312. 2. Start boration: a. Open BWST suction b. Start 2nd MUP c. Open MUV-24 d. Establish letdown path to RCBTs.
2. Ensure main turbine TVs and GVs fully closed.	1. Close MSIVs. 2. Select "ATMOS"on "TURB. BYPASS VLV" switch.
3. Ensure main block valves closed.	1. Trip both MFPs. 2. Refer to AP-450, Emergency Feedwater Actuation.
4. Ensure low load block valves closed.	1. Trip both MFPs. 2. Refer to AP-450, Emergency Feedwater Actuation.

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
5. Ensure PZR level ≥ 50".	1. Open suction from BWST. 2. Start 2nd MUP. 3. Open MUV-24. 4. Close MUV-51.
6. Close MUV-51, Letdown Block Orifice Bypass.	Close MUV-49, Letdown Containment Isolation.
7. Ensure STM HDR PRESS controlling at 1010 PSIG.	Manually control STM HDR PRESS at 1010 PSIG using: • HDR PRESS controller OR • Turbine Bypass Valves in "HAND" OR • Atmospheric Dump Valves in "HAND".

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
8. Ensure GEN output BKRs open: • BKR 1661 • BKR 1662.	

4.10 Key

3 answers (0.33 each)

ACTIONS

IMMEDIATE	REMEDIAL
1. Ensure full HPI flow.	Ensure: a. 2 HPI pumps are running. b. Open: o MUV-23 o MUV-25 o MUV-24 o MUV-26. c. HPI flow is $\geq$ 500 GPM total flow.
2. IF LPI is delivering flow, THEN maintain maximum LPI flow.	Ensure: o 2 LPI pumps are running. o Open: - DHV-5 - DHV-6.
3. Ensure OTSGs are at 95% on the operating range.	a. Select "CLOSE" on: o FWV-34 o FWV-162 o FWV-35 o FWV-161. b. Trip both MFPs. c. Ensure both EFPs start. d. Slowly raise OTSG levels to 95% using: o FWV-162 (A-OTSG) o FWV-161 (B-OTSG)

4.11 Key

13 responses 0.25 each) Max 3 points

ACTIONS

	IMMEDIATE	REMEDIAL
1.	1. <u>IF</u> RC PRESS < 1500 PSIG, <u>THEN</u> depress "HPI Actuation" Pushbutton "A" <u>AND</u> "B".	1. Bypass ES actuation. 2. Return ES equipment to STBY status. 3. Go to VP-580.
2.	2. Trip all RCPs.	Open <u>affected</u> 6900V BKRs: o 3101 o 3103 o 3102 o 3104.
3 4 5	3. Ensure HPI trains start: o 2 HPI pumps o SWPs SWP-1A + 1C o RWPs. RWP-2A+2B	Notify AB operator to start <u>affected</u> pump(s) at 4160V ES switchgear.
6	4. Ensure BWST suction valves open: o MUV-58 o MUV-73.	Notify AB operator to open <u>affected</u> valve(s) locally.
7	5. Ensure HPI valves open: o MUV-23 o MUV-25 o MUV-24 o MUV-26.	Notify AB operator to open <u>affected</u> valve(s) locally.

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
6. Ensure LPI trains start: 8 o DHPs DHP-3A + 3B (LPI) 9 o DCPs DCP-1A + 1B 10 o RWPs. RWP-3A + 3B	Notify AB operator to start <u>affected</u> pump(s) at switchgear: o 4160V ES o 480V ES o 4160V ES.
11 7. Ensure EDGs start.	Notify AB operator to start <u>affected</u> diesel locally.
12 8. Ensure diverse containment isolation actuation.	
13 9. Place RB sump pump in "PULL-TO-LOCK": o WDP-2A o WDP-2B.	Notify AB operator to open <u>affected</u> BKG at MCC: o Reactor 3A2 o Reactor 3B2.

4.12 Key

8 [illegible] (.5 each)

ACTIONS

IMMEDIATE

1. Start emergency boration:
   a. Establish letdown flow to MUT $\geq$ 40 GPM
   b. Open CAV-60
   c. Start Boric Acid Pump
      - CAP-3A

      OR

      - CAP-3B.

REMEDIAL

1. Adjust batch controller to 1000 GAL.
2. Select RCBT with highest boron concentration.
3. Establish flow to MUT.
4. Open CAV-57.
5. Start Boric Acid Pump:
   - CAP-3A

   OR

   - CAP-3B.

ENCLOSURE 3

MASTER

U. S. NUCLEAR REGULATORY COMMISSION

REACTOR OPERATOR REQUALIFICATION EXAMINATION

Facility: Crystal River - 3

Reactor Type: Babcock & Wilcox

Date Administered: March 5, 1985

Examiner: B.F. GORE

Candidate: ______________________

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up four (4) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
24 ~~25~~	25	________	________	1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
24 ~~25~~	25	________	________	2. Plant Design Including Safety and Emergency Systems
23 ~~25~~	25	________	________	3. Instruments and Controls
22 ~~25~~	25	________	________	4. Procedures: Normal, Abnormal, Emergency, and Radiological Control
93 ~~100~~		________		TOTALS

Final Grade ________ %

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

____
Candidate's Signature

CATEGORY 1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW (25.0 Points)

1.1 In the event of a rod ejection accident, which will be the first reactivity coefficient to insert negative reactivity? (1.0)

a. Moderator temperature coefficient.

b. Pressure coefficient.

c. Void coefficient.

d. Doppler coefficient.

1.2 It takes less reactivity to go prompt critical at: (1.0)

a. BOL because of the higher value of beta effective.

b. BOL because of the lower value of beta effective.

c. EOL because of the higher value of beta effective.

d. EOL because of the lower value of beta effective.

1.3 Which of the following correctly describes the effect of increasing core life? (1.0)

a. $_{eff}$ decreases and SUR increases for a given reactivity insertion.

b. Stuck rod worth at hot zero power increases.

c. Overcooling transient becomes less severe.

d. The SUR 5 minutes after a trip becomes more negative.

1.4 Which of the following radioactive isotopes, if found in the reactor coolant, would <u>NOT</u> indicate a leak through the fuel cladding? (1.0)

a. I - 131

b. Xe - 133

c. Co - 60

d. Kr - 85

1.5 The reactor is brought to 10^{-8} amps two hours after a trip from 100% FP at equilibrium xenon conditions. In order to maintain power level at 10^{-8} amps for the next hour, what will have to be done with the control rods? (1.0)

a. They will have to be withdrawn.

b. They will have to be inserted.

c. They will have to be withdrawn initially, then inserted to compensate for xenon burnout.

d. They will have to remain at a constant position because the rate of xenon burnout is almost exactly matched with the post-shutdown indirect xenon production rate.

1.6 RCS boration may reduce power without CRDM motion. Which of the following statements best describes the consequences of this method of power reduction? (1.0)

a. Imbalance becomes less negative and Power Range NI calibration becomes less conservative.

b. Imbalance becomes more negative and Power Range NI calibration becomes less conservative.

c. Imbalance becomes less negative and Power Range NI calibration becomes more conservative.

d. Imbalance becomes more negative and Power Range NI calibration becomes more conservative.

1.7 Which of the following statements about Sm-149 is true? (1.0)

a. It is removed from an operating reactor by burnout and radioactive decay.

b. When a reactor is restarted after a temporary shutdown Sm-149 concentration increases for several days.

c. It has less effect on reactor operation than Xe-135 due to its smaller fission yield and smaller microscopic neutron cross section.

d. The equilibrium concentration of Sm-149 at 50% FP is about two thirds of the equilibrium concentration at 100% FP.

1.8 Which of the following will increase the NPSH of the condensate pumps? (1.0)

a. Increasing the vacuum in the condenser.

b. Increasing the temperature of the condenser hotwell.

c. Restricting the flow from the condenser to the condensate pumps.

d. Restricting the flow exiting the condensate pumps.

delete

1.9 Which of the following statements best describes parameter changes in the pressurizer following a rapid load reduction of 15% FP? (1.0)

a. Pressurizer pressure and level will increase, with pressure increase stopping before level increase stops.

b. Pressurizer pressure and level will increase, with level increase stopping before pressure increase stops.

c. Pressurizer level and pressure will decrease, with pressure decrease stopping before level decrease stops.

d. Pressurizer level and pressure will decrease, with level decrease stopping before pressure decrease stops.

1.10 Why should RC cooldown on natural circulation not exceed 10°F/hr for T_c > 280°F? (1.0)

a. to prevent exceeding brittle fracture limits of the reactor vessel.

b. to ensure adequate mixing of HPI injection water with RC flow into the downcomer.

c. to ensure that adequate heat removal through the OTSGs is possible without having to increase level above 50%.

d. to prevent rapid and erratic changes in pressurizer level from occurring due to bubble formation in the vessel head.

1.11 On reactor trip, the steam header pressure setpoint is increased by 125 psi to reduce RCS shrinkage by elevating T_{ave}. Which of the statements below best explains the effect of this bias increase? (1.0)

a. After reactor trip T_c exceeds OTSG T_{sat}.

b. After reactor trip T_h decreases and approaches T_c.

c. After reactor trip the OTSG T_{sat} is increased.

d. After reactor trip OTSG level is maintained on low level limits.

1.12 Which of the following actions or occurrences is likely to cause water hammer? (1.0)

a. Maintaining the discharge line from an auto starting pump filled with fluid.

b. Water collecting in a steam line.

c. Pre-warming of steam lines.

d. Slowly closing the discharge valve of an operating pump.

1.13 Reactivity is added to a shutdown reactor by rod withdrawal, increasing k_{eff} from 0.950 to 0.974. if rods are again withdrawn, adding the same amount of reactivity as in the first withdrawal, the reactor will be: (1.0)

a. Subcritical by more than 0.1% delta k/k.

b. Within plus or minus 0.1% delta k/k of critical.

c. Supercritical by more than 0.1% delta k/k, but not prompt critical.

d. Prompt critical.

1.14 The reactor is shutdown by 5% delta k/k with a neutron count rate of 50 CPS. Rods are withdrawn inserting 2% delta k/k reactivity. Which of the following is closest to the resulting final neutron count rate? (1.0)

a. 70 CPS

b. 80 CPS

c. 90 CPS

d. 100 CPS

1.15 Which one of the following statements is TRUE concerning the change in differential boron worth (% delta k/k) with RCS boron concentration (range of 0 to 1800 ppm) and T_{ave} (range of 532°F of to 579°F)? (1.0)

a. It decreases as T_{ave} and RCS boron concentration increase.

b. It decreases as RCS boron concentration increases but is constant as T_{ave} increases.

c. It increases as T_{ave} and RCS boron concentration increase.

d. It increases as T_{ave} increases but is constant as RCS boron concentration increases.

1.16 The amount of heat being added by the reactor coolant pumps: (1.0)

a. Is less than the RCS heat loss to ambient at operating temperature.

b. Is less than the amount of heat being lost to letdown at operating temperature.

c. Causes total OTSG thermal output to be greater than the thermal output of the core itself.

d. Is insignificant at normal operating temperature.

1.17 During a LOCA with a resultant loss of subcooling margin, Reactor Coolant Pumps (RCPs) are secured for which one of the following reasons. (1.0)

a. To prevent pump damage resulting from operation under two phase conditions.

b. To prevent core damage resulting from phase separation upon subsequent loss of RCS flow.

c. To reduce RCS pressure by removing the pressure head developed by the RCPs.

d. To remove the thermal heat being added to the RCS by the operating RCPs.

1.18 Which of the following sources can potentially introduce the largest (in standard cubic feet) amount of non-condensible gas into the RCS? (1.0)

a. Zirc-water reaction.

b. Core Flood tanks.

c. Pressurizer steam space.

d. 100% failed fuel.

NOTE: The following questions ask you to select the incorrect, or negative, response from among a list.

1.19 Which of the following statements about control rod worth is INCORRECT? (1.0)

a. Integral rod worth decreases with increasing Tave.

b. Integral rod worth increases toward ECL.

c. Differential rod worth is least near full insertion and full withdrawal.

d. The integral worth of two control rods can be either larger or smaller than the sum of their integral worth when inserted separately.

1.20 Which of the following is NOT a reason why the integral rod worth curve for an APSR is shaped differently than the other rod groups? (1.0)

a. Active poison length is 3 feet.

b. Neutron flux is higher near the center of the core.

c. Neutron poison materials are the same in APSRs as in other control rods.

d. Differential rod worth depends on flux level at the rod position.

1.21 Which of the following statements about burnable poisons is NOT true? (1.0)

a. Including burnable poison in the fuel affects the doppler coefficient.

b. Including burnable poison in the fuel affects the moderator temperature coefficient.

c. As core life increases burnable poison effects partially compensate for fissile depletion of the fuel.

d. As core life increases burnable poison effects partially compensate for fission product buildup effects.

1.22 Which of the following statements about heat transfer regions along the OTSG tubes is NOT true? (1.0)

a. The film boiling region is always the smallest region.

b. The nucleate boiling region increases with increasing power.

c. As power increases the superheat region decreases and the film boiling region remains the same.

d. At 50% power the superheat region is the same size as the nucleate boiling region.

1.23 Which of the following flow measuring concepts is NOT based on the square root of a measured pressure difference? (1.0)

a. Rotameter

b. Orifice

c. Pitot tube

d. Venturi

1.24 Answer the following statements concerning core power distribution and thermal design limits TRUE or FALSE.

1. Over core life, the limitations on negative axial power imbalance become less restrictive. (0.5)

2. Tech Spec limitations on quadrant power tilt only apply in Mode 1 above 50% of Rated Thermal Power. (0.5)

3. The linear heat rate is limited to prevent centerline fuel melt, while DNBR is limited to prevent fuel clad failure. (0.5)

4. There are Tech Spec safety limits on both axial power imbalance and quadrant power tilt. (0.5)

END OF CATEGORY 1

CATEGORY 2. PLANT DESIGN, INCLUDING SAFETY AND EMERGENCY SYSTEMS (25.0 Points)

2.1 Which of the following statements about the Feedwater system is true? (1.0)

a. Deaeration of condensate in FWT-1 is accomplished by spraying condensate into a deaerator section at reduced temperature.

b. A FW Booster pump will trip if its suction valve is closed or its lube oil temperature is high.

c. During operation with one main FWP, if the associated suction valve FWV 14 or 15 drifts 10% from full open, the pump will trip in 30 seconds.

d. Low pressure steam for each MFP turbine is supplied through its upper steam chest, passing through "poppet" type valves to the upper turbine nozzles.

2.2 Which of the following statements about the Emergency Diesel System is true? (1.0)

a. Operator override valves parallel the air start solenoid valves, allowing manual starting of each engine, if necessary.

b. The air start reservoirs for either diesel are designed to allow at least 8 starts without recharging.

c. The fuel oil day tank for each diesel must be refilled once per day during operation at rated power.

d. During startup oil is supplied to the main drive end bearing by an auxiliary gear-driven pump.

2.3 Which of the following is the most important reason why Core Flood Tank pressure is carefully controlled? (1.0)

a. The borated water level in the CFTs can only be read on existing instrumentation to plus or minus one-half foot.

b. During a large LOCA CFT injection will occur immediately after "blowout" of water from the lower part of the core occurs.

c. During a small LOCA the CFTs will not empty if HPI can maintain RCS pressure.

d. The LPI system could not be designed to inject at CFT pressure.

2.4 Which of the following statements about the RC Pump seals is true? (1.0)

a. Under normal conditions the seal injection flow to each pump divides, with 3 gpm passing the first seal and 5 gpm entering the RCS.

b. If two pump seals fail the third can take the full RCS pressure.

c. Two pressure reducing devices carry a small leakage flow in parallel with the seals so that under normal conditions the RCS pressure is equally divided between seals one and two.

d. An alarm will sound if pressure in the third seal cavity exceeds 470 psig.

2.5 Lithium-7 is a concern in the RCS for which of the below listed reasons? (1.0)

a. Too much of it gives an excessively low pH.

b. It is a source of Tritium.

c. It adds to post shutdown radiation levels in the containment.

d. It fouls heat transfer surfaces.

2.6 Which of the following statements is true of the High Pressure Injection System (HPI)? (1.0)

a. The HPI pumps may be started at their local 480V breakers located on ES MCC AB on the 119' elevation.

b. The system has been designed such that during a low pressure situation, as long as <u>only</u> two HPI pumps are running, pump runout is not an operational concern.

c. Automatic initiation of HPI by the ES system starts <u>both</u> selected HPI pumps and <u>all</u> pumps necessary for LPI.

d. The LPI pumps are automatically lined up to supply the suction of the HPI pumps from the RB sump when the BWST reaches a specified minimum level.

2.7 The purpose of the 85 psig nitrogen overpressure in the NUCLEAR SERVICES SURGE TANK is to: (1.0)

a. Provide sufficient NPSH for the SW pumps.

b. Reduce the general corrosion rate.

c. Meet ASME code standards.

d. Prevent inleakage from the containment during a LOCA.

2.8 Direct cooling of the HPI pumps is provided by which of the following combinations: (1.0)

a. Nuclear Services Cooling water and Decay Heat Seawater

b. Decay Heat Closed Cycle Cooling water and Decay Heat Seawater

c. Decay Heat Closed Cycle Cooling Water and Secondary Services Closed Cycle cooling water.

d. Nuclear Services Cooling water and Decay Heat Closed Cycle cooling water.

2.9 Loss of all Reactor Coolant Pumps will directly cause which of the following: (1.0)

a. Close the MFW and the Low Load Block Valves and open the SU Block Valve.

b. Close the SU Block Valve and open the EFW Block Valve.

c. Close the EFW Block Valve and open the SU Block Valve.

d. Start the EFW pumps.

2.10 Why shouldn't hydrazine be added to the RCS during operation of the makeup demineralizers? (1.0)

a. Because the hydrazine will be removed by the demineralizers, and therefore wasted.

b. The demineralizer resin does not perform satisfactorily at the low temperatures at which hydrazine is used.

c. Hydrazine chemical reaction with the demineralizer resin could result in release of chlorides.

d. If high O_2 levels in the RCS warrant hydrazine addition, a potential source may be the demineralizer and therefore it should be off-service.

2.11 Which one of the following statements about the Low Pressure Injection (LPI) system is true? (1.0)

a. The reason NaOH is added to the discharge side of the LPI pumps is to prevent corrosion of the impellers.

b. Actuation of LPI by the RC pressure reaching 500 psi opens BSV-36 and BSV-37 causing NAOH to be added.

c. The DH pump operation in the recirculation mode (80-100 gpm) must be timed and limited to 20 hours total over the life of the pump.

d. The maximum allowable flow rate per DH pump is 4000 gpm.

2.12 Which of the following statements about the Turbine Bypass Valves is correct? (1.0)

a. The bypass valves are air opened and spring closed, and operate off a +10V to 0V signed at the EP convertor.

b. The loss of ICS power to the EP convertor will register as a zero volt signal, thus an EP convertor output signal of zero psig, causing the valves to fail as is.

c. Local manual operation of the TBV requires isolation of instrument air, opening of the position controller handle valve, opening the equalizing valve, and inserting a pin to connect the handwheel to the valve stem.

d. On loss of instrument air the lack of a close signal from the electropneumatic positioner will result in the TBV remaining at its current position.

2.13 The Makeup valve, MUV-31, may be bypassed manually. The bypass is normally throttled to maintain which one of the following? (1.0)

a. 8 gallons per minute Makeup flow to ensure that Makeup never falls below that required for seal return flow.

b. Greater than 15 gallons per minute to ensure that the running Makeup pump does not over-heat.

c. Greater than 15 gallons per minute at all times when the RCS is above a minimum temperature specified by procedure.

d. Equal to 1 gallon per minute at all times to minimize thermal shock to the Makeup nozzle.

2.14 The motor driven EFW pump (EFP-3A) is cooled by which one of the following? (1.0)

a. NSCCC

b. SSCCC

c. DHCCC

d. Its own discharge.

2.15 The condensate water storage tank with minimum water volume is sufficient to maintain the plant in HOT STANDBY for how many hours with steam discharge to atmosphere? (1.0)

a. 8

b. 24

c. 50

d. 100

NOTE: The following questions ask you to select the incorrect, or negative, response from among a list.

2.16 Select the CORRECT statement regarding the 480V to 120V AC distribution system. (1.0)

a. 120V AC Vital buses 3A and 3B are supplied from either DC Bus 3A or 480V ES MCC 3A-1 via dual input inverters.

b. DC Bus 3A or 3B can be supplied from a standby battery charger that is powered from 480V ES MCC 3AB.

c. ICS 'X' power supply is from 120V AC Vital Bus 3A and ICS 'Y' power supply is from 120V AC Vital Bus 3B.

d. Each 120V AC Vital Bus can be transferred from its normal inverter feed to the 480V ES MCC alternate feed via a Static Switch.

2.17 Which of the following statements is NOT a true statement concerning the design and operation of a feedwater heater? (1.0)

a. A high level in FWHE 5A will open the heater dump valve and close the extraction non-return valve feeding it.

b. The extraction steam flow rate must be increased as the heater level rises above normal.

c. A high level in a feedwater heater will result in a decrease in its efficiency.

d. The feedwater heater subcooler utilizes the heater inlet water as a cooling medium.

2.18 Which of the following statements is NOT true about the Auxiliary Steam System? (1.0)

a. During normal operation Aux Steam is supplied from Main Steam.

b. Aux Steam may be supplied by Unit 1.

c. Aux Steam is the normal steam source for the Gland Steam System.

d. Aux Steam header pressure is maintained by supply regulators set for 140 psia by either the normal (ASV-27) or backup (ASV-26, ASV-184) regulators.

2.19 Which of the following plant areas is NOT automatically protected by the Water Spray Deluge Fire Protection System? (1.0)

delete

a. Startup transformers

b. Unit auxiliary transformer

c. Charcoal plenum in Auxiliary Building

d. Hydrogen seal oil unit

2.20 Which of the following conditions for the Main Feedwater pump and turbine oil supply system is NOT indicative of proper operation? (1.0)

a. Lighted red light on oil test panel associated with the DC oil pump.

b. Lube oil filter delta p less than 20 psi.

c. Lighted red light on oil test panel associated with either AC oil pump.

d. Control oil pressure equals 110 psig.

2.21 Which of the following statements about the RC pumps is NOT true? (1.0)

a. Inertia of the pump flywheel allows adequate coastdown to limit the minimum DNBR on loss of pump power.

b. An impeller located below the lower pump seal pumps 70 gpm through the lower seal chamber and RC pump cooler.

c. Oil pressure for the anti-reverse rotation device is automatically provided during startup by a pump vane near the thrust bearing.

d. The pump flywheel is cooled by air which transfers heat to the NSCCC System.

2.22 Which of the following chemicals are NOT added to the indicated systems? (1.0)

a. Hydrazine is added to the EFW system.

b. Lithium Hydroxide is added to the RCS.

c. Sodium Hydroxide is added to the Building Spray System.

d. Ammonia is added to the RCS.

2.23 Which of the following statements about the Instrument Air System is INCORRECT? (1.0)

a. Compressors are powered from Reactor Aux Bus 3A and 3B.

b. Condensation collected in each aftercooler must be drained regularly by manually opening the tank drain valve.

c. Closure of the crosstie valve IAV-30 will not prevent service air from entering the IA system on low IA pressure.

d. Although moisture, oil and foreign matter must be periodically drained from the air receiver tanks, subsequent treatment results in air meeting the quality of breathing air.

2.24 Answer the following statements concerning the Core Flood Tanks TRUE or FALSE.

1. Isolation valves CFV-5 and 6 receive an open signal following ES actuation even though they are required to be open with their breakers in the "Locked Reset" position. (0.5)

2. When the breakers for CFV-5 and 6 are in the "Locked Reset" position, they lose position indication in the control room. (0.5)

3. During plant operation, the CF tank levels may be increased by adding from the makeup and purification (MUP) system and decreased by draining to the Auxiliary Building Sump. (0.5)

4. During plant operation, high CF Tank pressure may be relieved by venting to the Reactor Building. (0.5)

END OF CATEGORY 2

CATEGORY 3. INSTRUMENTS AND CONTROLS (25.0 Points)

3.1 Actuation of RB isolation results in the closing of most RB fluid penetrations. However, some valves are opened instead. Select the group below which includes all systems and supplies in which valves are opened when only ES Channel B actuates: (1.0)

a. RB spray, sodium hydroxide supply, sodium thiosulfate supply, and NSCCC

b. RB spray, sodium hydroxide supply, and NSCCC

c. NSCCC

d. RB spray and sodium hydroxide supply

3.2 Which of the following statements about power supplies to the ICS is correct? (1.0)

a. The 118 V field power supply will automatically transfer to VBDP-2 if it is available.

b. Power to the +24 V DC supply will be switched from VBDP-2 to VBDP-4 by an automatic bus transfer device if VBDP-2 is lost.

c. If the "S-1" -24 V DC power supply in the ICS cabinets fails the yellow "loss of ICS power" lamp on the redundant instrument panel will be extinguished.

d. The 118 V field power supply automatic transfer between vital buses may be immediate or delayed, depending on which bus is available.

3.3 Which of the following Atmospheric Monitoring System channel groups consist of iodine and gas measuring channels preceded by a particulate filter? (1.0)

a. RM-A1 and A2.

b. RM-A3, A4, A7 and A8.

c. RM-A5 and A6.

d. RM-A11, A12 and A13.

3.4 Which of the following statements correctly describes control of the Low Pressure Injection System? (1.0)

a. If RCS pressure is raised from 250 to 550 psig the white LPI bypass/reset permit lights will illuminate.

b. If RCS pressure is raised from 400 to 550 psig, and then is reduced to 450 psig LPI will initiate.

c. If, with LPI bypassed, RCS pressure is lowered from 550 psig to 450 psig, then increased to 550 psig, resetting all LPI bypass/reset switches will not result in LPI initiation.

d. If RCS pressure is lowered from 950 to 450 psig the white LPI bypass permit light lights and the blue LPI bistable tripped lights will illuminate.

delete

3.5 Which of the following statements about ESAS control and testing circuits is true? (1.0)

a. Testing of selected equipment groups can be done using manual switches and the manual actuation pushbutton, but return of tested equipment to its normal lineup requires use of the manual reset switch.

b. The RB Cooling and Isolation System has six group test switches, one for each group of equipment to be tested.

c. Valves are assigned to two or more test groups so that all may be full-stroke tested without affecting plant operations or damaging equipment.

d) By proper use of the auto test select switch and the auto test switches, equipment in HPI test groups 2 and 3 can be tested simultaneously.

3.6 Which of the following statements about maintenance and testing of the Reactor Protective System is true? (1.0)

a. Placing a channel into "Channel Bypass" changes RPS trip logic to a "one out of three" mode.

b. During functional testing of a channel in "Channel Bypass" a bright subsystem trip lamp indicates that the channel trip relay has tripped.

c. Maintenance of a single module in an RPS channel can be performed without keeping the entire channel in "Channel Bypass" or "Trip" mode, but it must pass through one of these modes during module removal.

d. Placing more than one channel into "Shutdown Bypass" will trip all CRD breakers.

3.7 Which of the following statements about Electrical System protective relays is correct? (1.0)

a. The speed of an overcurrent relay trip is independent of the overcurrent magnitude.

b. Lock-out relays prevent closing of a circuit breaker by mechanically blocking the closure mechanism.

c. A differential relay scheme balances current flows in each phase of a multi-phase line.

d. Because no current normally flows through a differential relay coil, this protection is less sensitive than overcurrent relay protection.

3.8 Which of the following statements about the Source Range NI System is true? (1.0)

a. High voltage supply is turned off when one Intermediate Range Channel reaches 10^{-9} amps.

b. Detectors detect only neutrons, not gammas.

c. Contains a rod withdrawal inhibit which is bypassed if any two power range channels indicate >10% FP.

d. A SUR signal from the Source Range goes to a bistable to halt rod withdrawal when the SUR exceeds 2 DPM. This is reset at 1 DPM.

3.9 Which of the following pairs of conditions is needed to put the RCS pilot-actuated relief valve in the "Overpressure Protection (550 psig)" position? (1.0)

a. RCV-10 in manual and "Low-Range" key switch in "ON".

b. LPI 500 psig trip bistables reset and "Low-Range" key switch in "ON".

c. LPI 500 psig trip bistables reset and RCV-10 in "AUTO".

d. RCV-10 in "AUTO" and "Low-Range" key switch in "ON".

delete

3.10 Which of the following statements is true regarding Control Room indication of Emergency Diesel Generator status? (1.0)

a. A yellow light is lit when there is 150# air being supplied to the air start control valve.

b. A yellow light is lit when the generator output breaker is closed.

c. A white light is lit when the generator output breaker is closed.

d. A yellow light is lit when the generator is at rated voltage and frequency.

3.11 Selecting another OTSG startup range level transmitter for both OTSGs at the same time can potentially cause which one of the following results? (1.0)

a. Lock in both high level limits.

b. Cause the Feedwater startup control valve to fail shut.

c. Cause Emergency Feedwater to actuate.

d. Cause the low-load block valve to open.

3.12 Which one of the following statements is true regarding the RCP electrical distribution? (1.0)

a. Upon losing 6900 VAC power, the RCP supply breakers trip within 6 cycles.

b. Upon losing 6900 VAC power, the RCP supply breakers fail as is.

c. Upon regaining 6900 VAC power, any RCP supply breaker that tripped on undervoltage will automatically reclose.

d. RCP supply breakers will trip open on UV after an 8 second time delay.

3.13 Which of the following statements concerning the Main Steam Rupture Matrix system is true? (1.0)

a. It contains three actuation channels, "A", "B" and "AB".

b. Each channel is automatically bypassed when MS pressure <725 psig.

c. Each channel contains four pressure switches, two located on an A and two located on a B main steam line.

d. Each channel automatically resets when MS pressure increases >600 psig.

NOTE: The following questions ask you to select the incorrect, or negative, response from among a list.

3.14 Which of the following statements about the Diamond Panel is INCORRECT? (1.0)

a. The LATCH switch allows CRD motors to be driven past the In Limit.

b. The MOTOR FAULT lamp identifies programmer operation without a command, or out motion during an in command.

c. The CLAMP/CLAMP RELEASE switch cross connects the Auxiliary power supply and the DC Hold bus.

d. The FAULT RESET switch closes CRDM trip breakers when groups are at the In Limit.

3.15 Which of the following statements about temperature measurement is NOT true? (1.0)

a. If the sensing wire of an RTD breaks the instrument will read offscale high.

b. If a thermocouple wire breaks the instrument will read off scale low.

c. RTDs respond faster to temperature changes than thermocouples.

d. The temperature range which can be measured by an RTD is smaller than that for a thermocouple.

3.16 Which of the following conditions will PREVENT starting of an RC pump? (1.0)

a. NSCCC flow equals 240 gpm.

b. Oil lift pressure equals 220 psig.

c. Seal injection flow equals 4 gpm.

d. Reactor power equals 25% FP.

3.17 Which of the following is NOT a condition required to allow "A" main feedwater block valve to open? (1.0)

a. Reactor reset

b. Turbine reset

c. A and B main feedwater pumps operating

d. Feedwater cross-over valve (FWV-28) closed

3.18 Which of the following will NOT cause the ICS to control the unit in "TRACK"? (1.0)

a. Reactor Trip

b. Turbine not in "ICS/AUTO"

c. SG/Rx master control station in "MANUAL"

d. Either feedwater loop control station in "MANUAL"

3.19 Which of the following statements about the design of the Emergency Diesel Generator loading control is NOT true? (1.0)

a. During block loading sequencing output voltage dips by 25% without tripping safeguards control center starters.

b. EDG start on loss of 4160 V ES bus voltage is accompanied by tripping of the battery charger feeder breakers, with reclosure about 5 seconds later.

c. Feeder breakers from a 4160 V ES bus to the HPI pumps are not tripped upon loss of bus voltage. However, until the generator comes up to speed it is not connected to the bus.

d. The RB spray pumps are not connected to the 4160 V. ES bus until about 15 seconds after block loading begins.

3.20 Which of the following statements about RB Purge control is NOT true? (1.0)

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

b. Exhaust duct temperature greater than 135°F 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.

3.21 Which of the following statements about the Power Range NI System is NOT true? (1.0)

a. Contains three bistables which input to the RPS.

b. Each channel contains a gain adjustment for use in calibration.

c. Provides the ICS power level signal as the output of the highest of the four channels.

d. Detectors detect both neutrons and gammas.

3.22 If the Reactor Control Station is in "Auto" and neutron power level is >60% FP, the reactor will automatically run back to 60% neutron power and a rod out-inhibit exist if any of the following conditions EXCEPT one exists. Select that one.? (1.0)

a. Lose safety rod out-limit.

b. One or more rods are >9 inches out of alignment with the group average position for Group 5.

c. Insufficient or excessive overlap exists between Group 5 and 6, or 6 and 7.

d. One or more rods are >9 inches out of alignment with the group average position for Groups 6, 7, and 8, and an in-limit is actuated.

3.23 Which of the following indication would NOT be expected, and might indicate an instrument failure? (1.0)

a. The CRD "Travel" lamp does not indicate when Group 8 rods are in motion.

b. Group 7 out-motion is prevented past 91.4%.

c. When you depress the "CRD Travel In" lamp test pushbutton, the "CRD Travel Out" lamp comes on.

d. During a transfer of a group from DC hold to Auxiliary, when you select "SEQ-OR," the "SEQ-OR" lamp is on and the "Seq" lamp goes off.

3.24 Identify by letter from the list below the detector type used in the Reactor Diagnostic System (RDS) for the individual monitoring subsystems listed below. NOTE: some subsystems may use more than one type of detector.

Detector Types

A. Displacement probes
B. Excore nuclear
C. Incore nuclear
D. Acoustic Noise
E. Accelerometers

Monitoring Subsystem

1. Loose parts (0.5)
2. External structural vibration (0.5)
3. Reactor coolant pump (0.5)
4. Reactor internals vibration (0.5)

END OF CATEGORY 3

CATEGORY 4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL (25.0 Points)

4.1 If an overcooling transient has reduced Tc to 495°F and RC pressure to 1450 psig, which of the following immediate or remedial actions should be taken according to the appropriate EP. (1.0)

a. Reduce RCS pressure to 1000 psig.

b. Initiate a 3 hour hold at that condition.

c. Reduce feedwater flow until T_c increases above 500°F.

d. Stabilize T_c at 100°F subcooled and initiate engineering evaluation.

4.2 According to OP-210, REACTOR STARTUP, how often should RCS boron concentration be sampled during deboration? (1.0)

a. Every hour.

b. Every 30 minutes.

c. Every 20 ppm B.

d. Every 50 ppm B.

4.3 According to OP-204, POWER OPERATION, if, during a power decrease, either OTSG goes on low level control, which of the following is CORRECT?? (1.0)

a. The delta T_c load ratio control setting in AUTO should be verified to be at 0.

b. The Diamond or Reactor Demand stations should NOT be placed in HAND since FW cannot accept T_{avg} control.

c. The Steam Generator/Reactor master should be kept in AUTO to prevent overriding the OTSG low level control signal.

d. The delta T_c load ratio control station should be placed in HAND.

4.4 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, which one of the following statements accurately describes a correct course of action for maintaining OTSG level? (1.0)

a. If less than two HPI pumps are available, then OTSG levels should be established at 50%.

b. If PZR level is less than 50 inches, DO NOT exceed an OTSG level of 50%.

c. If subcooling margin is 25°F and RCS pressure is >1500 psig. then maintain OTSG level at 50%.

d. If subcooling margin exceeds 100°F, OTSG levels may be decreased below 50%.

4.5 Which one of the following conditions is a procedural requirement for manually tripping the reactor? (1.0)

a. Emergency Feedwater actuates.

b. Subcooling margin drops below 50°F during power operation.

c. Shutdown margin is determined to be less than 1.0% Delta K/K.

d. Feedwater flow is lost.

4.6 Thermoluminescent dosimeters should be rezeroed prior to reaching: (1.0)

a. 50% of full scale

b. 75% of full scale

c. 90% of full scale

d. 100% of full scale

4.7 The background reading on a frisker used for whole body frisking should be no more than: (1.0)

a. 10 cpm

b. 50 cpm

c. 100 cpm

d. 300 cpm

4.8 According to the OSIM, during an emergency, when is it permissible to use the PORV to prevent a high pressure trip? (1.0)

a. When the block valve is operable, and a "dedicated operator" is used.

b. When the cause of the highpressure has been determined to be an under cooling event.

c. When subcooling margin is $\geq$ 60°F.

d. It is never permissible to use the PORV for this purpose.

4.9 List all of the Immediate Actions for a REACTOR PROTECTION SYSTEM ACTUATION, (AP-580). (Do NOT include Remedial Actions.) (2.0)

4.10 The first Immediate Action of EP-290, INADEQUATE CORE COOLING is to ensure full HPI flow. List the Remedial Actions associated with this step. (1.0)

4.11 List all of the Immediate Actions for an ENGINEERED SAFEGUARDS SYSTEM ACTUATION, (AP-380). (Do NOT include Remedial Actions.) (3.0)

4.12 List all of your Immediate and Remedial Actions for EP-140, EMERGENCY REACTIVITY CONTROL. (2.0)

NOTE: The following questions ask you to select the incorrect, or negative, response from among a list.

4.13 When responding to an OTSG leak, which of the following is NOT a method recommended by EP-390, OTSG TUBE RUPTURE, for determining the affected OTSG during cooldown and depressurization? (1.0)

a. Observe MS radiation monitors.

b. Notify chem/rad to survey main steam lines.

c. Compare OTSG levels and feed flows.

d. Notify chem/rad to sample the OTSGs.

4.14 According to OP-502, CONTROL ROD DRIVE SYSTEM, which of the following statements about a jammed CRDM is NOT true? (1.0)

deleted

a. Stator cooling water must be flowing and the stator thermocouple temperature must be continuously monitored during attempts to free the mechanism.

b. Jamming usually occurs due to metal chips lodging between the motor tube and the segment arms.

c. Attempts to free the rod may be made using controls in the Control Rod Drive Room.

d. If the CRDM will not move at run speed it is not permissible to attempt moving it at jog speed in either direction.

4.15 Which of the following limits and precautions about PLANT COOLDOWN (OP-209) is INCORRECT? (1.0)

NOTE: Do not judge the accuracy of the following statements (in this question only) based on information in parentheses.

a. The pressurizer spray shall not be used if the delta T between the RCS and the pressurizer is >(410°F).

b. When RCS pressure is <(150 psig) lock out and red tag the breakers for all makeup pumps and all HPI valves, MUV-(23,24,25,26).

c. The average shell temperature of the OTSGs shall not exceed (60°F) above or below RC temperature.

d. Continuous blowdown of the secondary side of the steam generators via sample line is required whenever reactor power is <(15% FP) and RC temperature is >(250°F).

delete

4.16 Which of the following statements about producing a steam bubble in the pressurizer does NOT agree with OP-202, PLANT HEATUP? (1.0)

a. Pressurizer temperature and RC wide range pressure must be placed on trend recorders.

b. Nitrogen heaters must be deenergized and breakers #19 and #16 opened.

c. When heating the pressurizer to saturation, maintain pressure between 50 and 150 psig.

d. If chemical analysis indicates incomplete venting after saturation is reached, reopen RCV-6 and RCV-5 to the waste gas system.

4.17 Which of the following is NOT an immediate action for AP-542, ASYMMETRIC ROD RUNBACK? (1.0)

a. Ensure NI power decreasing.

b. Ensure Control Rods inserting.

c. Ensure Feedwater flows decreasing.

d. Ensure RC pressure stable.

4.18 Which of the following immediate actions related to an RMA-5 "HIGH" alarm is INCORRECT? (1.0)

a. Ensure dampers D-1 and D-2 are closed and D-3 is open.

b. Ensure stopped or in slow speed: AHF-20A, AHF-20B.

c. Ensure stopped: AHF-17A and B, and AHF-19A and B.

d. Ensure stopped: AHF-30, and AHF-34A and B.

4.19 Which of the following are NOT required to determine cooldown rate after a trip? (1.0)

a. Decimal equivalent of clock time since trip.

b. Pretrip average of 5 highest incore thermocouples.

c. Present T_c.

d. Pretrip T_c.

deleted

4.20 According to OP-209, PLANT COOLDOWN, Safety Rod Groups 1 through 4 should be at their fully withdrawn position whenever reactivity is being changed by all EXCEPT one of the following. Select the INCORRECT statement. (1.0)

a. Reduction in boron.

b. Decrease in RC temperature.

c. Motion of APSRs.

d. Motion of full-length control rod banks.

4.21 According to Crystal River Operating Procedures, which one of the following actions does NOT have to be taken prior to tripping an RCP at power? (1.0)

a. Bypass the individual RCP power monitor.

b. Reduce power to below 60%.

c. Run AC oil lift pump for at least two minutes.

d. Ensure cold leg temperature selected for delta T_c control is for loop other than for the pump that is to be secured.

END OF CATEGORY 4

END OF EXAM

EQUATION SHEET

$Q = m\Delta h$

$Q = UA\Delta T$

$x_p^3 = xw$

$Q = mcp\Delta T$

$DNBR = \frac{Q_c}{Q_x}$

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

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

$SUR = \frac{26.06}{T}$

$T = \frac{\beta - \rho}{\lambda \rho}$

$T = \frac{1^*}{\rho} + \frac{\beta - \rho}{\lambda \rho}$

$\rho = \frac{Keff - 1}{Keff}$

$\rho = \frac{K_2 - K_1}{K_2 K_1}$

$\frac{CR1}{CR2} = \frac{1 - Keff_2}{1 - Keff_1}$

$RR = IfSth$

$SCR = \frac{S}{1 - Keff}$

$M = \frac{CR_1}{Cr_o}$

$x^2(ft) = xw$

$\ell^* = 10^{-8}$ sec

$A = \lambda N$

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

$N = N_o e^{(-\lambda t)}$

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

$R/_{hr} = \frac{60En}{d^2}$

$\lambda = 0.1\ sec^{-1}$

$q\ 1\text{-}2 = h_2 - h_1$

$q = h\ a\ \Delta\ t$

$x\dot{m} = xw$

$KE_1 + h_1 + q_{12} = KE_2 + h_2 + w_{12}$

where:

1) KE is Kinetic energy
2) w is work done
3) q is the heat transferred
4) h is the enthalpy

MASTER

ENCLOSURE 3

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

Facility: Crystal River - 3

Reactor Type: Babcock & Wilcox

Date Administered: March 5, 1985

Examiner: J.C. HUENEFELD

Candidate: ______

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up four (4) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
23 ~~25~~	25			5. Theory of Nuclear Power Plant Operation, Fluids and Thermodynamics
23 ~~25~~	25			6. Plant System Design, Control and Instrumentation
24 ~~25~~	25			7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
24 ~~25~~	25			8. Administrative Procedures, Conditions, and Limitations
94 ~~100~~				TOTALS

Final Grade ______ %

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

Candidate's Signature

5.0 Theory of Nuclear Power Plant Operation, Fluids, and Thermodynamics (25 Points)

5.1 Voiding has occurred in the RCS, in the vicinity of the reactor vessel during a natural circulation cooldown. Which of the following CORRECTLY characterizes the process of collapsing the void? (1.0)

a) The void will collapse immediately upon increasing the pressure above the local saturation pressure; the main concern is water hammer.

b) The void will collapse at a rate equivalent to the rate of HPI flow; therefore, full HPI should be run until the void is fully collapsed.

c) The void will be composed largely of hydrogen gas, and will therefore require degasifying of the RCS in order to begin collapsing it.

d) The void will superheat if an attempt is made to collapse it too fast. The rate of collapse will be governed largely by ambient heat loss from the void.

delete

5.2 While operating at 70% power with three reactor coolant pumps running, which of the following statements is CORRECT about the relationship between loop outlet temperatures? (1.0)

a) T_h in both reactor outlets will be the same because there is complete fluid mixing in the core.

b) T_h in the loop with lower flow will be higher because of the following energy balance: $Q = m\, c_p\, (T_h - T_c)$

c) The loop with lower flow is receiving less pump heat than is the loop with higher flow, and is therefore at a lower temperature.

d) The loop with lower flow is at a lower temperature because the neutron power is suppressed in the regions of lower flow.

(Section 5.0 Continued on Next Page)

5.3 Which of the following is TRUE regarding OTSG outlet pressure? (i.e., the actual pressure of the steam just as it leaves the OTSG) (1.0)

a) OTSG outlet pressure increases with increasing power to overcome head loss in the main steam piping.

b) OTSG outlet pressure decreases with increasing power because of the increasing effect of aspirating steam.

c) OTSG outlet pressure decreases with increasing power because of the decrease in length of the superheat region.

d) OTSG outlet pressure does not vary with power because turbine header pressure is maintained constant.

5.4 When the main generator is synchronized with the grid, excitation current is proportional to: (1.0)

a) reactive load (MVAR)

b) real load (MW)

c) output voltage (KV)

d) generator speed (RPM)

5.5 The amount of heat being added by the reactor coolant pumps: (1.0)

a) is less than the RCS heat loss to ambient at operating temperature.

b) is less than the amount of heat being lost to letdown at operating temperature.

c) causes total OTSG thermal output to be greater than the thermal output of the core itself.

d) is insignificant at normal operating temperature.

(Section 5.0 Continued on Next Page)

5.6 During a LOCA with a resultant loss of subcooling margin, why are the Reactor Coolant Pumps (RCPs) secured? (1.0)

a) To prevent pump damage resulting from operation under two phase conditions.

b) To prevent core damage resulting from phase separation upon subsequent loss of RCS flow.

c) To reduce RCS pressure by removing the pressure head developed by the RCPs.

d) To remove the heat being added to the RCS by the operating RCPs.

5.7 Which of the following is the LARGEST (in standard cubic feet) potential source of RCS non-condensable gas? (1.0)

a) Zirc-water reaction

b) Core Flood tanks

c) Pressurizer steam space

d) 100% failed fuel.

5.8 The RCS is in Hot Standby with no Reactor Coolant Pumps running. If OTSG pressure is decreased, according to the Plant Verification procedure (VP-580), which of the following temperature responses best indicates the presence of natural circulation? (1.0)

a) T_h increases, T_c remains the same

b) T_h increases, T_c decreases

c) T_h decreases, T_c decreases

d) T_h remains the same, T_c decreases.

5.9 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? (1.0)

a) Nuclear overpower trip setpoint

b) RCS pressure high setpoint

c) RCS outlet temperature high

d) RCS variable pressure temperature low

(Section 5.0 Continued on Next Page)

5.10 The reactor is brought to 10^{-8} amps 2 hours after a trip from 100% FP at equilibrium xenon conditions. In order to maintain power level at 10^{-8} amps for the next hour, what will have to be done with control rods? (1.0)

a) They will have to be withdrawn.

b) They will have to be inserted.

c) They will need to be withdrawn initially, then inserted to compensate for xenon burnout.

d) The rods will have to remain at a constant position because the rate of xenon burn out is almost exactly matched with the post shutdown indirect xenon production rate.

5.11 Which of the following best describes the behavior of equilibrium xenon reactivity over core life? (1.0)

a) It decreases, because of the increased fuel burn-up.

b) It decreases, because of the decrease in plutonium-xenon yield.

c) It increases, because of the increase in thermal flux.

d) It increases, because of the decrease in boron concentration.

5.12 The reactor is critical at 10^{-8} amps. Which of the following best describes the behavior of neutron power following a prompt insertion of negative reactivity? (1.0)

a) Neutron power drops immediately to "Beta" (delayed neutron fraction) times the neutron power prior to the prompt insertion of negative reactivity.

b) Neutron power decreases linearly with time after the initial prompt drop.

c) After the initial prompt drop, neutron power decreases on a constant negative period; the magnitude of the period determined by the amount of negative reactivity inserted.

d) Because only delayed neutrons are left immediately after a negative reactivity insertion, neutron power decreases on an 80 second period regardless of the size of the negative reactivity insertion.

(Section 5.0 Continued on Next Page)

5.13 Which of the following statements best describes the consequences of an RCS boration that reduces power without Control Rod motion? (1.0)

a) Imbalance becomes less negative and Power Range NI calibration becomes less conservative.

b) Imbalance becomes more negative and Power Range NI calibration becomes less conservative.

c) Imbalance becomes less negative and Power Range NI calibration becomes more conservative.

d) Imbalance becomes more negative and Power Range NI calibration becomes more conservative.

5.14 Which of the following statements about Sm-149 is TRUE? (1.0)

a) It is removed from an operating reactor by burnout and radioactive decay.

b) When a reactor is restarted after a temporary shutdown Sm-149 concentration increases for several days.

c) It has less effect on reactor operation than Xe-135 due to its smaller fission yield and smaller microscopic neutron cross section.

d) The equilibrium concentration of Sm-149 at 50% FP is about two thirds of the equilibrium concentration at 100% FP.

5.15 Which of the following statements best describes parameter changes in the pressurizer following a rapid load reduction of 15% FP? (1.0)

delete

a) Pressurizer pressure and level will increase, with the pressure increase stopping before the level increase stops.

b) Pressurizer pressure and level will increase, with the level increase stopping before the pressure increase stops.

c) Pressurizer level and pressure will decrease, with the pressure decrease stopping before the level decrease stops.

d) Pressurizer level and pressure will decrease, with the level decrease stopping before the pressure decrease stops.

(Section 5.0 Continued on Next Page)

5.16 Why should an RCS cooldown on natural circulation NOT exceed 10°F/hr for T_c > 280°F? (1.0)

a) to prevent exceeding brittle fracture limits of the reactor vessel.

b) to ensure adequate mixing of HPI injection water with RC flow into the downcomer.

c) to ensure that adequate heat removal through the OTSGs is possible without having to increase level above 50%.

d) to prevent rapid and erratic changes in pressurizer level from occurring due to void formation in the vessel head.

5.17 Which one of the following statements is TRUE concerning the change in differential boron worth (% delta k/k) with RCS boron concentration (range of 0 to 1800 ppm) and T_{ave} (range of 532°F to 579°F)? (1.0)

a) It decreases as T_{ave} and RCS boron concentration increase.

b) It decreases as RCS boron concentration increases but is constant as T_{ave} increases.

c) It increases as T_{ave} and RCS boron concentration increase.

d) It increases as T_{ave} increases but is constant as RCS boron concentration increases.

5.18 On a reactor trip from 100% power and equilibrium xenon conditions, peak xenon will be reached in approximately ______ hours. (1.0)

a) 4 to 6
b) 8 to 10
c) 12 to 14
d) 72

5.19 What is the effect of starting a large induction motor on a bus while being supplied by a DG? (1.0)

a) It increases the real load, but reactive load remains unchanged.

b) It decreases the power factor.

c) It increases the real load, but decreases the reactive load.

d) It increases both the real and the reactive load.

(Section 5.0 Continued on Next Page)

5.20 At normal operating temperature, a leak from the PZR water space to the containment atmosphere would consist of: (1.0)

a) Super-heated steam.

b) Saturated steam.

c) Low quality steam.

d) Saturated water.

5.21 Which of the following would tend to place the ICS closer to a BTU limit? (1.0)

a) A decrease in feedwater flow.

b) An increase in feedwater temperature.

c) An increase in OTSG pressure.

d) An increase in T_{ave}.

5.22 The ratio of Pu-239 and Pu-240 atoms to U-235 atoms changes over core life. Which one of the pairs of parameters below are most affected by this change? (1.0)

a) moderator temperature coefficient and doppler coefficient

b) doppler coefficient and beta

c) beta and moderator temperature coefficient

d) moderator temperature coefficient and neutron generation time.

(Section 5.0 Continued on Next Page)

5.23 A moderator is necessary to slow neutrons down to thermal energies. Which of the following is the CORRECT reason for operation with thermal instead of fast neutrons? (1.0)

a) Increased neutron efficiency since thermal neutrons are less likely to leak out of the core than fast neutrons.

b) Reactors operating primarily on fast neutrons are inherently unstable and have a higher risk of going prompt critical.

c) The fission cross section of the fuel is much higher for thermal energy neutrons than fast neutrons.

d) Doppler and moderator temperature coefficients become positive as neutron energy increases.

5.24 The reactor core Safety Limit Curve (Figure 2.1-1 in the Technical Specifications) is prevented from being exceeded by a combination of four RPS trips. LIST the combination of RPS trips that define the reactor trip envelope. (DO NOT include setpoints) (2.0)

(End of Section 5.0)

6.0 <u>Plant Systems Design, Control, and Instrumentation</u> (25 Points)

6.1 The Makeup valve, MUV-31, may be bypassed manually. The bypass is normally throttled to maintain: (1.0)

a) 8 gallons per minute Makeup flow to ensure that Makeup never falls below that required for seal return flow.

b) greater than 15 gallons per minute to ensure that the running Makeup pump does not over-heat.

c) greater than 15 gallons per minute at all times when the RCS is above a minimum temperature specified by procedure.

d) equal to 1 gallon per minute at all times to minimize thermal shock to the Makeup nozzle.

6.2 Selecting another OTSG startup range level transmitter in both OTSGs at the same time can potentially: (1.0)

a) lock in both high level limits.

b) cause the Feedwater startup control valve to fail shut.

c) cause Emergency Feedwater to actuate.

d) cause the low-load block valve to open.

~~6.3 Three of the conditions given below should always cause an asymmetric rod runback. Which one will NOT necessarily cause an asymmetric rod runback? (1.0)~~

deleted

a) One or more Group 7 rods are > 9 in. out of alignment with the group average and an in-limit is actuated.

b) One or more APSRs are > 9 in. out of alignment with the group average and an in-limit is actuated.

c) One safety rod is dropped.

d) One or more Group 5 rods are > 9 in. out of alignment with the group average position.

(Section 6.0 Continued on Next Page)

6.4 In the main turbine steam enters the steam chest by passing through the throttle valves and exits the steam chest by passing through the governor valves. Which of the following statements is consistent with the steam flow path: (1.0)

a) If both throttle valves in one steam chest are open, then the OTSG's steam headers are cross connected.

b) If any two governor valves are shut, then the OTSG steam headers are no longer cross connected.

c) If any two throttle valves are shut, then the OTSG steam headers are no longer cross connected.

d) If only one throttle valve is open in each steam chest, then the OTSG steam headers are cross connected.

6.5 Which of the following is an IMPROPER action to perform when taking manual control of an atmospheric steam dump valve? (1.0)

a) Secure instrument air to the position controller.

b) Place the position controller to the "BY-PASS" position.

c) Open the vent valve up-stream of the position controller pressure regulator.

d) Position the atmospheric dump valve by using the actuator handwheel.

6.6 Which one of the following load limiting conditions and corresponding load limit is CORRECT? (1.0)

a) Loss of 1 RC pump with 4 running - 30%/min to maximum limit of 75%

b) Loss of 2 RC pumps with 4 running - 30%/min to maximum limit of 50%

c) Loss of a Feedwater Booster pump - 30%/min to maximum limit of 55%

d) Asymmetric Rod - 30%/min to maximum limit of 60%

(Section 6.0 Continued on Next Page)

delete

6.7 Which component is loaded on a safeguards bus during block one loading? (1.0)

a) The motor driven EFW pump

b) A battery charger

c) A Reactor Building fan

d) A Reactor Building Spray pump

6.8 Which of the following is TRUE regarding the RCP electrical distribution? (1.0)

a) Upon losing 6900 VAC power, the RCP supply breakers trip within 6 cycles.

b) Upon losing 6900 VAC power, the RCP supply breakers fail as is.

c) Upon regaining 6900 VAC power, any RCP that tripped on undervoltage will automatically restart.

d) RCP supply breakers will trip open on UV after an 8 second time delay.

6.9 Which of the following actions will cause the "A" CRDM breaker to open? (1.0)

a) Placing more than one channel "A" module test switch in "test".

b) Racking out both the channel "A" low pressure bistable and the channel "A" high flux bistable.

c) Placing the "A" channel output trip test switch on the "A" reactor trip module in "test".

d) Placing the "A" channel in "channel bypass" and then deenergizing the "A" RPS cabinet.

6.10 Which of the following RPS trips is NOT bypassed when the RPS is in "Shutdown Bypass"? (1.0)

a) Low Pressure (1800 psig)

b) High Flux

c) Flux/Delta Flux/Flow

d) Variable Pressure Temperature

(Section 6.0 Continued on Next Page)

6.11 All R'S equipment (sensors, recorders, modules, etc.) is powered from: (1.0)

a) $\pm$ 15 VDC or 120 VAC from its associated channel.

b) $\pm$ 15 VDC or 120 VAC from the other three channels.

c) $\pm$ 15 VDC of 120 VAC from a separate vital bus.

d) the DC distribution system.

6.12 Which of the following is a direct result of a loss of NNI "X": (1.0)

a) T_{ave} fails to 570° F, control rods withdraw.

b) Diamond panel transfers to manual.

c) RC total flow fails to 75%, and the ULD runs back to 75%.

d) Turbine bypass valves fail to mid-position.

6.13 The motor driven EFW pump (EFP-3A) is cooled by: (1.0)

a) NSCCC

b) SSCCC

c) DHCCC

d) its own discharge.

6.14 The condensate water storage tank with minimum water volume is sufficient to maintain the plant in HOT STANDBY for _?_ hours with steam discharge to atmosphere. (1.0)

a) 8

b) 24

c) 50

d) 100

(Section 6.0 Continued on Next Page)

6.15 Which of the following statements about the Steam Line Rupture Matrix is NOT correct? (1.0)

a) The maintenance bypass key in "Maint" position and bypass pushbutton depressed will bypass the rupture matrix.

b) If the rupture matrix actuates when in the test mode, the MSIVs will close.

c) The bypass reset buttons will remove the bypass if depressed only if pressure is > 600 psig.

d) Each S/G is protected by both matrix "1" and "2".

6.16 Under which condition will the Main Feedwater block valves NOT shut? (1.0)

a) Reactor trip

b) Feedwater demand reaches 50% decreasing

c) Main Feedwater pump trip

d) Feedwater pump discharge crosstie is not shut.

6.17 Which of the following statements about RB Purge control is NOT true? (1.0)

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

b) Exhaust duct temperature greater than 135° F 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.

(Section 6.0 Continued on Next Page)

6.18 The primary fire protection system protecting the Emergency Diesel Generators is a: (1.0)

a) Wet pipe sprinkler system

b) Deluge system

c) Pre-action sprinkler system (Dry pipe)

d) Open nozzle sprinkler system

6.19 Which of the following statements about Emergency Diesel Generator control and loading is <u>NOT</u> true? (1.0)

a) During block loading, system voltage may dip by several percent without tripping safeguards loads.

b) While the 3A ES bus is being supplied by the EDG, a condition causing the initiation of EFW will result in a load shed of the 3A ES bus, followed by an auto-start of the electric EFW pump.

c) 4160 V ES breaker for a running HPI pump is not tripped upon loss of bus voltage; therefore, it immediately automatically re-starts when its ES bus is reenergized by the diesel.

d) The RB spray pumps are not connected to the 4160 V ES bus until about 15 seconds after block loading begins.

6.20 Which of the following statements is <u>TRUE</u> regarding the Emergency Core Cooling System (ECCS)? (1.0)

a) The HPI pumps may be started at their local 480V breakers located on ES MCC AB on the 119' elevation.

b) The system has been designed such that during a low pressure situation, as long as <u>only</u> two HPI pumps are running, pump runout is not an operational concern.

c) Automatic initiation of HPI by the ES system starts <u>both</u> selected HPI pumps and <u>all</u> pumps necessary for LPI.

d) The LPI pumps are automatically lined up to supply the suction of the HPI pumps from the RB sump when the BWST reaches a specified minimum level.

(Section 6.0 Continued on Next Page)

6.21 Why shouldn't hydrazine be added to the RCS during operation of the makeup demineralizers? (1.0)

a) Because the hydrazine will be removed by the demineralizers, and therefore wasted.

b) The demineralizer resin does not perform satisfactorily at the low temperatures at which hydrazine is used.

c) Hydrazine chemical reaction with the demineralizer resin could result in release of chlorides.

d) If high O_2 levels in the RCS warrant hydrazine addition, a potential source may be the demineralizer and therefore it should be off-service.

6.22 Select the CORRECT statement concerning the Nuclear Services Booster Pumps and the CRD Cooling System. (1.0)

a) One pump is normally operated with the other serving as backup. A drop in line flow (<100 gpm) will start the idle pump.

b) On an ES signal, the supply and return valves will close and the booster pumps will have to be manually secured.

c) SWP-2A is powered form ES MCC 3A2 and SWP-2B is powered from ES MCC 3B2.

d) Maximum allowable temperature of the cooling water is 120° F; there are no limits on minimum temperature.

6.23 With regard to overspeed protection of the main turbine, select the one CORRECT statement: (1.0)

a) There is a mechanical overspeed trip at 103% and a backup electrical overspeed trip at 111%.

b) With the Overspeed Protection Control (O.P.C.) switch in the "Test" position, the electrical overspeed trip is bypassed.

c) At approximately 103% shaft speed only the governor and intercept valves will close, while at 111% speed, all four sets of valves will close.

d) In the "Overspeed Test" position on the O.P.C. switch, only the Reheat and intercept valves close.

(Section 6.0 Continued on Next Page)

6.24 When conducting a plant cooldown, several operations are required to prevent inadvertent ES actuation. Which of the following statements is TRUE during a plant cooldown? (1.0)

a) When RC pressure is reduced to 1800 psi, the HPI white bypass permit lights will come on.

b) If HPI was properly bypassed, the 1500 psi bistable tripped lights will not come on when pressure is reduced below this value.

c) When RC pressure reaches 900 psi, the LPI white bypass permit lights will come on allowing the operator to bypass LPI and RB spray.

d) When each channel was bypassed, its respective amber channel bypassed light would have come on, and the green channel function enabled lights and the green bypass/reset lights would have gone out.

6.25 If all three makeup pumps are expected to be running following an ES actuation and the pumps are powered from the ES busses as shown below, where should the selector switches be positioned?

MUP A running, powered from ES Bus "A"
MUP B standby, powered from ES Bus "A"
MUP C standby, powered from ES Bus "B"

1) A-B selector switch in _?_. (0.5)

2) B-C selector switch in _?_. (0.5)

NOTE: For 1) and 2) above, write the appropriate letter "A", "B", or "C" on your answer sheet.

(End of Section 6.0)

7.0 Procedures - Normal, Abnormal, Emergency, and Radiological Control (25 Points)

7.1 Reactor Coolant Pumps have been lost because of a loss of off-site power. Plant control is being maintained in accordance with the Natural Circulation procedure, AP-530. According to AP-530, which of the following is CORRECT regarding OTSG level control? (1.0)

a) If less than 2 HPI pumps are available, then OTSG levels should be established at 50%.

b) If PZR level is less than 50" then DO NOT exceed an OTSG level of 50%.

c) If subcooling margin is 25° F and RCS pressure is >1500 psig. then maintain OTSG level at 50%.

d) If operating range level indication is lost on one OTSG, then mairtain level in the other OTSG at 95% until RCS flow is re-established.

7.2 Prior to reaching 200° F RCS temperature during a heatup, a vacuum is drawn on the OTSGs. This is done: (1.0)

a) because there is danger of oxygen pitting of the OTSG tubes during heatup; therefore all air must be removed from the OTSG.

b) to ensure that all nitrogen is removed from the OTSG prior to reaching 212° F.

c) to promote early boiling of the OTSG water inventory; therefore, promoting even heating of the OTSG shell.

d) to minimize the possibility of water hammer.

7.3 Three of the four items below must be completed prior to entering Mode 4 from Mode 5. According to the Heatup procedure (OP-202), which item need NOT be completed prior to entering Mode 4? (1.0)

a) Containment integrity must be established.

b) OTSG levels must be reduced to $\leq$ 350 in.

c) Degasification must be complete.

d) The DH system should be shutdown.

(Section 7.0 Continued on Next Page)

7.4 Which of the following conditions is a procedural requirement for manually tripping the reactor? (1.0)

a) Emergency Feedwater actuates.

b) Subcooling margin drops below 50° F during power operation.

c) Shutdown margin is determined to be less than 1.0% Delta K/K.

d) Feedwater flow is lost.

7.5 If one MSIV drifts shut, according to the Power Operations procedure (OP-204), what is the proper response? (1.0)

a) Trip the reactor.

b) Manually reduce power to 60%.

c) Shut one MSIV on the other side to balance OTSG steam loads.

d) Manually open the MSIV.

7.6 Should a Xenon oscillation start, according to the Power Operation procedure (OP-204), it is best to: (1.0)

a) increase or decrease power by 10% to 15% as soon as the oscillation is diagnosed.

b) immediately determine the oscillation period and make rod position corrections 1 to 2 hours after the peak deviation.

c) determine the oscillation period over a 2 to 3 day duration and then make rod position corrections 1 to 2 hours before the peak deviation.

d) adjust the axial power shaping rods frequently to maintain imbalance between 0% and -10%.

(Section 7.0 Continued on Next Page)

7.7 According to the RCP Operation procedure (OP-302), which of the following statements is TRUE? (1.0)

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.

7.8 During a Steam Generator Tube Rupture (EP-390), which of the following does NOT require the use of the emergency cooldown limits? (1.0)

a) The main condenser is not available.

b) HPI is required to maintain PZR level.

c) The affected OTSG cannot be identified.

d) RCPs are not operating.

7.9 Thermoluminescent dosimeters should be re-zeroed prior to reaching: (1.0)

a) 100% of full scale.

b) 90% of full scale.

c) 75% of full scale.

d) 50% of full scale.

7.10 The background reading on a frisker used for whole body frisking should be no more than: (1.0)

a) 10 cpm

b) 50 cpm

c) 100 cpm

d) 300 cpm.

(Section 7.0 Continued on Next Page)

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7.11 During fuel or core internals handling operations at elevations above the seal plate, you must keep a careful watch over the level in the refueling canal. Upon recognition of an uncontrolled decrease in refueling canal water level, components being handled should be positioned: ~~(1.0)~~

a) to maintain at least 5 feet of water shielding.

b) to the level of the seal plate.

c) in a minimum of 4 feet below the seal plate.

d) as is, since you are required to immediately evacuate the RB.

7.12 During refueling operations, if problems occur within the Control Rod mast that will not allow the Control Rod to be fully withdrawn, ANSWER the following TRUE or FALSE:

a) There is a special grapple release tool that can be used to disengage the control rod grapple. (0.5)

b) A control rod (or burnable poison rod) shall not be released if it is more than the maximum of one foot up from full insertion. (0.5)

7.13 Seating of fuel assemblies has been a generic problem at Crystal River Unit 3. According to the Fuel Handling Equipment Operations procedure (FP-601), ANSWER the following TRUE or FALSE concerning the proper action to take if fuel assembly hang-up is experienced at the spacer grid level?

a) Rotate the fuel assembly and attempt to seat it again. (0.5)

b) Reverse the motion of the assembly until the underload or overload is relieved, then shake the cable supporting the fuel assembly. (0.5)

7.14 List all of the Immediate Actions for a Reactor Protection System Actuation, (AP-580). (Do NOT include Remedial Actions) (3.0)

7.15 The first Immediate Action of EP-290, "Inadequate Core Cooling" is to ensure full HPI flow. List the Remedial Actions associated with this step. (1.0)

7.16 List all of the Immediate Actions for an Engineered Safeguards System actuation, (AP-380). (Do NOT include Remedial Actions) (3.0)

(Section 7.0 Continued on Next Page)

7.17 List all of your Immediate and Remedial Actions for EP- 140, "Emergency Reactivity Control". (2.0)

7.18 Which of the following is NOT an immediate action for AP-542, "Asymmetric Rod Runback"? (1.0)

a) Ensure NI power decreasing.

b) Clear the asymmetric condition.

c) Ensure turbine runback.

d) Ensure RC Pressure stable.

7.19 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. (0.5)

b) The "Operator at the Controls" is responsible for verification of the radiation monitor setpoints as they are specified on the release permit. (0.5)

c) If meteorological conditions show a delta temperature of zero or positive, you are not allowed to proceed with a gaseous release. (0.5)

d) If the flowrate monitor is inoperable, Technical Specifications allow continuing the gaseous release (assuming the action statement IS met). (0.5)

(End of Section 7.0)

8.0 Administrative Procedures, Conditions, and Limitations (25 Points)

8.1 Which of the following four situations causes entry of a technical specification action statement requiring action to be initiated within one hour? (1.0)

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a) One air lock door exceeds the technical specification limit for leakage (0.05 L_a at P_a).

b) The containment average temperature is greater, by just a few degrees, than its technical specification limit (130° F).

c) The letdown isolation valve, MUV-49, is temporarily inoperable. MUV-49 is one of the containment isolation valves listed in Table 3.6-1 of STS 3.6.3.1.

d) One containment cooling unit is found to be inoperable.

8.2 During power operation, according to the Power Operation procedure (OP-204), the Chem Rad department must be notified whenever power is changed __?__ in any __?__ period: (1.0)

a) 15%, 1 hr

b) 50%, 2 hr

c) 15%, 2 hr

d) 50%, 6 hr

8.3 The operability of the Main Steam Code Safeties is addressed in the technical specifications, STS 3.7.1.1. Which of the following most accurately reflects the requirements for Main Steam Code Safety operability? (1.0)

a) All must be operable for continued operation.

b) Up to four may be inoperable, provided that the atmospheric dump valves and the turbine bypass valves are operable.

c) Up to three may be inoperable, provided RPS setpoints are lowered appropriately.

d) Up to five may be inoperable provided power is reduced by 14% for each inoperable valve.

(Section 8.0 Continued on Next Page)

8.4 Which of the following is limited to ensure that "Power Peaking" limits are maintained: (1.0)

a) Control rod speed

b) Axial power imbalance

c) RCS pressure

d) RCS flow

8.5 The fuel pin compression limit: (1.0)

a) is more restrictive with forced RCS flow than with natural circulation.

b) is more restrictive with no RCPs running than with 2 RCPs running.

c) is the same regardless of the number of running RCPs.

d) is only applicable during RCS heatup.

8.6 According to the OSIM, the equipment out of service log is required to be updated and maintained when the plant is in: (1.0)

a) modes 1 and 2 only.

b) modes 1,2,and 3 only.

c) modes 1,2,3 and 4 only.

d) All Modes of Operation.

8.7 All short-term instructions shall automatically expire after ___?___ if not previously cancelled. (1.0)

a) one week

b) one month

c) 90 days

d) 6 months.

(Section 8.0 Continued on Next Page)

8.8 According to the OSIM, in the interim between a trip and the approval for recovery, the Nuclear Shift Supervisor: (1.0)

a) must ensure that the SCRAM breakers remain open.

b) may authorize the withdrawal of all four Safety Groups provided that a 1% Delta K/K shutdown margin is maintained.

c) may authorize the withdrawal of Safety Group 1 provided that a 1% Delta K/K shutdown margin is maintained.

d) may take the reactor critical, holding at 10^{-8} amps.

8.9 According the OSIM, if two makeup pumps become inoperable: (1.0)

a) the time for obtaining operability of one more pump may be extended beyond the 72 hours allowed by Technical Specifications.

b) one additional MUP should be made operable within 8 hours, or a plant shutdown should begin.

c) operation may continue, but only if the "C" MUP is the operable pump, and its cooling water is supplied from both the NSCCCS and the DHCCCS.

d) operation may continue, not to exceed Technical Specification requirements, but consideration will be given to reducing power.

8.10 The Fire Brigade is composed of: (1.0)

a) two operations personnel, two maintenance personnel, and one security guard.

b) three operations personnel, a team leader, and two maintenance personnel.

c) three operations personnel, including the team leader and two maintenance personnel

d) three maintenance personnel, three operations personnel, and two security guards.

(Section 8.0 Continued on Next Page)

8.11 According to the OSIM, during an emergency, when is it permissible to use the PORV to prevent a high pressure trip? (1.0)

a) It is never permissible to use the PORV for this purpose.

b) When subcooling margin is $\geq$ 60° F.

c) When the block valve is operable, and a "dedicated operator" is used.

d) When the cause of the high pressure has been determined to be an under cooling event.

8.12 According to the OSIM, which of the following must be used for proper tracking of "special valve line-ups"? (1.0)

a) Placing an entry in the Operator's Log.

b) Listing on the shift relief check list.

c) Placing an entry in the Shift Supervisors Log.

d) Making a temporary procedure change.

8.13 Which of the following is <u>NOT</u> listed as an OSIM requirement for removing a decay heat train from service? (1.0)

a) Only one decay heat train may be removed from service at any one time.

b) Total decay heat load should be less than 25 MW.

c) The requirements of CP-115, In-Plant Clearance and Switching Orders, must be met.

d) The refueling transfer canal is flooded or one OTSG is available for heat removal.

8.14 What is the <u>HIGHEST</u> level of approval necessary prior to performing maintenance on systems that could trip the unit (as specified in the OSIM)? (1.0)

a) Nuclear Operator

b) Assistant Shift Supervisor

c) Nuclear Shift Supervisor

d) Operations Superintendent or person on-call

(Section 8.0 Continued on Next Page)

8.15 While conducting a cooldown in Mode 5, if both diesel generators become inoperable: (1.0)

a) no Technical Specification action statement is entered.

b) Technical Specifications require that immediate actions should be taken to establish Mode 6.

c) Technical Specification requires that positive reactivity changes be stopped.

d) Technical Specifications requires that OTSGs must remain operable as a means of heat removal.

8.16 Which of the following Technical Specification action statements require some action to be taken within one hour? (1.0)

a) Primary containment internal pressure exceeds the Technical Specification limit.

b) Two control rods are fully inserted and inoperable.

c) One APSR becomes inoperable.

d) One Reactor Coolant Pump becomes inoperable while in Mode 1.

8.17 Which of the following MAY proceed given that a Technical Specification action statement has been entered requiring you to "suspend all CORE ALTERATIONS"? (1.0)

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 $\leq$ .95.

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

(Section 8.0 Continued on Next Page)

8.18 According to the Defueling and Refueling procedure (FP-203), boration of the RCS is to begin immediately if: (1.0)

a) there is a perceptible increase in the audible countrate.

b) countrate on one neutron monitor doubles with no core geometry change.

c) countrate on more than one neutron monitor doubles with no core geometry change.

d) countrate on any two indicators shows a perceptible increase with no geometry change.

8.19 According to the Site Emergency Plan, the NRC must be notified of the declaration of a General Emergency within what time limit? (1.0)

a) 15 minutes

b) 30 minutes

c) 1 hour

d) 90 minutes

8.20 The Crystal River STS has an action statement which states, in part, "whenever the point defined by the combination of Reactor Coolant System flow, Axial Power Imbalance and Thermal Power has exceeded the appropriate safety limit,__________." Which one of the following CORRECTLY completes this action statement? (1.0)

a) be in Hot Standby within one hour.

b) be in Hot Standby within 15 minutes.

c) reduce thermal power within its limit within one hour.

d) reduce the thermal power within its limit within 15 minites.

8.21 Which of the following are NOT considered "CORE ALTERATIONS" by Technical Specifications? (1.0)

a) Movement of core internals

b) Removal of reactor vessel head

c) Exercising the internals vent valves

d) Replacement of surveillance capsules.

(Section 8.0 Continued on Next Page)

8.22 According to Technical Specifications, what is the DIFFERENCE between a high radiation area with levels of 800 mrem/hr, as opposed to one with levels of 1200 mrem/hr? (1.0)

a) The 1200 mrem/hr area requires that a staff member entering have an accompanying HP representative, the 800 mrem/hr area does not.

b) The 1200 mrem/hr area requires that a staff member entering take an audible dosimeter, the 800 mrem/hr area does not.

c) The 1200 mrem/hr area requires key-locked doors to prevent unauthorized entry, the 800 mrem/hr area does not.

d) The 1200 mrem/hr area requires posting as an "Extremely High Radiation Area", the 800 mrem/hr area does not.

8.23 ANSWER the following TRUE or FALSE:

a) The Emergency Coordinator shall not delegate the responsibility for decisions related to, emergency classification, notification, and/or protective action recommendations. (0.5)

b) At the time that the EOF is manned and operational, the EOF director will assume responsibility for emergency classification, notifications, and protective action recommendation. (0.5)

c) The TSC and OSC must be activated for all emergency action levels except an Unusual Event. (0.5)

d) The Site Director, Nuclear Plant Manager, or their designated altenatives are the only individuals who may relieve the Nuclear Shift Supervisor as Emergency Coordinator. (0.5)

8.24 According to the Technical Specifications, while operating in modes 1 through 3, the maximum level allowed in the OTSGs is: (1.0)

a) 83% on the Operating Range

b) 87% on the Operating Range

c) 96% on the Operating Range

d) 98% on the Operating Range

(End of Section 8.0)

(END OF EXAMINATION)

MASTER

CRYSTAL RIVER-3

Answer Key, Section 5.0

5.1 d)	Ref:	SECY 82-475 Lesson on EP-260, EP-290 Fundamentals of National Circulation
delete 5.2 d)	Ref:	Curve 1.5B, Curve Book
5.3 a)	Ref: ICS	Curve 1.6, Curve Book Analog and Digitals
5.4 a)	Ref:	OP-203 Rev. 43, Page 20
5.5 c)	Ref:	SP-0312, STM-420
5.6 b)	Ref:	Lesson No. RQ-84-7E Recognition/Mitigation of Degraded Core
5.7 a)	Zr - H_2O CFTs Pzr Fuel	420,000 26,000 140 1,130
	Ref:	Fundamentals of Natural Circulation
5.8 c)	Ref:	VP 580 Rev. 0-2, Page 19
5.9 b)	Ref:	STS Page B 2-6
5.10 a)	Ref:	NUS Module 3 Sect. 10.3
5.11 c)	Ref:	CR Study Guide Page 2
5.12 c)	Ref:	NUS Module 3 Sect. 5
5.13 c)	Ref:	NUS Module 2 Sec. 16.5 NUS Module 3 Sec. 8.4
5.14 c)	Ref:	NUS Module 3, Sec. 10.5
delete 5.15 a)	Ref:	STM 419 Page 30
5.16 d)	Ref:	AP-530, Page 4
5.17 a)	Ref:	Plant Curve Book, Curve 3.2A
5.18 b)	Ref:	CR Training Ltr TRA 85-0013
5.19 d)	Ref:	STM-15-1

5.20 c) Ref: Any Mollier Diagram or Steam Tables

5.21 c) Ref: ICS Analog and Digitals

5.22 b) Ref: CR Training Ltr TRA 85-0013

5.23 c) Ref: Duke Power Company, FNRE

5.24 Low RCS Pressure
High RCS Pressure
RCS Outlet Temp - High
Variable Pressure - Temperature Trip

Ref: TS Figure 2.1-1

CRYSTAL RIVER-3

Answer Key Section 6.0

6.1 c)	Ref:	OP-202 Rev. 56, Page 22, 3 FP-302-661, Sheet 3 of 4
deleted ~~6.3 c)~~	~~Ref:~~	~~STM Vol. 2, Section 12, Page 16~~ ~~OP-204 Rev. 38, Page 11~~
6.2 c)	Ref:	OP-203 Rev. 43, Page 3
6.4 ~~d~~ a	Ref:	Main Steam, Page 3, 8
6.5 b)	Ref:	Main Steam, Page 78
6.6 d)	Ref:	ICS Analog and Digitals, Page 6
delete 6.7 b)	Ref:	Handout - Failure of both diesel generators to start, Page 3
6.8 d)	Ref:	CR Transient Assessment
6.9 d)	Ref:	CR-3 RPS Handout, Figure 2
6.10 b)	Ref:	CR-3 RPS, Page 8, Figure 2
6.11 a)	Ref:	CR-3 RPS, Page 14
6.12 a)	Ref:	NNI/ICS Power Supplies Handout
6.13 a) or d)	Ref:	OP-605 Rev. 30, Page 29
6.14 b)	Ref:	TS B 3/4 7-2
6.15 c)	Ref:	CR SLRM Handout, Page 6
6.16 b)	Ref:	OP-504, Page 8, 5.2.2.8
6.17 a)	Ref:	STM-22, Page 22-25
6.18 c)	Ref:	CR Training Letter TRA 85-0013
6.19 b) or c)	Ref:	STM-15, Page 6, 35
6.20 c)	Ref:	STM-4, Page 8
6.21 c)	Ref:	OP-403, Sec. 4.7.10, Page 4
6.22 b)	Ref:	STM 23-7 and OP-502, Page 3

6.23 c)	Ref:	STM-28-6/8
6.24 d)	Ref:	STM 11-24
6.25 1) B	Ref:	STGM 17-14 .5
2) C		STM 17-14 .5

CRYSTAL RIVER-3

Answer Key Section 7.0

7.1 c)	Ref: AP-530
7.2 c)	Ref: OP-202, Rev. 56, Page 23
7.3 c)	Ref: OP-202 and TS 3.6.1.1, Pages 3/4 6-1
7.4 d)	Ref: OP-204, Rev. 38, Page 7
7.5 b)	Ref: OP-204, Rev. 38, Page 7
7.6 c)	Ref: OP-204, Rev. 38, Page 18
7.7 b)	Ref: OP-302
7.8 c)	Ref: EP-390, Page 5, 7
7.9 c)	Ref: RP-101, Rev. 20, Page 17
7.10 c)	Ref: RP-101, Rev. 20, Page 23
delete 7.11 c)	Ref: FP-203, Rev. 12, Page 8
7.12 a-T b-T	Ref: FP-601, Rev. 19, Page 52 .5 .5
7.13 a-F b-T	Ref: FP-601, Rev. 19, Page 28 .5 .5
7.14 - 7.17	Ref: Attached Procedures
7.18 b)	Ref: AP-542 1.0
7.19 a-T b-F c-F d-T	Ref: OP-412, Page 3-10, 18 .5 .5 .5 .5

REACTOR PROTECTION SYSTEM ACTUATION

ENTRY

SYMPTOMS	CONDITIONS*
Annunciator alarms associated with reactor protection system actuation: 1) Automatic or 2) Manual.	• Plant parameter(s) has exceeded a Limited Safety System Setting on 2 out of 4 channels (nominal). • Anticipitory Reactor Trip System exceeded setpoint on 2 out of 4 channels (nominal). • Manual reactor trip.

*THIS PROCEDURE ADDRESSES SAFETY RELATED COMPONENTS

...d By PRC J.R. Kerr Date 05-25-84 Mtg.# 84-21
...d By NPM R.J. McRa Date 6/18/84

ACTIONS

IMMEDIATE	REMEDIAL
1. Ensure GRP 1-7 rods inserted: • Depress "Reactor Trip" pushbutton • Observe "TRIP CONF" light lit on diamond panel.	1. Open 480V BKRs - 3305 - 3312. 2. Start boration: a. Open BWST suction b. Start 2nd MUP c. Open MUV-24 d. Establish letdown path to RCBTs.
2. Ensure main turbine TVs and GVs fully closed.	1. Close MSIVs. 2. Select "ATMOS"on "TURB. BYPASS VLV" switch.
3. Ensure main block valves closed.	1. Trip both MFPs. 2. Refer to AP-450, Emergency Feedwater Actuation.
4. Ensure low load block valves closed.	1. Trip both MFPs. 2. Refer to AP-450, Emergency Feedwater Actuation.

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
•	
5. Ensure PZR level ≥ 50".	1. Open suction from BWST. 2. Start 2nd MUP. 3. Open MUV-24. 4. Close MUV-51.
6. Close MUV-51, Letdown Block Orifice Bypass.	Close MUV-49, Letdown Containment Isolation.
7. Ensure STM HDR PRESS controlling at 1010 PSIG.	Manually control STM HDR PRESS at 1010 PSIG using: • HDR PRESS controller OR • Turbine Bypass Valves in "HAND" OR • Atmospheric Dump Valves in "HAND".

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
8. Ensure GEN output BKRs open: • BKR 1661 • BKR 1662.	

INADEQUATE CORE COOLING

ENTRY

SYMPTOMS	CONDITIONS
...g Margin Monitor ...core thermocouples	Loss of heat transfer from core.

PROCEDURE ADDRESSES SAFETY RELATED COMPONENTS

Document Section
INFORMATION ONLY

...By PRC W.W. [illegible] Date 09-20-84 Mtg.# 84-36

...By NPM R.J. McGee Date 10/10/84

ACTIONS

IMMEDIATE	REMEDIAL
1. Ensure full HPI flow.	Ensure: a. 2 HPI pumps are running. b. Open: o MUV-23 o MUV-25 o MUV-24 o MUV-26. c. HPI flow is ≥ 500 GPM total flow.
2. IF LPI is delivering flow, THEN maintain maximum LPI flow.	Ensure: o 2 LPI pumps are running. o Open: - DHV-5 - DHV-6.
3. Ensure OTSGs are at 95% on the operating range.	a. Select "CLOSE" on: o FWV-34 o FWV-162 o FWV-35 o FWV-161. b. Trip both MFPs. c. Ensure both EFPs start. d. Slowly raise OTSG levels to 95% using: o FWV-162 (A-OTSG) o FWV-161 (B-OTSG)

1.0 Inadequate Core Cooling

FOLLOW-UP

ACTIONS	DETAILS
1.1 Ensure CFT isolation valves are open.	Open: o CFV-5 o CFV-6.
1.2 Lower and maintain OTSG TSAT 90-110°F less than TSAT for the existing RC pressure.	o Lower and maintain OTSG pressure using: - TBVs - ADVs. o Determine TSAT for existing RC PRESS <u>AND</u> required OTSG PRESS. o Refer to saturated steam tables.

ENGINEERED SAFEGUARDS SYSTEM ACTUATION

ENTRY

SYMPTOMS	CONDITIONS
1. Annunciator alarms associated with Engineered Safeguards Systems Actuation: o Automatic o Manual.	o RC PRESS has exceeded ESFAS trip setpoint on 2 of 3 channels. o RB PRESS has exceeded ESFAS trip setpoint on 2 of 3 channels. o Manual Engineered Safeguard System Actuation. o Loss of Coolant Accident.
2. ES status lights indicating actuation: o HPI, RC PRESS < 1500 PSIG o LPI, RC PRESS < 500 PSIG o RB Isolation and Cooling, RB PRESS > 4 PSIG o RB Spray, RB PRESS > 30 PSIG.	

Reviewed By PRC JRKr Date 09-20-84 Mtg.# 84-36

Approved By NPM P.J. McKee Date 10/18/84

ENTRY (Cont'd)

SYMPTOMS	CONDITIONS
3. Subcooling meter or monitor indicating:	

RC PRESSURE	SUBCOOLING MARGIN
PSIG	°F
> 1500	< 20
≤ 1500	< 50

ACTIONS

IMMEDIATE	REMEDIAL
1. IF RC PRESS < 1500 PSIG, THEN depress "HPI Actuation" Pushbutton "A" AND "B".	1. Bypass ES actuation. 2. Return ES equipment to STBY status. 3. Go to VP-580.
2. Trip all RCPs.	Open affected 6900V BKRs: o 3101 o 3102 o 3103 o 3104.
3. Ensure HPI trains start: o 2 HPI pumps o SWPs o RWPs.	Notify AB operator to start affected pump(s) at 4160V ES switchgear.
4. Ensure BWST suction valves open: o MUV-58 o MUV-73.	Notify AB operator to open affected valve(s) locally.
5. Ensure HPI valves open: o MUV-23 o MUV-24 o MUV-25 o MUV-26.	Notify AB operator to open affected valve(s) locally.

ACTIONS (Cont'd)

IMMEDIATE	REMEDIAL
6. Ensure LPI trains start: o DHPs o DCPs o RWPs.	Notify AB operator to start affected pump(s) at switchgear: o 4160V ES o 480V ES o 4160V ES.
7. Ensure EDGs start.	Notify AB operator to start affected diesel locally.
8. Ensure diverse containment isolation actuation.	
9. Place RB sump pump in "PULL-TO-LOCK": o WDP-2A o WDP-2B.	Notify AB operator to open affected BKG at MCC: o Reactor 3A2 o Reactor 3B2.

ACTIONS

IMMEDIATE

Start emergency boration:

- Establish letdown flow to MUT $\geq$ 40 GPM
- Open CAV-60
- Start Boric Acid Pump
  - CAP-3A

  OR

  - CAP-3B.

REMEDIAL

1. Adjust batch controller to 1000 GAL.
2. Select RCBT with highest boron concentration.
3. Establish flow to MUT.
4. Open CAV-57.
5. Start Boric Acid Pump:
   - CAP-3A

   OR

   - CAP-3B.

CRYSTAL RIVER-3

Answer Key Section 8.0

delete 8.1 a)	Ref:	Tech Specs 3.6.1.3, 1.5, 2.3, 3.1
8.2 a)	Ref:	OP-204 Rev. 38, Page 8
8.3 c)	Ref:	Main Steam Handout, Page 27 Tech Specs 3.7.1.1 Page 3/4 7-1
8.4 b)	Ref:	Tech Specs Page B 2-2 Requal Cycle 2, 1984, J. P. Haerle
8.5 b)	Ref:	EP-390 Encl 1 Page 11
8.6 c)	Ref:	OSIM I III-9
8.7 c)	Ref:	OSIM I III-10
8.8 c)	Ref:	OSIM I IV-2
8.9 d)	Ref:	OSIM Gen 04 V-3 Policy Statement 84-1
8.10 c)	Ref:	OSIM V-21
8.11 c)	Ref:	OSIM V-22
8.12 d)	Ref:	OSIM V-2
8.13 b)	Ref:	OSIM VI-2
8.14 d)	Ref:	OSIM VI-3
8.15 c)	Ref:	Tech Specs STS 3.8.1.2 Page 3/4 8-6
8.16 a)	Ref:	Ref: STS 3.6.1.4, 3.1.3.1, 3.1.3.2, 3.4.1
8.17 d)	Ref:	FP-203, Page 18
8.18 c)	Ref:	FP-203 Rev. 12, Page 13
8.19 c)	Ref:	EM-207, Page 6
8.20 a)	Ref:	STS 2.1.2, Page 2-1
8.21 c)	Ref:	TS insert, CR, 4/1/83 Refueling
8.22 c)	Ref:	TS 6-19
8.23 a-T b-F c-T d-F	Ref:	EM-202 .5 .5 .5 .5

8.24 c) Ref: Tech Specs 3.4.5, Page 3/4 4-6
Figure 3.4-5

EQUATION SHEET

Where $\dot{m}_1 = \dot{m}_2$

$(\text{density})_1(\text{velocity})_1(\text{area})_1 = (\text{density})_2(\text{velocity})_2(\text{area})_2$

$KE = \frac{mv^2}{2}$ $PE = mgh$ $PE_1+KE_1+P_1V_1 = PE_2+KE_2+P_2V_2$ where V = specific volume
P = Pressure

$Q = \dot{m}c_p(T_{out}-T_{in})$ $Q = UA\ (T_{ave}-T_{stm})$ $Q = \dot{m}(h_1-h_2)$

$P = P_0 10^{sur(t)}$ $P = P_0 e^{t/T}$ $SUR = \frac{26.06}{T}$

$\text{delta } K = (K_{eff}-1)/K_{eff}$ $CR_1(1-K_{eff1}) = CR_2(1-K_{eff2})$

$M = \frac{(1-K_{eff1})}{(1-K_{eff2})}$ $SDM = \frac{(1-K_{eff}) \times 100\%}{K_{eff}}$

$\text{decay constant} = \frac{\ln(2)}{t_{1/2}} = \frac{0.693}{t_{1/2}}$ $A = A_0 e^{-(\text{decay constant})x(t)}$

<u>Water Parameters</u>

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

<u>Miscellaneous Conversions</u>

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 inch = 2.54 centimeters
Degrees F = (1.8) x (Degrees C) + 32
1 Btu = 778 ft-lbf
g = 32.174 $ft\text{-}lbm/lbf\text{-}sec^2$