UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

ENCLOSURE 1

EXAMINATION REPORT - 50-302/OL-85-03

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, Florida.

Chief Examiner: Sandy Lawyer — 7/30/85
Sandy Lawyer — Date Signed

Approved by: Bruce A. Wilson — 7/30/85
Bruce A. Wilson, Section Chief — Date Signed

Summary:

Requalification examinations on July 9 - 11, 1985

Written requalification examinations were administered to eight SROs and nine ROs; oral requalification examinations were administered to seven SROs and seven ROs; four of the SROs and six of the ROs passed these examinations.

This was the last of two scheduled re-examinations following the March 1985 Requalification Program evaluation conducted by the NRC. Oral examinations were waived for those three individuals who passed this phase of the requalification examinations in March.

The performance on this portion of the requalification examinations (58.8% pass rate) and on the May and July examinations combined (71.0% pass rate) is an indication that corrective actions applied to the Crystal River requalification training program have not been fully effective. Corrective measures to resolve this deficiency will be defined in separate correspondence.

REPORT DETAILS

1. Facility Employees Contacted

J. Alberdi, Manager-Site Nuclear Operations Technical Services (E)
P. F. McKee, Plant Manager (E)
E. M. Howard, Director, Site Nuclear Operations (E)
T. A. Kamann, Nuclear Operations Records Manager (E)
W. P. Ellsberry, Nuclear Operations Technical Training Supervisor (E)
J. L. Bufe, Nuclear Compliance Specialist (E)
R. Wittman, Operations Superintendent (E)
G. Boldt, Nuclear Plant Operations Manager (R/E)
L. C. Kelley, Nuclear Operations Training Manager (E)
M. P. Holmes, Nuclear Operations Instructor (R/E)
M. F. Penovich, Nuclear Operations Training Supervisor (E)
J. L. Springer, Nuclear Operations Instructor (R)
R. C. Zareck, Nuclear Operations Instructor (R)

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

2. NRC Personnel

B. A. Wilson, NRC, Region II
D. P. Falconer, Jr., NRC - Region II Inspector
T. F. Stetka, NRC - SRI
*S. Lawyer, NRC, Region II
J. C. Huenefeld, PNL
B. Gore, 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. RO Examination

(1) Question 1.19

Facility Comment: Choice (a) should be considered as an acceptable answer since Axial Power Imbalance is DNB related per Tech Spec bases.

NRC Resolution: Agree. This is confirmed on Tech Spec page B.2-5. Answer key changed to accept both (d) and (a).

(2) Question 1.23

Facility Comment: Part (c), acceptable answer should be three pump operation vice three and four pump operation.

NRC Resolution: Agree: Intent is the same, i.e., power level is restricted with only three RCPs operating.

(3) Question 2.6

Facility Comment: Choice (c) is correct instead of choice (d).

NRC Resolution: Agree. This is confirmed by reference STM 2-11.

(4) Question 2.12

Facility Comment: Answer key should reflect upper and lower oil coolers as acceptable terminology for upper thrust bearing and lower guide bearing coolers.

NRC Resolution: Agree. Any terminology consistent with the purpose of the coolers is acceptable.

(5) Question 2.18

Facility Comment: This question requires memorization of a valve which is human engineered to provide indication in Control Room to indicate to the operator that it is ES controlled.

NRC Resolution: We regard the question as pertinent for the following reasons:

1. A stated learning objective of the PASS was to "State the administrative requirements associated with the Post-Accident Sampling System."

2. The PASS Lesson Plan states that "Tech Specs require that all containment isolation valves that are not included in the ES matrix must be closed and deenergized."

   Only CAV-431 is included on the ES matrix; therefore, all other containment isolation valves in the PASS systems must be deenergized during normal operation.

3. The fact that the valve is singularly indicated in the control room as an ES valve should enable any candidate with control room familiarity to correctly answer the question.

(6) Question 2.20

Facility Comment: Knowledge asked for is trivial; requires too much memorization.

NRC Resolution: Disagree. The reference provided to the NRC, "Main Steam" system description; lists the following as the first two learning objectives:

1. Will be able to draw a one-line diagram of the Main Steam System, indicating all major flow paths, major valves and numbers.

2. Will be able to explain the primary and secondary function.

We consider the question, which asked to identify the steam supply lines to each of five major components, to fall within these two objectives.

(7) Question 2.21

Facility Comment: Answer (c) is not fully correct. Trip condition for MFP is suction valve <60% open instead of not full open. Choice (b) should be acceptable since it will ultimately result in a trip of both main FW and booster pumps.

NRC Resolution: Accept both answers (b) and (c). Choice (b) is supported by reference STM-27-72.

(8) Question 2.24

Facility Comment: A more correct answer may be found in AP-380.

NRC Resolution: A complete answer required the following three sets of valves:

1. DHV-11 and 12
2. DHV-34 and 35
3. DHV-42 and 43

Since the question asked for six valves (instead of three pairs of valves), any listed in addition to the above were not graded as incorrect.

(9) Question 3.5

Facility Comment: Choice (b) is also correct since actuation of the steam line rupture matrix will shut the MFW Pump Suction Valves which, in turn, will trip both main feedwater pumps. On reset, the crossover valve FWV-28 will auto open if either or both MFW pumps are tripped.

NRC Resolution: Agree. This was confirmed by references "Main Steam Rupture Matrix" and STM 27-56.

(10) Question 3.11

Facility Comment: Gain adjustment of power range channels is an I&C function, not a licensed operator function.

NRC Resolution: Granted, however, it is a function that licensed personnel must be familiar with. No change to question or answer key.

(11) Question 3.14

Facility Comment: Answer (c) is correct for 6.9 KV buses, but not for 4.16 KV buses; their breaker operation occurs within 30 cycles. Recommend answer (d) also be accepted or question deleted.

NRC Resolution: Elementary diagram B-208-040 provided to support facility comment. Answers (c) and (d) accepted.

(12) Question 3.18

Facility Comment: All choices except (b) are correct. Elementary diagram B-208-027 provided to support comment.

NRC Resolution: Comment accepted. System Description was vaguely worded and misinterpreted by examiner. Since three choices were correct, question was deleted.

(13) Question 3.22

Facility Comment: The two answers on answer key are incorrect and the following answers should be accepted:

Wide Range T_c (cold leg)
DH-Hx Outlet Temp.

NRC Resolution: Surveillance Procedure, SP-422 verifies the above comment. Answer key changed to reflect the above answers. Incore thermocouples was also accepted as a correct response since it will provide an RCS temperature indication even though not required by SP-422.

(14) Question 4.1

Facility Comment: Since the correct answer to Part (a) is NONE, that should be listed in the response column.

NRC Resolution: Verbal clarification was provided during the examination. Response column will include NONE in future examinations.

(15) Question 4.2

Facility Comment: Answer should be SDV-90 and SDP-7 instead of SOV-90 and SOP-7.

NRC Resolution: Typographical errors corrected.

(16) Question 4.5

Facility Comment: Procedure change has been initiated to correct the Remedial Actions of Step 1, AP-380.

However, answer key correctly shows the procedural action required by the current revision of AP-380.

NRC Resolution: Responses will be graded according to answer key.

(17) Question 4.8

Facility Comment: If purpose of question is to memorize steps of procedure, it is outside the bounds of required knowledge of licensed personnel. If the intent is to determine CRD system knowledge, both choices (a) and (b) are correct.

NRC Resolution: Purpose of question was to determine CRD system knowledge. Answers (a) and (b) accepted based on EHC Lesson Plan provided to support comment.

(18) Question 4.18 and 4.19

Facility Comment: Reference for both answers was RP-101. This document has been replaced by RSP-101.

NRC Resolution: New document does not change questions or answers. It is the responsibility of Crystal River to provide us with the most current reference material available.

(19) Question 4.20

Facility Comment: Licensed personnel should only be responsible for knowledge of facility administrative limits concerning radiation protection since these are more conservative than 10 CFR 20 limits.

NRC Resolution: Personnel are responsible for knowledge of legal dose limits (10 CFR 20) as well as facility administrative limits. No change to question or answer key.

b. SRO Examination

The following SRO questions were also on the RO examination which have been commented on and resolved in paragraph 3:

SRO Question	RO Question
6.6	2.12
6.9	2.18
6.11	2.21
6.12	2.24
6.17	3.5
6.19	3.14
6.20	3.18
7.1	4.1
7.2	4.2
7.4	4.5
7.19	4.18
7.20	4.19
7.21	4.20

(1) Question 5.21

Facility Comment: The reference used on the answer key was questioned.

NRC Resolution: The reference is a 1979 submittal from Crystal River which was based on the B&W generic Small Break LOCA analysis. The information contained in it is still relevant.

(2) Question 7.16

Facility Comment: Bypassing the RCP Power Monitors is no longer required. Reference, if applicable, should be OP-204 instead of OP-210.

NRC Resolution: Step 4.14 of OP-210, "Reactor Startup", Revision 16, contains the information addressed in this question. This procedure was part of reference material package supplied by Crystal River. No change to question or answer key.

(3) Question 8.22

Facility Comment: Wording of question is confusing. It is difficult to figure out what question is asking.

NRC Resolution: Question was very close to verbatim from reference. No candidate expressed any concern over the wording to the examiners during conduct of the examination. No change to question or answer key.

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.

There were no generic weaknesses noted during the oral examination. The cooperation given to the examiners was noted and appreciated. The licensee did not identify as proprietary any of the material provided to or reviewed by the examiners.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

ENCLOSURE 3

(1 of 2)

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR REQUALIFICATION EXAMINATION

Facility: Crystal River
Reactor Type: B&W 177
Date Administered: July 9, 1985
Examiner: S. Lawyer
Candidate: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for answers. Write answers on one side only. Staple question sheet on top of the answer sheets. 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 Category Value	Category
25	____	_____	_____	1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
25	____	_____	_____	2. Plant Design Including Safety and Emergency Systems
24 ~~25~~	____	_____	_____	3. Instruments and Controls
25	____	_____	_____	4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
99 ~~100~~		_____		TOTALS

Final Grade _____%

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

_____
Candidate's Signature

1.0 PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW (25.0)

1.1 When xenon is in equilibrium, the iodine formed equals the iodine lost and the xenon formed equals the xenon lost. Select the CORRECT statement concerning the xenon equilibrium balance equations. (1.0)

a. Most of the iodine formed is coming directly from fission.

b. Most of the iodine lost is a result of its neutron absorption loss.

c. Most of the xenon formed comes directly from fission.

d. Most of the xenon lost is a result of its neutron absorption loss.

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

a. Pu^{239} causing an increase in βeff.

b. Pu^{239} causing a decrease in βeff.

c. Pu^{240} causing an increase in βeff.

d. Pu^{240} causing a decrease in βeff.

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

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

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

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

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

1.4 Which one of the following factors will hinder natural circulation? (1.0)

a. Reduction of turbine bypass valve setpoint.

b. Increase in OTSG level.

c. Reduction of feedwater temperature.

d. Decrease in decay heat.

1.5 During a reactor startup, power is being raised above the point of adding heat (POAH). Which of the following statements is CORRECT? (Assume a linear reactor power increase to about 3% power) (1.0)

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

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

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

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

1.6 A general rule is often stated "doubling the count rate halves the margin to criticality." This is mathematically stated by the equation. (1.0)

$$\frac{CR1}{CR2} = \frac{1\text{-keff } 2}{1\text{-keff } 1}$$

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

a. Both keff1 and keff2 have to be less than 1.0

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

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

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

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

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

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

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

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

1.8 The reactor trips from full power, equilibrium xenon conditions. Six hours later the reactor is brought critical at 10^{-8} amps on the intermediate range. If power level is maintained at 10^{-8} amps which of the following statements is CORRECT concerning control rod motion? (1.0)

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

b. Rods will have to be inserted due to xenon decay.

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

d. Rods will approximately remain as is as the xenon establishes its equilibrium value for this power level.

1.9 Figure 6.2-3 shows a graph of pump laws i.e., the relationship between pump speed and other pump parameters. Which one of the following parameters is represented by curve 2? (1.0)

a. Power

b. Flow Rate

c. Voltage

d. Discharge Pressure

1.10 Startup of a centrifugal pump with the discharge valve shut is best characterized by which one of the following? (1.0)

a. high motor current and high discharge pressure

b. low motor current and low discharge pressure

c. low motor current and high discharge pressure

d. high motor current and low discharge pressure

1.11 Figure 43, "Surface Utilization vs Flow," represents the heat transfer process in your OTSGs. Which of the following statements is CORRECT concerning Departure from Nucleate Boiling (DNB) Ratio as it relates to this Figure? (1.0)

a. DNBR of 1.0 occurs prior to nucleate boiling and cannot be shown on this figure.

b. DNBR of 1.0 occurs between the nucleate boiling and the film boiling areas.

c. DNBR of 1.0 occurs between the film boiling and the superheat areas.

d. DNBR of 1.0 must be avoided all at costs and does not occur in the OTSGs.

1.12 With the main steam temperature and pressure at 636°F and 885 psig respectively, a main steam relief valve seat begins to leak to atmospheric pressure. The temperature of the steam three feet out of the relief valve is approximately: (1.0)

a. 636°F

b. 500°F

c. 444°F

d. 212°F

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

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

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

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

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

1.14 Given the power history shown on Figure 2 attached, select the most accurate curve displaying the expected xenon history. (1.0)

a.

b.

c.

d.

1.15 The reactor is being shutdown. A stable neutron decay rate of -78 seconds (-1/3 DPM SUR) has been established from the point at which both intermediate range channels read 5 x 10^{-8} amps. One intermediate detector is properly compensated, the other is undercompensated. Select the CORRECT statement concerning reset of the SRM high voltage bistable. (1.0)

a. The bistable will reset in about six minutes.

b. The bistable will reset in longer than six minutes due to the undercompensated detector.

c. The bistable will reset in shorter than six minutes due to the undercompensated detector.

d. The backup from the power range channels will reset the bistable in about six minutes.

1.16 An estimated critical boron concentration of 500 ppm was calculated using the information on Worksheet II (attached). Assume the reactor achieved criticality at 80% withdrawn on Group 7. How would this critical rod position change (Group 7 more inserted, more withdrawn or no change) if each of the following conditions were different from that on Worksheet II? Assume no boron change and consider each condition separately.

a. Line 2.2.a. Last power level was 50% FP for 50 hours. (.5)

b. Line 2.2.b. Time shutdown was 72 hours. (.5)

c. Line 4.a. Average RC Temperature was 532°F. (.5)

d. Line 5. Group 8 @ 0% WD. (.5)

1.17 Which one of the following statements about condenser vacuum is CORRECT? (1.0)

a. The pressure difference between the actual vacuum and absolute zero is termed condensate depression.

b. The pressure difference between the actual vacuum and MSR outlet is termed LP turbine back pressure.

c. By operating at a vacuum, the condenser permits steam at about 80°F to be exhausted from the turbine; without a vacuum, the steam would be at 212°F.

d. As condenser vacuum decreases, cycle efficiency decreases but turbine exhaust steam temperature is not affected.

1.18 The Main Steam Line Break Accident forms the basis for the Shutdown Margin requirement at End-of-Life (EOL) conditions because: (1.0)

a. Beta-effective is at its maximum value.

b. MTC is at its most negative value.

c. Control rod insertion limits are most restrictive.

d. Hot channel factors are at the most conservative values.

1.19 Which one of the following is one of the DNB related parameters that must be maintained within Tech Spec limits? (1.0)

a. axial power imbalance

b. regulating rod insertion limits

c. regulating rod group overlap

d. pressurizer pressure

1.20 The process of hydrogen generation in the reactor building after a LOCA which is controlled by the addition of caustic (NaOH) is: (1.0)

a. Radiolysis

b. Zinc-water Reaction

c. Hydrogen coming out of solution

d. Zinc-boric acid Reaction

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

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

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

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

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

1.22 Which statement best characterizes Natural Circulation? (1.0)

a. It needs a pump to get started.

b. The elevation of the heat source must be above that of the heat sink.

c. The driving force is a difference in density.

d. Heat transfer is more efficient if steam or gas is mixed with water.

1.23 Refer to Figure 2.1-2, "Reactor Core Safety Limit." Identify by name or title the parts of the Figure marked A, B, C, and D. (2.0)

END OF SECTION 1

2.0 PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS (25.0)

2.1 Which of the following statements concerning the reactor building isolation and cooling system (RBI & CS) interlocks is CORRECT? (1.0)

a. RBI and CS can be bypassed before it is actuated but only if RB pressure >2 psig.

b. Only two of the three channels of actuation are required to be bypassed by the system logic for the operator to regain control of all components actuated by the RBI & CS.

c. Once a component has been actuated to its ES position, it will remain in that position except the RB fans which can be shifted to FAST speed if required.

d. The RBI and CS actuation will override any other signal except the control signal.

2.2 Select the INCORRECT statement concerning the Chilled Water System. (1.0)

a. The system supplies low temperature water to the Control Complex Air Handlers, Post Accident Sampling Coolers, Penetration Air Handlers, and Switchgear Room.

b. The Chilled Water System pumps (CHP-1A & 1B) are powered from 480V ES MCCs.

c. The Water Chiller units can be cooled by either Nuclear Services Closed Cycle Cooling or Secondary Services Closed Cycle Cooling.

d. Under accident conditions, only the Control Complex Air Handler cooling function is required to be operable.

2.3 Select the CORRECT statement concerning the Heater Drain and Vent System. (1.0)

a. The only heater drain valves that have control switches on the Main Control Board are the high level dumps for the MSR HP flash tanks and the high level dumps for the MSR LP Flash Tanks.

b. A high level in the 1A, 1B, 2A, and/or 2B heaters will trip the main turbine.

c. All condensate and feedwater heaters have extraction steam non-return valves to prevent damage to the LP turbines.

d. When the main turbine trips, the high level dump valves on all condensate and feedwater heaters open and dump to the main condenser.

2.4 Which one of the following parameters is changed to vary condensate pump speed? (1.0)

a. Motor input voltage

b. Motor/pump coupling

c. Motor frequency

d. Motor/bus phase

2.5 The design feature of the Reactor Coolant Pumps at Crystal River which prevents exceeding the minimum DNBR limit on a total loss of AC power to the pumps is the: (1.0)

a. anti-reverse rotation device

b. flywheel

c. Kingsbury double acting thermal bearing

d. adequate RCP seal injection

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

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

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

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

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

2.7 What design feature of the ECCS limits the amount of zirconium hydride reaction under accident conditions? (1.0)

a. Limiting the temperature of the fuel.

b. Use of only zirconium oxide (no metalic zirc).

c. Eliminate hydrogen from the vicinity of the fuel clad.

d. Maintain pH basic (7.2-11.0).

2.8 Which of the following statements concerning the Core Flood (CF) system during normal plant operation is CORRECT? (1.0)

a. When increasing CFT pressure by nitrogen addition, the nitrogen heater must be energized ten minutes or more prior to establishing nitrogen flow to prevent condensation.

b. High core flood tank pressure may be relieved by venting to the Reactor Building.

c. The preferred method of decreasing the CFT water level is by draining to the RC drain tanks.

d. The CFT water level may be increased by adding from the makeup and purification (MUP) system.

2.9 The synchronizing pin and bearing in the upper portion of the rotor tube in the Control Rod Drive Mechanism (CRDM) is used to ensure... (1.0)

a. uniform rod speed over full travel

b. proper direction of rotation

c. both segment arms move together

d. correct place relationship between individual rods within a group.

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

a. Unloader valves

b. Relief valves

c. High pressure accumulators

d. Pressure switches

2.11 With regard to the Reactor Building Spray System, which one of the following statements is CORRECT? (1.0)

a. Full post-accident heat removal capability is provided by the RB Spray System and at least one RB Emergency Cooling Unit.

b. The NaOH additive lowers the pH of the borated water into the acidic range to remove airborne iodine in the RB atmosphere.

c. A single pressure-vacuum relief valve on the NaOH tank provides both overpressure and excessive vacuum protection.

d. The RB spray pumps are cooled by Nuclear Services Closed Cycle Cooling.

2.12 The Nuclear Services Closed Cycle Cooling System supplies four separate coolers on each Reactor Coolant Pump and Motor. LIST these four coolers. (1.0)

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

a. Turbine building ventilation supply fan (AHF-25A).

b. Steam generator compartment fan 3A(AHF-4A).

c. Spent fuel pool supply fan (AHF-23A).

d. Intermediate building ventilation exhaust fan (AHF-29A).

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

a. Main lube oil pump

b. Main gear oil pump

c. Backup gear oil pump

d. Backup lube oil pump

2.15 Select the CORRECT statement about the makeup and purification system radiation monitoring. (1.0)

a. Since RML-1 is upstream of the connection with the DHR system, it is inoperable when the letdown system is used in connection with the DHR system.

b. RML-1 is an ionization detector installed in the letdown line.

c. After leaving RML-1, the letdown passes through a 750 ft. delay coil to allow N^{16} to decay out.

d. The letdown flow from RML-1 re-enters the makeup system upstream of the post filters.

2.16 Which one of the following statements is CORRECT regarding the design of the emergency diesel generator air start system? (1.0)

a. There are two valves, one manual and the other remotely operated, in the interconnecting line between the two diesel air start systems.

b. The manual air shutoff valve between the air reservoirs and its starting air manifold is provided with an alarm switch which actuates whenever the valve is not fully open.

c. An air pressure low alarm (APLA) pressure switch alarms at 150 psig decreasing and auto starts the DC compressor motor.

d. The pressure switch that auto starts and stops the AC motor (at 225 psig and 250 psig respectively) does not function when the DC motor is used; the DC motor must be started and stopped manually.

2.17 The internal vent valves are installed in the core support shield to prevent a pressure imbalance following which accident? (1.0)

a. Ejected rod

b. Cold leg LOCA

c. Hot leg LOCA

d. S/G tube rupture

2.18 Four Post Accident Sampling System (PASS) containment isolation valves are circled on the attached Figure 3. Of these, all but one must be deenergized during normal operation. Which one? (1.0)

a. CAV-429

b. CAV-430

c. CAV-431

d. CAV-432

2.19 Select the CORRECT statement concerning the Diesel Generator fuel oil system. (1.0)

a. Sufficient fuel oil is stored in each unit's day tank for approximately 24 hours at name plate rating.

b. The two 30,000 gallon fuel oil storage tanks have a double valve connection between them to provide additional fuel capacity to either diesel generator unit.

c. Both fuel oil transfer pumps on each DG are DC powered to provide redundancy in case of a station blackout.

d. Care must be taken when filling the day tank from a storage tank since the day tank overflows to the waste system.

2.20 There are four main steam lines designated A-1, A-2, B-1 and B-2. For each of the following systems or steam supplies, LIST the appropriate steam line(s). (2.0)

a. Emergency Feed Pump

b. Main FW Pump 3A

c. Turbine bypass (steam to condenser)

d. Deaerator

e. Atmospheric dump valves

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

a. Overspeed

b. Low deaerator level

c. Suction valves not full open

d. Main steam line rupture matrix actuation

2.22 Which one of the following normal manual operations is NOT provided for the three fire pumps? (1.0)

a. start from control room

b. start from pump house

c. stop from control room

d. stop from pump house

2.23 Match the Engineered Safeguards channel or NI&P Channel with its appropriate color. (1.0)

a. ES Channel A or NI&P channel 1	1. Blue or black with blue stripe
b. ES Channel B or NI&P channel 2	2. Brown or black with brown stripe
c. ES Channel AB or NI&P channel 3	3. Green or black with green stripe
d. NI&P channel 4	4. Red or black with red stripe
	5. Yellow or black with yellow stripe

2.24 In the long term, following a SBLOCA, the BWST has reached its lo-lo level alarm setpoint, but RCS pressure has remained above the shutoff head of the LPI pumps. LIST the sequence of valve manipulations (by name or number) that are necessary to set up the LPI and HPI systems for continued injection into the RCS. (Six valves required.) (1.0)

END OF SECTION 2

3.0 INSTRUMENTS AND CONTROLS (25.0)

3.1 Which one of the following load limiting conditions and corresponding load limit is CORRECT for loss of one RC pump at full power? (1.0)

a. 30%/min to maximum limit of 75%.

b. 30%/min to maximum limit of 45%.

c. 50%/min to maximum limit of 75%.

d. 50%/min to maximum limit of 45%.

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

a. The station will control in either auto or manual, whichever was last selected.

b. The station will not control in either auto or manual.

c. The station will control in auto since auto overrides when both are selected.

d. The station will control in manual since manual overrides when both are selected.

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

a. The 0% switch is located 1.5 inches above the in-limit switch.

b. The 100% switch is located 1.5 inches above the out-limit switch.

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

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

3.4 Which of the following statements concerning the decay heat (DH) system suction valves, DHV-3, 4 and 41 is CORRECT? (1.0)

a. All three valves have local control pushbuttons on their respective breakers in addition to a control switch on the control room ES Panels.

b. Only DHV-3 and DHV-4 have local control pushbuttons although all three valves have control room control switches.

c. An interlock prevents opening all three valves when RC pressure is >330 psi.

d. An interlock prevents opening DHV-3 and 4 at 300 psi while DHV-41 is set for 330 psi.

3.5 Select the CORRECT statement concerning the FW Pump Discharge Crossover Valve, FWV-28. (1.0)

a. During normal full power operation, the valve is open with its control switch in AUTO position.

b. On reset of the steam line rupture matrix it will automatically open.

c. It will auto close on actuation of either steam line rupture matrix or ES channels A and B.

d. The auto open signal comes from a pressure switch on the main feedwater pump control oil pressure.

3.6 a. LIST by name or number the valves that will be isolated following actuation of the Steam Line Rupture Matrix. Consider either OTSG. (2.0)

b. What are the two conditions, either of which must be satisfied in order to reopen any of the isolated valves? (1.0)

3.7 A synchroscope moving slowly in the SLOW direction (counter-clockwise) indicates which of the following? (1.0)

a. Machine frequency higher than bus frequency, phases not matched.

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

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

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

3.8 Which of the following statements is CORRECT concerning the source range channels? (1.0)

a. The source range signals originate in two high sensitivity BF_3 detectors that operate in the proportional range.

b. Tne detectors are surrounded by lead shielding, thus making gamma compensation unnecessary.

c. Due to the low level pulses from the detectors, preamplifiers located in the RPS cabinets are required to provide impedance matching.

d. Due to their sensitivity, long term outages will have no noticeable effect on the range of indication.

3.9 Assume the reactor tripped on high Th of 618°F. After Th stabilized at a lower value (550°F) what would you expect to see on the Output State Lamp and Output Memory Lamp for the Th bistables in each RPS cabinet? (1.0)

a. both lamps dim

b. both lamps bright

c. Output State Lamp - dim
Ouput Memory Lamp - bright

d. Output State Lamp - bright
Output Memory Lamp - dim

3.10 The gas channels on the atmospheric monitoring channels, when alarmed, would be more indicative of an instantaneous release of radioactivity than would the particulate or iodine channels. What is the reason for this statement? (1.0)

3.11 Which one of the following functions is NOT served by the power range nuclear instrument bistable module. (1.0)

a. Over power trip $\leq$5% full power.

b. Rod withdrawl hold bypass at 10% full power.

c. Source range detector high voltage cut off at 10% full power.

d. Power range gain adjustment at 50% full power.

3.12 If an operator mistakenly sets the low load limit high (≈85%) and an asymmetric rod runback occurs while at 100% power, which of the following would occur? (1.0)

a. Demand would decrease to 55%

b. Demand would decrease to 60%

c. Demand would decrease to 85% of 55% F.P.

d. Demand would decrease to 60% of 85% F.P.

3.13 Each area radiation monitoring channel has a remote local readout, for example, the readout module near the personnel access hatch on elevation 132 (RM-G9). Select the correct statement concerning this remote local readout module. (1.0)

a. In the event that the control room readout module malfunctions which causes its meter to read incorrectly, you may be able to determine the correct reading from the meter on the elevation 132 module.

b. The alarm reset pushbutton on the elevation 132 module will reset any previous alarms provided the input is below the alarm setpoints.

c. The elevation 132 module will indicate "warning" and "high" alarms but not "failures".

d. Only the control room module contains a Sr^{90} check source.

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

a. both the outgoing and the incoming will close

b. both the outgoing and the incoming will trip

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

d. the outgoing will trip before the incoming will close

e. the outgoing will trip after the incoming closes

3.15 Which one of the following states the method of powering the "safeguard communication system"? (1.0)

a. 120 VAC vital bus 3A

b. 480 VAC ES bus 3B2

c. 125/250 VDC Bus 3B

d. sound powered phones

e. dual input inverter 3E

3.16 Which one of the following is NOT part of the POWER/IMBALANCE/ FLOW TRIP Circuitry? (1.0)

a. Hammel-Dahl flow tube

b. Square root extractor

c. Buffer amplifier

d. Optical Isolator

3.17 Which one of the following statements is CORRECT concerning the EHC control panel operation? (1.0)

a. When the throttle pressure controller IN button is depressed, the throttle and governor valves will run back to their fully closed position if the throttle pressure is less than the set point.

b. When the oper. integ. control system button is depressed, if there is a pressure difference of +50 psi from the normal control set point (885 psi), the EHC control system will automatically revert to the oper. auto mode.

c. When the oper. auto sync button is depressed with the unit within 50 rpm of synchronized speed, the EHC control system will close both output breakers when the correct conditions of phase and speed are attained.

d. When the oper. manual button is depressed, the valve position limit is no longer in effect.

3.18 Which one of the following choices of depressing STOP push-buttons will, by itself, trip the diesel generator output breaker? ~~(1.0)~~

Delete

a. stop pushbutton in the control room

b. one stop push button on the diesel gaugeboard

c. both stop push buttons on the diesel gaugeboard

d. stop pushbutton on the diesel generator local control panel by the D-G air start compressor

3.19 With regard to the pressurizer heater control circuits, if under normal operation, the pressurizer level drops to less than 40", which of the following indications would occur? (1.0)

a. white indicating light on bank D heater will go out

b. white indicating light on bank C heater will go out

c. red indicating light on bank D heater will go out

d. red indicating light on bank C heater will go out

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

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

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

c. Sequence monitor No. 1 provides a fault indication when the groups are inserting or withdrawing out of sequence in the manual mode.

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

3.21 Which of the following indications warn that the feed selector handle should NOT be pulled up? (1.0)

a. "Bleed Mode B4 and B5 selected" white light lit

b. "Waste disposal bleed permit" white light lit

c. "CAV-57 open" white light lit

d. both "bleed mode B4 or B5 selected" white light and "waste disposal bleed permit" white light lit

3.22 a. During a plant cooldown using OP-209 "plant cooldown", it requires that the cooldown rate be restricted. Complete the following table with the CORRECT temperature and cooldown rates. (1.0)

RCS Temperature (T)	Cooldown Rate	RCS Temperature Change in any One Hour Period
T > (1) °F	(2) °F/HR	(2) °F
(1) °F > T > (3) °F	(4) °F/HR	(4) °F
(3) °F > T	(5) °F/HR	(5) °F

b. LIST two different sources of RCS temperature for monitoring the above cooldown rates, i.e., what two temperatures in the RCS can be read to verify that you are within the above limits? (1.0)

END OF SECTION 3

4.0 PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL (25.0)

4.1 The Immediate Actions, in response to High Alarms from Atmospheric Radiation Monitors RM-A1 through RM-A5, require you to "ensure stopped" various ventilation fans. Match the fans you are required to ensure stopped with the appropriate monitor and procedure. (2.5)

NOTE: Some fans may be required in more than one procedure.

a.	RM-A1 (AP-241)	1.	AHF-9A & 9B
b.	RM-A2 (AP-242)	2.	AHF-10
c.	RM-A3 (AP-243)	3.	AHF-11A and 11B
d.	RM-A4 (AP-244)	4.	AHF-17A and 17B
e.	RM-A5 (AP-243)	5.	AHF-19A and 19B
		6.	AHF-20A and 20B (or in slow speed)
		7.	AHF-30
		8.	AHF-34
		9.	AHF-44A and 44B

4.2 List your immediate actions in response to an alarm from RM-L7. (0.5)

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

a. Select "DISABLE" on "HIGH ALARM" toggle switch OR "LO ALARM" toggle switch.

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

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

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

4.4 An alarm on which one of the following radiation monitors would be an indication of loss of decay heat removal? (1.0)

a. RM-A3

b. RM-A4

c. RM-A5

d. RM-A6

4.5 The following is the first immediate action under AP-380, "Engineered Safeguards system actuation". IF SRMA present OR RC PRESS < 1500 psig, THEN depress "HPI Actuation" Pushbutton "A" and "B". What are the Remedial Actions associated with this step? (1.0)

4.6 LIST your Immediate Actions to AP-450, "Emergency Feedwater Actuation." (2.0)

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

a. Less than three stators are energized and the reactor is NOT critical.

b. RC system temperature is between 200°F and 300°F.

c. Air temperature around the drives in the service structure is less than 150°F.

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

4.8 To accomplish CRD safety group latching as per OP-502 which one of the following shows the proper order in which the actions should be taken? (1.0)

a. Press "trip reset"; press "fault reset"; and reset "reactor tripped".

b. Press "trip reset"; reset "reactor tripped"; and press "fault reset".

c. Press "fault reset"; press "trip reset"; and reset "reactor tripped".

d. Press "fault reset"; reset "reactor tripped"; and press "trip reset".

4.9 If OTSG's are available, Step 14.a of AP-380 (see Figure 5 & 6 attached) requires the starting of a number of RCPs in a particular loop configuration. (NOTE: Some information has been deleted from Figure 5 & 6). If the RC pressure is 300 psi and RC temperature (Tc) is 300°F, you should: (1.0)

a. start one pump in either loop

b. start one pump in each loop

c. start two pumps in either loop

d. start two pumps in each loop

e. Refer to AP-530

4.10 Annunciator Window I-2-3 on the ICS Panel is labeled "Pressure Transient in Progress." Which one of the following is a CORRECT indicated condition for this annunciator? (1.0)

a. Pressurizer Safety Valve Open

b. High RC pressure at low temperature (NDTT)

c. High RCS pressure (above trip setpoint)

d. HPI Actuation on low RCS pressure

4.11 ICS procedure, OP-501 states in part, "If operating signal source malfunctions make signal source transfer necessary, transfer to another signal source should be done ... " Which one of the following CORRECTLY completes this statement? (1.0)

a. immediately after placing the affected ICS station in HAND.

b. immediately, regardless of ICS operating mode.

c. only after checking the computer for a valid alternate signal and placing the affected ICS station in HAND.

d. only after checking the computer for a valid alternate signal; affected ICS station may be in HAND or AUTO.

4.12 Where would you expect to find the correct procedure for adding lithium hydroxide (LiOH) to the makeup system? (1.0)

a. OP 202 - Plant heatup

b. OP 304 - Soluble poison concentration control

c. OP 402 - Makeup and purification system

d. OP 403 - Chemical addition system

4.13 Of the following maneuvering restrictions during power escalation, one applies ONLY at cycle startup. Which one? (1.0)

a. Below 20% FP power escalation is limited to 10%/hr.

b. From 90 to 95% FP power escalation is limited to 10%/hr.

c. Above 40% FP power escalation is limited to 3%/hr.

d. Hold at 75 ± 2% FP for a 5-hour soak.

4.14 Which one of the following is an appropriate "immediate" action according to EP-120, "Inadequate Shutdown Value?" (1.0)

a. Stop cleanup.

b. Establish letdown flow to MUT $\geq$ 40 gpm.

c. Start boric acid pump CAP-3A or 3B.

d. Verify reactor trip, go to VP-580.

4.15 Which one of the following is CORRECT concerning the operation of the ICS main feedwater pump speed control station? (1.0)

a. Tripping of the associated feedwater pump will inhibit "auto" operation and light both "auto" and "hand" lamps.

b. Care should be taken when simultaneously transferring both Loops "A" and "B" main feedwater pump control stations to "auto".

c. "Meas-VAR" position indicates feedwater demand error when the main block valves are shut.

d. "MEAS-VAR" position indicates feedwater train ΔP when the main block valves are open.

4.16 Which one of the following is a CORRECTLY stated Limit and Precaution as contained in OP-605, "Feedwater System". (1.0)

a. If at any time emergency FW pump discharge drops to zero pressure, immediately secure the pump under all operating conditions.

b. If at any time emergency FW pump discharge drops to to zero pressure, immediately secure the pump, except under emergency operation.

c. The motor-driven emergency FW pump (EFP-1) will not auto-start if emergency diesel generator 3B (EDG-3B) is running and closed onto its respective bus.

d. The motor-driven emergency FW pump (EFP-1) will not auto-start if emergency diesel generator 3B (EDG-3B) is running with its output breaker open.

4.17 An Immediate Action to AP-770, "Emergency Diesel Generator Actuation" is: (1.0)

IF under voltage exists on 4160V ES bus, then ensure affected bus is energized by EDG.

What are the Remedial Actions associated with this step?

4.18 Which one of the following "Radiation Area" definitions means the same as that given in RP-101, "Radiation Protection Manual"? (1.0)

a. any area where the dose rate exceeds five mrem/hr or where, in any five (5) consecutive day period, exceeds 100 mrem/hr at any time.

b. any accessible area where a major portion of the body could exceed a dose of five mrem in any one (1) hour, or in any five (5) consecutive days a dose in excess of 100 mrem.

c. any accessible area where any portion of the body could exceed a dose rate of five mrem/hr or where, in any five (5) consecutive day period, could exceed a dose rate of 100 mrem/hr at any time.

d. any area where the dose rate to any portion of the body could exceed a dose of five mrem in any one (1) hour, or in any five (5) consecutive days a dose in excess of 100 mrem.

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

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

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

c. The background reading should be less than 300 dpm/100 cm^2.

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

4.20 Which one of the following is CORRECTLY stated regarding a permissible dose to an operator in a restricted area as specified in 10CFR 20. (1.0)

a. Under non-accident conditions, the operator is permitted to receive no more than 7½ rems per calendar quarter to each hand and to each foot.

b. Under non-accident conditions, the operator is permitted to receive no more than 1¼ rad of beta per calendar quarter to the lens of the eye.

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

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

4.21 TRUE OR FALSE

a. When performing procedural actions, you are required to have and follow the "Working Copy" of all OPs used regardless of how frequently the procedure is performed. (0.5)

b. Unlicensed plant management personnel, not in a training status, are allowed to manipulate the controls only under the direction and in the presence of a licensed operator or senior operator. (0.5)

c. In an emergency affecting the safety of operations, the "Operator at the Controls" may momentarily leave the red-carpeted area to respond to annunicators on back panels (ventilation panel for example). (0.5)

d. Reading the Shift Supervisors Log and Control Center log by the oncoming Reactor Operator may be accomplished immediately after shift turnover. (0.5)

4.22 According to EP-290, "Inadequate Core Cooling", the hot leg vents should be used under two separate conditions. Which of the following choices states those conditions. (See page 7 of EP-290 attached for reference to "Regions"). (1.0)

a. Pzr press >1500 psig; press and temperature in Region 2

b. Pzr press >1500 psig; subcooling margin <50°F

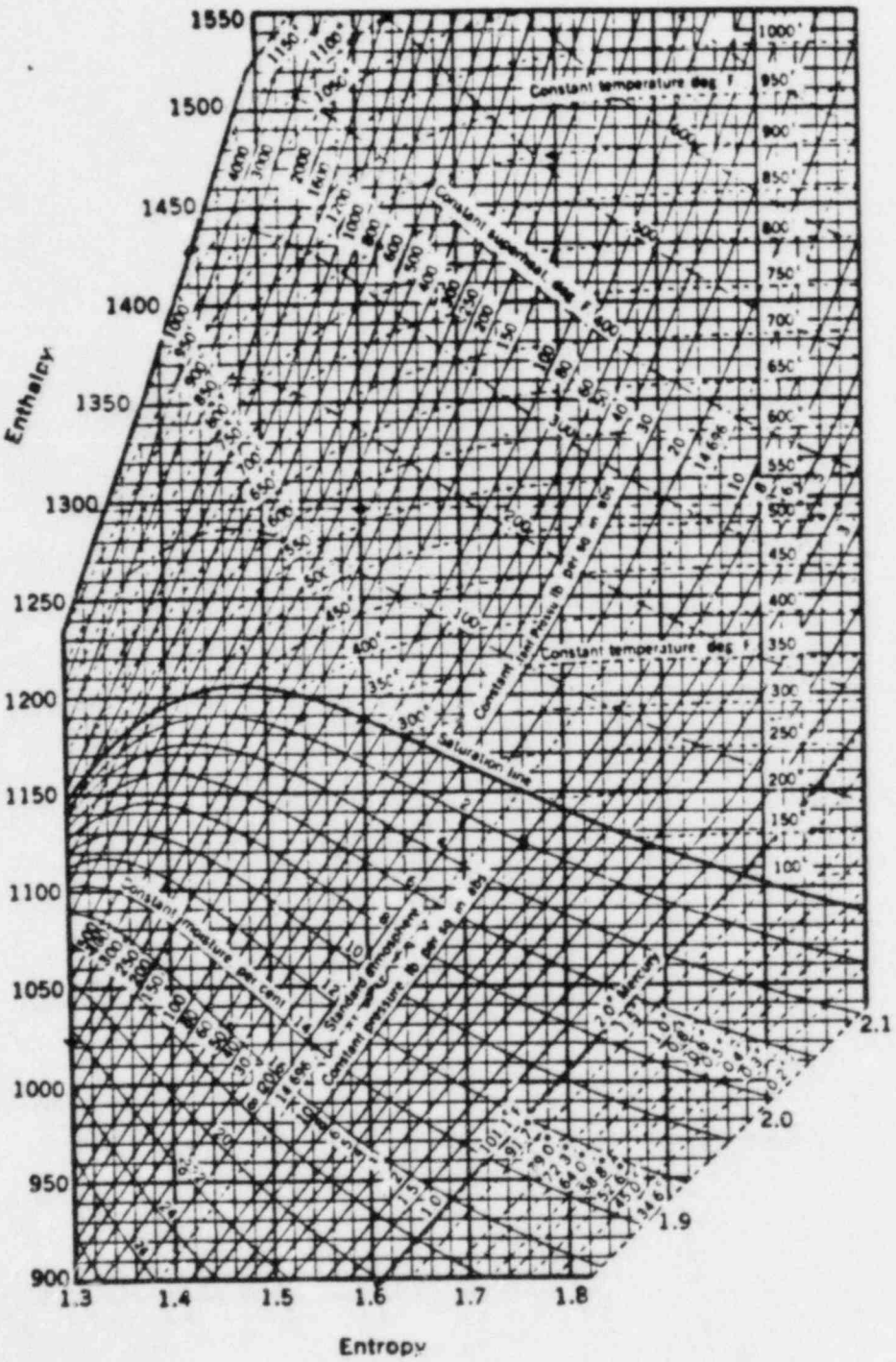
c. Pzr press >1500 psig; press and temperature in Region 3

d. Pzr press >2300 psig; subcooling margin <50°F

e. Pzr press >2300 psig; press and temperature in Region 3

END OF SECTION 4

END OF EXAM



Mollier diagram for steam

TABLE D-1.*

Properties of Dry Saturated Steam *

Pressure

Abs press., psia	Temp., °F	Specific volume		Enthalpy			Entropy		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor	Sat liquid	Evap	Sat vapor
p	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
1.0	101.74	0.01614	333.6	69.70	1036.3	1106.0	0.1326	1.8456	1.9782
2.0	126.08	0.01623	173.73	93.99	1022.2	1116.2	0.1749	1.7451	1.9200
3.0	141.48	0.01630	118.71	109.37	1013.2	1122.6	0.2008	1.6855	1.8863
4.0	152.97	0.01636	90.63	120.86	1006.4	1127.3	0.2198	1.6427	1.8625
5.0	162.24	0.01640	73.52	130.13	1001.0	1131.1	0.2347	2.6094	1.8441
6.0	170.06	0.01645	61.98	137.96	996.2	1134.2	0.2472	1.5820	1.8292
7.0	176.85	0.01649	53.64	144.76	992.1	1136.9	0.2581	1.5586	1.8167
8.0	182.86	0.01653	47.34	150.79	988.5	1139.3	0.2674	1.5383	1.8057
9.0	188.28	0.01656	42.40	156.22	985.2	1141.4	0.2759	1.5203	1.7962
10	193.21	0.01659	38.42	161.17	982.1	1143.3	0.2835	1.5041	1.7876
14.696	212.00	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
15	213.03	0.01672	26.29	181.11	969.7	1150.8	0.3135	1.4415	1.7549
20	227.96	0.01683	20.089	196.16	960.1	1156.3	0.3356	1.3962	1.7319
25	240.07	0.01692	16.303	208.42	952.1	1160.6	0.3533	1.3606	1.7139
30	250.33	0.01701	13.746	218.82	945.3	1164.1	0.3680	1.3313	1.6993
35	259.28	0.01708	11.898	227.91	939.2	1167.1	0.3807	1.3063	1.6870
40	267.25	0.01715	10.498	236.03	933.7	1169.7	0.3919	1.2844	1.6763
45	274.44	0.01721	9.401	243.36	928.6	1172.0	0.4019	1.2650	1.6669
50	281.01	0.01727	8.515	250.09	924.0	1174.1	0.4110	1.2474	1.6585
55	287.07	0.01732	7.787	256.30	919.6	1175.9	0.4193	1.2316	1.6509
60	292.71	0.01738	7.175	262.09	915.5	1177.6	0.4270	1.2168	1.6438
65	297.97	0.01743	6.655	267.50	911.6	1179.1	0.4342	1.2032	1.6374
70	302.92	0.01748	6.206	272.61	907.9	1180.6	0.4409	1.1906	1.6315
75	307.60	0.01753	5.816	277.43	904.5	1181.9	0.4472	1.1787	1.6259
80	312.03	0.01757	5.472	282.02	901.1	1183.1	0.4531	1.1676	1.6207
85	316.25	0.01761	5.168	286.39	897.8	1184.2	0.4587	1.1571	1.6158
90	320.27	0.01766	4.896	290.56	894.7	1185.3	0.4641	1.1471	1.6112
95	324.12	0.01770	4.652	294.56	891.7	1186.2	0.4692	1.1376	1.6068
100	327.81	0.01774	4.432	298.40	888.8	1187.2	0.4740	1.1286	1.6026
110	334.77	0.01782	4.049	305.66	883.2	1188.9	0.4832	1.1117	1.5948

TABLE D-1a
Properties of Dry Saturated Steam *(continued)*
Pressure

Abs press psia	Temp °F	Specific volume		Enthalpy			Entropy		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor	Sat liquid	Evap	Sat vapor
P	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
120	341.25	0.01789	3.728	312.44	877.9	1190.4	0.4916	1.0962	1.5878
130	347.32	0.01796	3.455	318.81	872.9	1191.7	0.4995	1.0817	1.5812
140	353.02	0.01802	3.220	324.82	868.2	1193.0	0.5069	1.0682	1.5751
150	358.42	0.01809	3.015	330.51	863.6	1194.1	0.5138	1.0556	1.5694
160	363.53	0.01815	2.834	335.93	859.2	1195.1	0.5204	1.0436	1.5640
170	368.41	0.01822	2.675	341.09	854.9	1196.0	0.5266	1.0324	1.5590
180	373.06	0.01827	2.532	346.03	850.8	1196.9	0.5325	1.0217	1.5542
190	377.51	0.01833	2.404	350.79	846.8	1197.6	0.5381	1.0116	1.5497
200	381.79	0.01839	2.288	355.36	843.0	1198.4	0.5435	1.0018	1.5453
250	400.95	0.01865	1.8438	376.00	825.1	1201.1	0.5675	0.9588	1.5263
300	417.33	0.01890	1.5433	393.84	809.0	1202.8	0.5879	0.9225	1.5104
350	431.72	0.01913	1.3260	409.69	794.2	1203.9	0.6056	0.8910	1.4966
400	444.59	0.0193	1.1613	424.0	780.5	1204.5	0.6214	0.8630	1.4844
450	456.28	0.0195	1.0320	437.2	767.4	1204.6	0.6356	0.8378	1.4734
500	467.01	0.0197	0.9278	449.4	755.0	1204.4	0.6487	0.8147	1.4634
550	476.94	0.0199	0.8424	460.8	743.1	1203.9	0.6608	0.7934	1.4542
600	486.21	0.0201	0.7698	471.6	731.6	1203.2	0.6720	0.7734	1.4454
650	494.90	0.0203	0.7083	481.8	720.5	1202.3	0.6826	0.7548	1.4374
700	503.10	0.0205	0.6554	491.5	709.7	1201.2	0.6925	0.7371	1.4296
750	510.86	0.0207	0.6092	500.8	699.2	1200.0	0.7019	0.7204	1.4223
800	518.23	0.0209	0.5687	509.7	688.9	1198.6	0.7108	0.7045	1.4153
850	525.26	0.0210	0.5327	518.3	678.8	1197.1	0.7194	0.6891	1.4085
900	531.98	0.0212	0.5006	526.6	668.8	1195.4	0.7275	0.6744	1.4020
950	538.43	0.0214	0.4717	534.6	659.1	1193.7	0.7355	0.6602	1.3957
1000	544.61	0.0216	0.4456	542.4	649.4	1191.8	0.7430	0.6467	1.3897
1100	556.31	0.0220	0.4001	557.4	630.4	1187.7	0.7575	0.6205	1.3780
1200	567.22	0.0223	0.3619	571.7	611.7	1183.4	0.7711	0.5956	1.3667
1300	577.46	0.0227	0.3293	585.4	593.2	1178.6	0.7840	0.5719	1.3559
1400	587.10	0.0231	0.3012	598.7	574.7	1173.4	0.7963	0.5491	1.3454
1500	596.23	0.0235	0.2765	611.6	556.3	1167.9	0.8082	0.5269	1.3351
2000	635.82	0.0257	0.1878	671.7	463.4	1135.1	0.8619	0.4230	1.2849
2500	668.13	0.0287	0.1307	730.6	360.5	1091.1	0.9126	0.3197	1.2322
3000	695.36	0.0346	0.0858	802.5	217.8	1020.3	0.9731	0.1885	1.1615
3206.2	705.40	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

TABLE D-1b
Properties of Dry Saturated Steam *(continued)*
Temperature

Temp.	Abs. pressure	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
t	p	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
32	0.08854	0.01602	3306	0.00	1075.8	1075.8	0.0000	2.1877	2.1877
35	0.09995	0.01602	2947	3.02	1074.1	1077.1	0.0061	2.1709	2.1770
40	0.12170	0.01602	2444	8.05	1071.3	1079.3	0.0162	2.1435	2.1597
45	0.14752	0.01602	2036.4	13.06	1068.4	1081.5	0.0262	2.1167	2.1429
50	0.17811	0.01603	1703.2	18.07	1065.6	1083.7	0.0361	2.0903	2.1264
60	0.2563	0.01604	1206.7	28.06	1059.9	1088.0	0.0555	2.0393	2.0948
70	0.3631	0.01606	867.9	38.04	1054.3	1092.3	0.0745	1.9902	2.0647
80	0.5069	0.01608	633.1	48.02	1048.6	1096.6	0.0932	1.9428	2.0360
90	0.6982	0.01610	468.0	57.99	1042.9	1100.9	0.1115	1.8972	2.0087
100	0.9492	0.01613	350.4	67.97	1037.2	1105.2	0.1295	1.8531	1.9826
110	1.2748	0.01617	265.4	77.94	1031.6	1109.5	0.1417	1.8106	1.9577
120	1.6924	0.01620	203.27	87.92	1025.8	1113.7	0.1645	1.7694	1.9339
130	2.2225	0.01625	157.34	97.90	1020.0	1117.9	0.1816	1.7296	1.9112
140	2.8886	0.01629	123.01	107.89	1014.1	1122.0	0.1984	1.6910	1.8894
150	3.718	0.01634	97.07	117.89	1008.2	1126.1	0.2149	1.6537	1.8685
160	4.741	0.01639	77.29	127.89	1002.3	1130.2	0.2311	1.6174	1.8485
170	5.992	0.01645	62.06	137.90	996.3	1134.2	0.2472	1.5822	1.8293
180	7.510	0.01651	50.23	147.92	990.2	1138.1	0.2630	1.5480	1.8109
190	9.339	0.01657	40.96	157.95	984.1	1142.0	0.2785	1.5147	1.7932
200	11.526	0.01663	33.64	167.99	977.9	1145.9	0.2938	1.4824	1.7762
210	14.123	0.01670	27.82	178.05	971.6	1149.7	0.3090	1.4508	1.7598
212	14.696	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
220	17.186	0.01677	23.15	188.13	965.2	1153.4	0.3239	1.4201	1.7440
230	20.780	0.01684	19.382	198.23	958.8	1157.0	0.3387	1.3901	1.7288
240	24.969	0.01692	16.323	208.34	952.2	1160.5	0.3531	1.3609	1.7140
250	29.825	0.01700	13.821	216.48	945.5	1164.0	0.3675	1.3323	1.6998
260	35.429	0.01709	11.763	228.64	938.7	1167.3	0.3817	1.3043	1.6860
270	41.858	0.01717	10.061	238.84	931.8	1170.6	0.3958	1.2769	1.6727
280	49.203	0.01726	8.645	249.06	924.7	1173.8	0.4096	1.2501	1.6597
290	57.556	0.01735	7.461	259.31	917.5	1176.8	0.4234	1.2238	1.6472
300	67.013	0.01745	6.466	269.59	910.1	1179.7	0.4369	1.1980	1.6350
310	77.68	0.01755	5.626	279.92	902.6	1182.5	0.4504	1.1727	1.6231
320	89.66	0.01765	4.914	290.28	894.9	1185.2	0.4637	1.1478	1.6115
330	103.06	0.01776	4.307	300.68	887.0	1187.7	0.4769	1.1233	1.6002
340	118.01	0.01787	3.788	311.13	879.0	1190.1	0.4900	1.0992	1.5891

TABLE D-1b
Properties of Dry Saturated Steam *(continued)*
Temperature

Temp. °F	Abs. press. psia	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
t	p	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
350	134.63	0.01799	3.342	321.63	870.7	1192.3	0.5029	1.0754	1.5783
360	153.04	0.01811	2.957	332.18	852.2	1194.4	0.5158	1.0519	1.5677
370	173.37	0.01823	2.625	342.79	853.5	1196.3	0.5286	1.0287	1.5573
380	195.77	0.01836	2.335	353.45	844.6	1198.1	0.5413	1.0059	1.5471
390	220.37	0.01850	2.0836	364.17	835.4	1199.6	0.5539	0.9832	1.5371
400	247.31	0.01864	1.8633	374.97	826.0	1201.0	0.5664	0.9608	1.5272
410	276.75	0.01878	1.6700	385.83	816.3	1202.1	0.5788	0.9386	1.5174
420	308.83	0.01894	1.5000	396.77	806.3	1203.1	0.5912	0.9166	1.5078
430	343.72	0.01910	1.3499	407.79	796.0	1203.8	0.6035	0.8947	1.4982
440	381.59	0.01926	1.2171	418.90	785.4	1204.3	0.6158	0.8730	1.4887
450	422.6	0.0194	1.0993	430.1	774.5	1204.6	0.6280	0.8513	1.4793
460	466.9	0.0196	0.9944	441.4	763.2	1204.6	0.6402	0.8298	1.4700
470	514.7	0.0198	0.9009	452.8	751.5	1204.3	0.6523	0.8083	1.4606
480	566.1	0.0200	0.8172	464.4	739.4	1203.7	0.6645	0.7868	1.4513
490	621.4	0.0202	0.7423	476.0	726.8	1202.8	0.6766	0.7653	1.4419
500	680.8	0.0204	0.6749	487.8	713.9	1201.7	0.6887	0.7438	1.4325
520	812.4	0.0209	0.5594	511.9	686.4	1198.2	0.7130	0.7006	1.4136
540	962.5	0.0215	0.4649	536.6	656.6	1193.2	0.7374	0.6568	1.3942
560	1133.1	0.0221	0.3868	562.2	624.2	1186.4	0.7621	0.6121	1.3742
580	1325.8	0.0228	0.3217	588.9	588.4	1177.3	0.7872	0.5659	1.3532
600	1542.9	0.0236	0.2668	610.0	548.5	1165.5	0.8131	0.5176	1.3307
620	1786.6	0.0247	0.2201	646.7	503.6	1150.3	0.8398	0.4664	1.3062
640	2059.7	0.0260	0.1798	678.6	452.0	1130.5	0.8679	0.4110	1.2789
660	2365.4	0.0278	0.1442	714.2	390.2	1104.4	0.8987	0.3485	1.2472
680	2708.1	0.0305	0.1115	757.3	309.9	1067.2	0.9351	0.2719	1.2071
700	3093.7	0.0369	0.0761	823.3	172.1	995.4	0.9905	0.1484	1.1389
705.4	3206.2	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

Properties of Superheated Steam*

Abs press., psia (Sat. temp., °F)		Temperature, °F											
		200	300	400	500	600	700	800	900	1000	1100	1200	1400
1 (101.74)	v	392.6	452.3	512.0	571.6	631.2	690.8	750.4	809.9	869.5	929.1	988.7	1107.8
	h	1150.4	1195.8	1241.7	1288.3	1335.7	1383.8	1432.8	1482.7	1533.5	1585.2	1637.7	1745.7
	s	2.0512	2.1153	2.1720	2.2233	2.2702	2.3137	2.3542	2.3923	2.4283	2.4625	2.4952	2.5566
5 (162.24)	v	78.16	90.25	102.26	114.22	126.16	138.10	150.03	161.95	173.87	185.79	197.71	221.6
	h	1148.8	1195.0	1241.2	1288.0	1335.4	1383.6	1432.7	1482.6	1533.4	1585.1	1637.7	1745.7
	s	1.8718	1.9370	1.9942	2.0456	2.0927	2.1361	2.1767	2.2148	2.2509	2.2851	2.3178	2.3792
10 (193.21)	v	38.85	45.00	51.04	57.05	63.03	69.01	74.98	80.95	86.92	92.88	98.84	110.77
	h	1146.6	1193.9	1240.6	1287.5	1335.1	1383.4	1432.5	1482.4	1533.2	1585.0	1637.6	1745.6
	s	1.7927	1.8595	1.9172	1.9689	2.0160	2.0596	2.1002	2.1383	2.1744	2.2068	2.2413	2.3028
14.696 (212.00)	v		30.53	34.68	38.78	42.86	46.94	51.00	55.07	59.13	63.19	67.25	75.37
	h		1192.8	1239.9	1287.1	1334.8	1383.2	1432.3	1482.3	1533.1	1584.8	1637.5	1745.5
	s		1.8160	1.8743	1.9261	1.9734	2.0170	2.0576	2.0958	2.1319	2.1662	2.1989	2.2603
20 (227.96)	v		22.36	25.43	28.46	31.47	34.47	37.46	40.45	43.44	46.42	49.41	55.37
	h		1191.6	1239.2	1286.6	1334.4	1382.9	1432.1	1482.1	1533.0	1584.7	1637.4	1745.4
	s		1.7808	1.8396	1.8918	1.9392	1.9829	2.0235	2.0618	2.0978	2.1321	2.1648	2.2263
40 (267.25)	v		11.040	12.628	14.168	15.688	17.198	18.702	20.20	21.70	23.20	24.69	27.68
	h		1186.8	1236.5	1284.8	1333.1	1381.9	1431.3	1481.4	1532.4	1584.3	1637.0	1745.1
	s		1.6994	1.7608	1.8140	1.8619	1.9058	1.9467	1.9850	2.0212	2.0555	2.0883	2.1498
60 (292.71)	v		7.259	8.357	9.403	10.427	11.441	12.449	13.452	14.454	15.453	16.451	18.446
	h		1181.6	1233.6	1283.0	1331.8	1380.9	1430.5	1480.8	1531.9	1583.8	1636.6	1744.8
	s		1.6492	1.7135	1.7678	1.8162	1.8605	1.9015	1.9400	1.9762	2.0106	2.0434	2.1049
80 (312.03)	v			6.220	7.020	7.797	8.562	9.322	10.077	10.830	11.582	12.332	13.830
	h			1230.7	1281.1	1330.5	1379.9	1429.7	1480.1	1531.3	1583.4	1636.2	1744.5
	s			1.6791	1.7346	1.7836	1.8281	1.8694	1.9079	1.9442	1.9787	2.0115	2.0731
100 (327.81)	v			4.937	5.589	6.218	6.835	7.446	8.052	8.656	9.259	9.860	11.060
	h			1227.6	1279.1	1329.1	1378.9	1428.9	1479.5	1530.8	1582.9	1635.7	1744.2
	s			1.6518	1.7085	1.7581	1.8029	1.8443	1.8829	1.9193	1.9538	1.9867	2.0484
120 (341.25)	v			4.081	4.636	5.165	5.683	5.195	6.702	7.207	7.710	8.212	9.214
	h			1224.4	1277.2	1327.7	1377.8	1428.1	1478.8	1530.2	1582.4	1635.3	1743.9
	s			1.6287	1.6869	1.7370	1.7822	1.8237	2.8625	1.8990	1.9335	1.9664	2.0281
140 (353.02)	v			3.468	3.954	4.413	4.861	5.301	5.738	6.172	6.604	7.035	7.895
	h			1221.1	1275.2	1326.4	1376.8	1427.3	1478.2	1529.7	1581.9	1634.9	1743.5
	s			1.6087	1.6683	1.7190	1.7645	1.8063	1.8451	1.8817	1.9163	1.9493	2.0110
160 (363.53)	v			3.008	3.443	3.849	4.244	4.631	5.015	5.396	5.775	6.152	6.906
	h			1217.6	1273.1	1325.0	1375.7	1426.4	1477.5	1529.1	1581.4	1634.5	1743.2
	s			1.5908	1.6519	1.7033	1.7491	1.7911	1.8301	1.8667	1.9014	1.9344	1.9962
180 (373.06)	v			2.649	3.044	3.411	3.764	4.110	4.452	4.792	5.129	5.466	6.136
	h			1214.0	1271.0	1323.5	1374.7	1425.6	1476.8	1528.6	1581.0	1634.1	1742.9
	s			1.5745	1.6373	1.6894	1.7355	1.7776	1.8167	1.8534	1.8882	1.9212	1.9831
200 (381.79)	v			2.361	2.726	3.060	3.380	3.693	4.002	4.309	4.613	4.917	5.521
	h			1210.3	1268.9	1322.1	1373.6	1424.8	1476.2	1528.0	1580.5	1633.7	1742.6
	s			1.5594	1.6240	1.6767	1.7232	1.7655	1.8048	1.8415	1.8763	1.9094	1.9713
220 (389.86)	v			2.125	2.465	2.772	3.066	3.352	3.634	3.913	4.191	4.467	5.017
	h			1206.5	1266.7	1320.7	1372.6	1424.0	1475.5	1527.5	1580.0	1633.3	1742.3
	s			1.5453	1.6117	1.6652	1.7120	1.7545	1.7939	1.8308	1.8656	1.8987	1.9607
240 (397.37)	v			1.9276	2.247	2.533	2.804	3.068	3.327	3.584	3.839	4.093	4.597
	h			1202.5	1264.5	1319.2	1371.5	1423.2	1474.8	1526.9	1579.6	1632.9	1742.0
	s			1.5319	1.6003	1.6546	1.7017	1.7444	1.7839	1.8209	1.8558	1.8889	1.9510
260 (404.42)	v				2.063	2.330	2.582	2.827	3.067	3.305	3.541	3.776	4.242
	h				1262.3	1317.7	1370.4	1422.3	1474.2	1526.3	1579.1	1632.5	1741.7
	s				1.5897	1.6447	1.6922	1.7352	1.7748	1.8118	1.8467	1.8799	1.9420
280 (411.05)	v				1.9047	2.156	2.392	2.621	2.845	3.066	3.286	3.504	3.938
	h				1260.0	1316.2	1369.4	1421.5	1473.5	1525.8	1578.6	1632.1	1741.4
	s				1.5796	1.6354	1.6834	1.7265	1.7662	1.8033	1.8383	1.8716	1.9337
300 (417.33)	v				1.7675	2.005	2.227	2.442	2.652	2.859	3.065	3.269	3.674
	h				1260.0	1316.2	1368.3	1420.6	1472.8	1525.2	1578.1	1631.7	1741.0
	s				1.5701	1.6268	1.6751	1.7184	1.7582	1.7954	1.8305	1.8638	1.9260
350 (431.72)	v				1.4923	1.7036	1.8980	2.084	2.266	2.445	2.622	2.798	3.147
	h				1251.5	1310.9	1365.5	1418.5	1471.1	1523.8	1577.0	1630.7	1740.3
	s				1.5481	1.6070	1.6563	1.7002	1.7403	1.7777	1.8130	1.8463	1.9086
400 (444.59)	v				1.2851	1.4770	1.6508	1.8161	1.9767	2.134	2.290	2.445	2.751
	h				1245.1	1306.9	1362.7	1416.4	1469.4	1522.4	1575.8	1629.6	1739.5
	s				1.5281	1.5894	1.6396	1.6842	1.7247	1.7623	1.7977	1.8311	1.8936

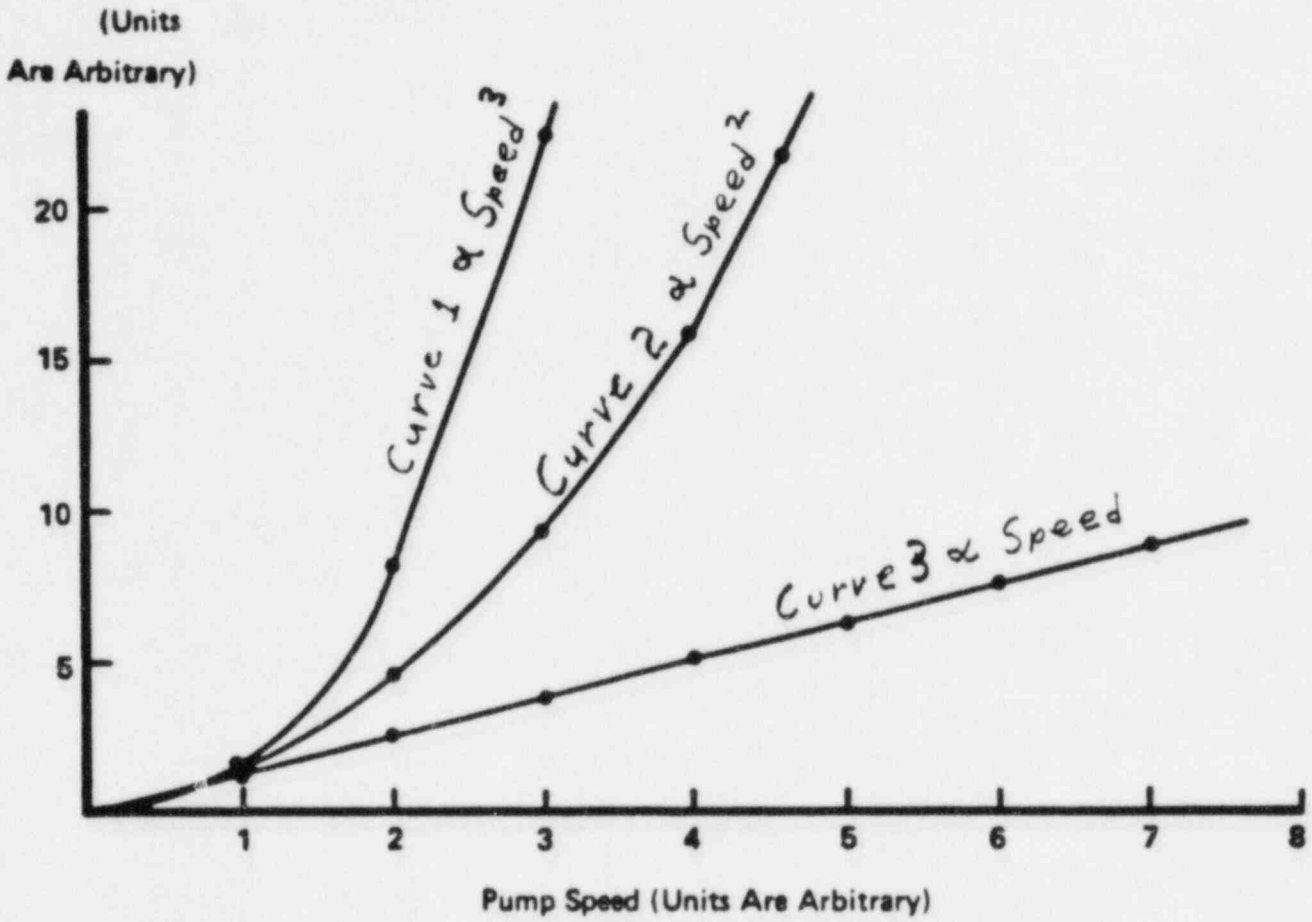


Figure 6.2-3. Pump Laws

SURFACE UTILIZATION Vs FLOW

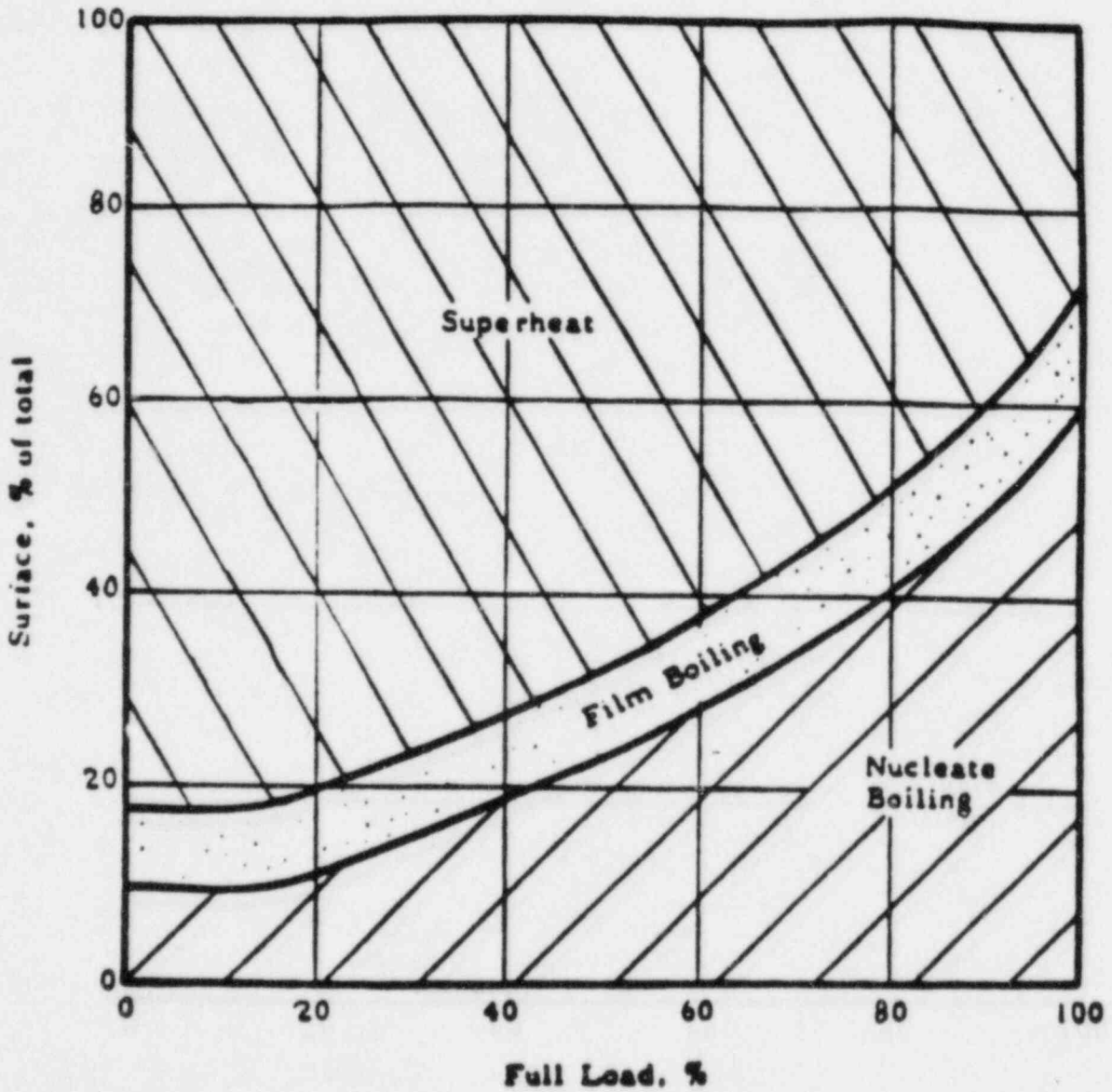
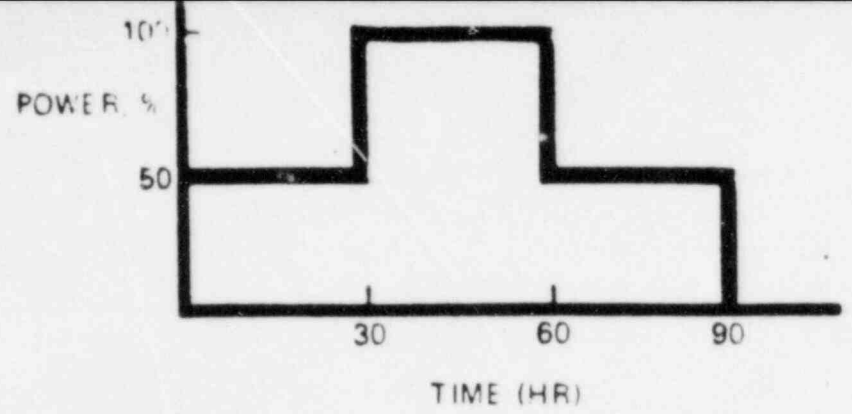
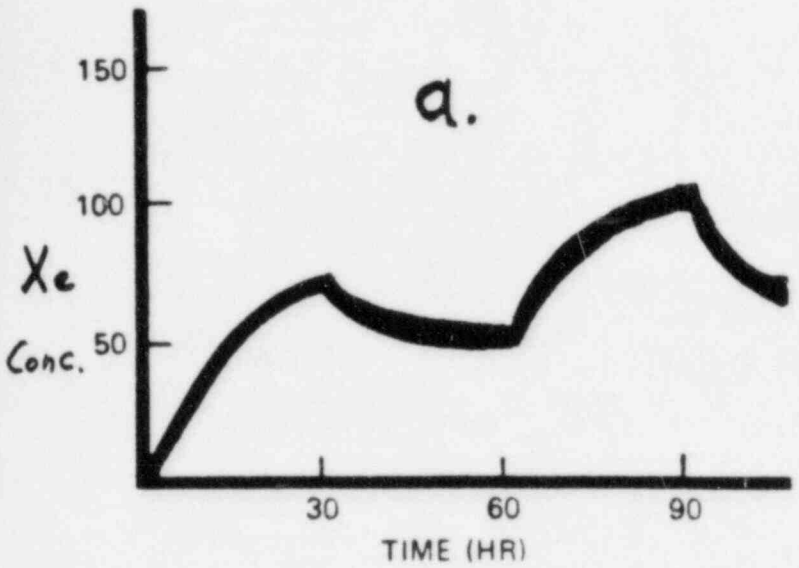
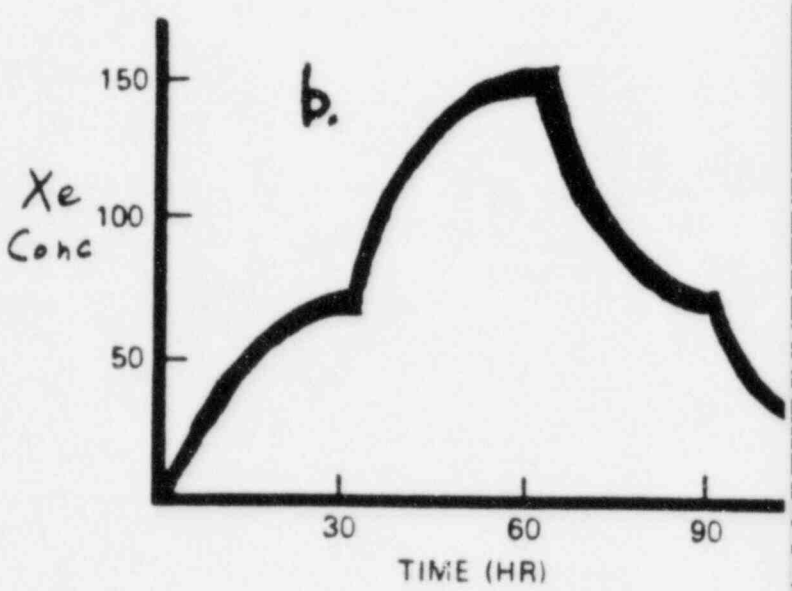
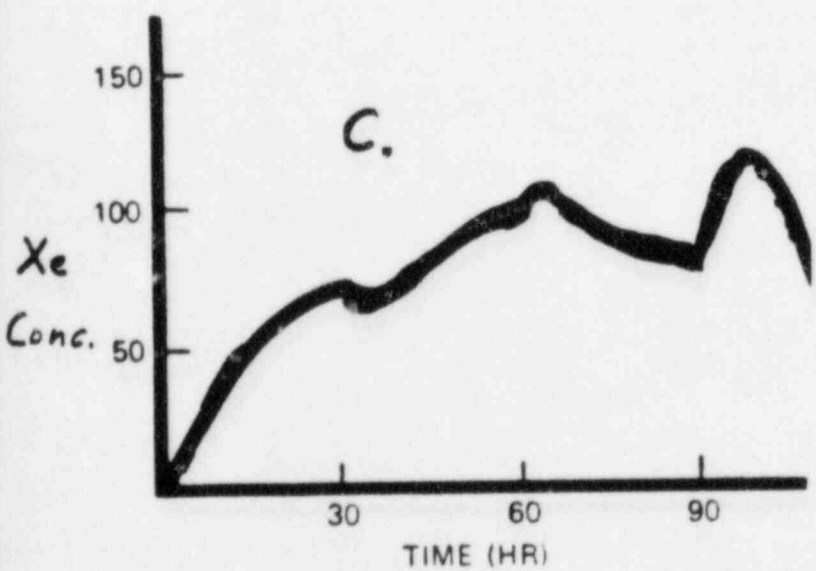


FIGURE 43


POWER %
100
50
30
60
90
TIME (HR)


a.
150
100
50
Xe
Conc.
30
60
90
TIME (HR)


b.
150
100
50
Xe
Conc
30
60
90
TIME (HR)


C.
150
100
50
Xe
Conc.
30
60
90
TIME (HR)

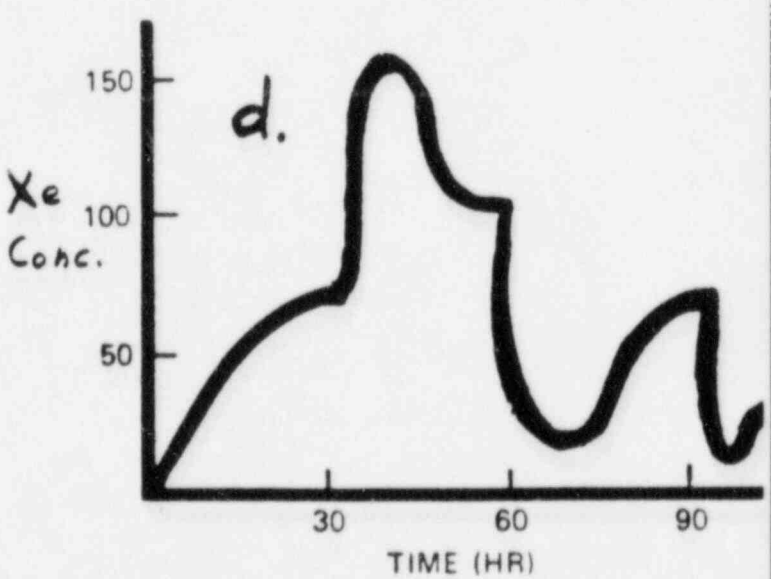

d.
150
100
50
Xe
Conc.
30
60
90
TIME (HR)

Fig. 2.

ESTIMATED CRITICAL BORON CONCENTRATION

REFERENCE CONDITIONS: 532°F, 0% FP, No Xenon, No Control Rods, Equilibrium Samarium

1. **Fuel Reactivity**

   a. Core Burnup 200 EFPD
   b. Read Curve 3.1 of OP-103, Plant Curve Book. ____ % Δk/k

2. **Xenon Reactivity** (Use Step 2.1 or 2.2)

2.1 Value calculated by SAXON I (submit printout).
(_____ % Δk/k) = _____ % Δk/k

OR

2.2 a. Last power level was 100 % FP for 504 hrs.
   b. Time Shutdown 24 hrs.
   c. If time at last power level was < 40 hrs. and SAXON is unavailable, consult with Reactor Specialist.
(_____ % Δk/k) = _____ % Δk/k

3. **Samarium Reactivity Buildup After Shutdown**

3.1 Value calculated by SAXON I (submit printout) _____ % Δk/k

4. **Reactivity Effect From Temperature**

   a. Average RC Temperature 535 °F
   b. Reference temperature is 532°F.
   c. Temperature coefficient at _____ ppmB is obtained from Curve 3.6 of OP-103, Plant Curve Book, to be _____ x 10^{-2}% Δk/k/°F.
   d. Reactivity = [T(ave) - 532] [Temp. Coeff.]
   e. Reactivity = (_____ - _____) (_____ x 10^{-2}% Δk/k/°F) = _____ % Δk/k

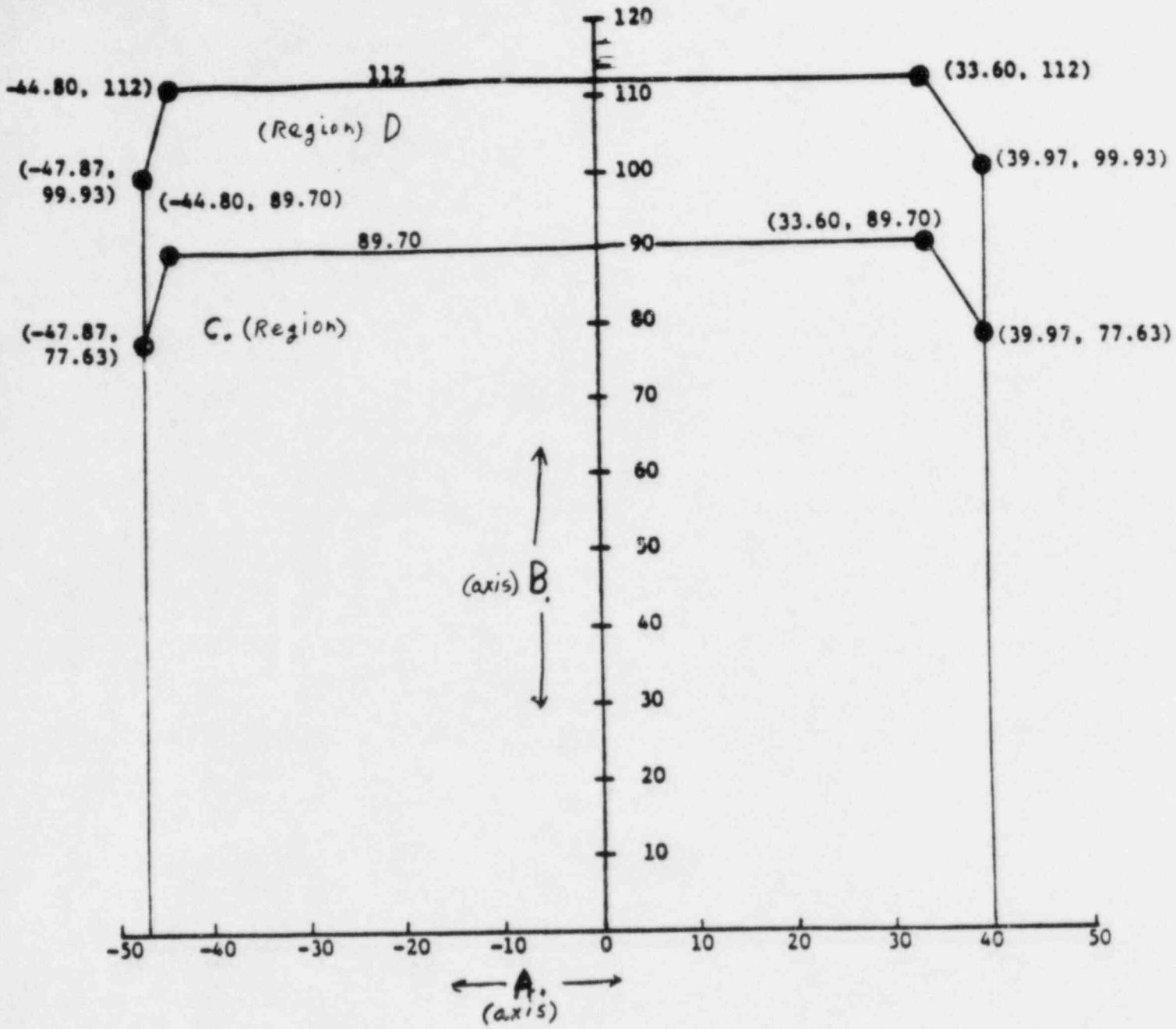
5. **Reactivity of Control Rods at Desired Insertion**

Groups 1-4 at	100 % WD		
Group 5 at	100 % WD		
Group 6 at	100 % WD		
Group 7 at	80 % WD	Regulating Group Worth	_____ % Δk/k
Group 8 at	40 % WD	Group 8 Worth	_____ % Δk/k

Calculated By _____ Date _____

FIGURE 2.1-2

REACTOR CORE SAFETY LIMIT



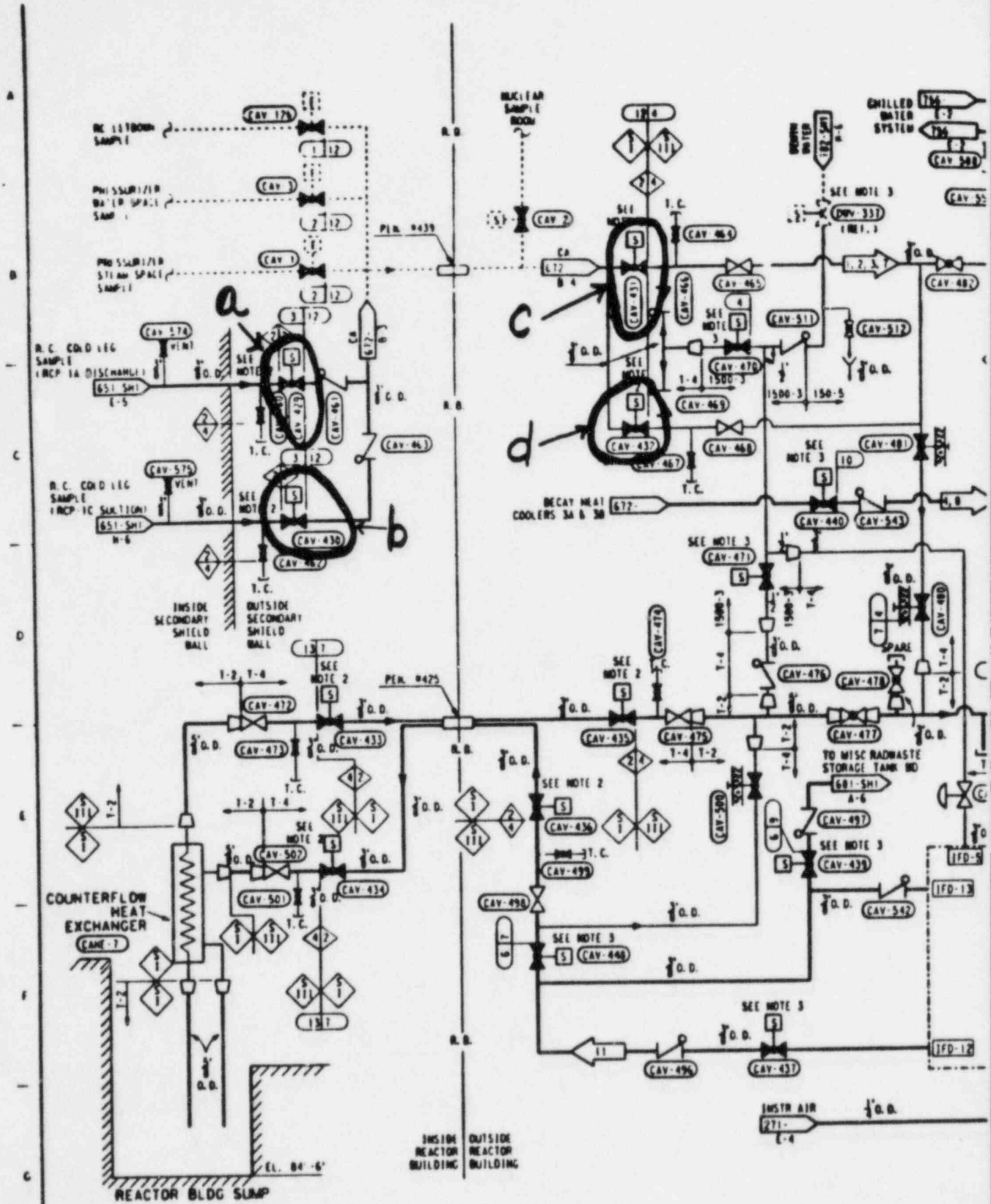

a
b
c
d
INSIDE SECONDARY SHIELD WALL
OUTSIDE SECONDARY SHIELD WALL
COUNTERFLOW HEAT EXCHANGER
REACTOR BLDG SUMP
EL. 84'-6"
INSIDE REACTOR BUILDING
OUTSIDE REACTOR BUILDING
NUCLEAR SAMPLE ROOM
DECAY HEAT COOLERS 3A & 3B
TO MISC RADWASTE STORAGE TANK 3D
INSTR AIR
SPARE

Fig 3

FOLLOW-UP (Cont'd)

ACTIONS	DETAILS
14. IF RCPs are available, THEN ensure: • Seal injection • Seal return • SW cooling AND: a. IF OTSGs available, THEN start 1 RCP in each loop OR start 2 RCPs in one loop OR b. IF OTSGs NOT available, THEN start one RCP.	NOTE RCPs are available when the following criteria are met: • Pump start permissive • Power available NOTE RCP-1B is preferred. IF RCPs NOT available, THEN refer to AP-530, Natural Circulation.

Fig. 5

ENCLOSURE 1

RCP CURVES

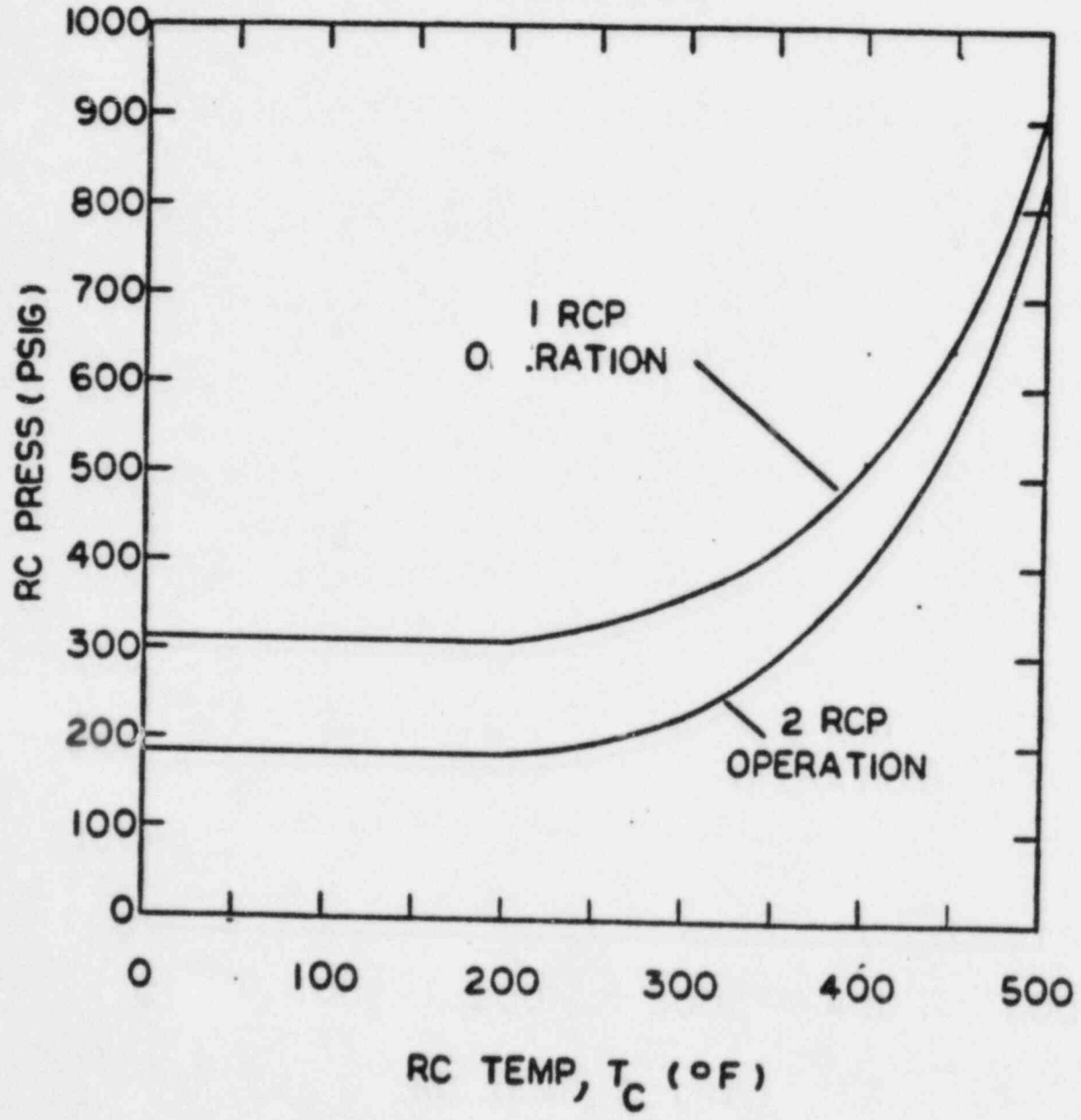
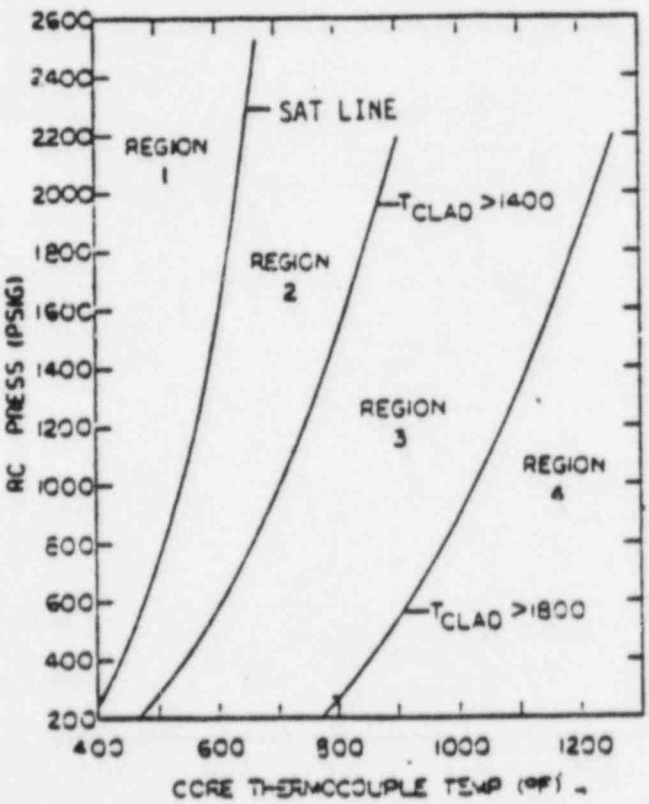


Fig 6

FOLLOW-UP (Cont'd)

ACTIONS	DETAILS
1.8 Refer to Figure 1. o IF in Region 2, THEN go to Step 1.9 o IF in Region 3, THEN go to Section 2.0 (T_{CLAD} > 1400°) o IF in Region 4, THEN go to Section 3.0 (T_{CLAD} > 1800°)	

Figure 1 CORE EXIT FLUID TEMPERATURE FOR INADEQUATE CORE COOLING



Master Answer Key

ANSWERS SECTION 1

1.1 d. Ref: NETRO 10.2-2 (1.0)

1.2 b. Ref: NETRO 11.4-3 (1.0)

1.3 b. Ref: Duke Power Company, FNRE; pp. 126-128 (1.0)

1.4 d. Ref: CR3 HTFF, pp. 158 and 159 (1.0)

1.5 b. Ref: CR3 HTFF pp. 148-156 (1.0)

1.6 a. Ref: 1. Duke Power Company, FNRE; pp. 115-120 (1.0)
2. NETRO, 12.1-4

1.7 b. Ref: 1. OP-210, Rev. 16, p.8 (1.0)
2. NUS, NETRO, Unit 6
3. Westinghouse Reactor Physics, Sect. 3 & 5

1.8 a. Ref: NETRO, p. 10.3-2 (1.0)

1.9 d. Ref: NETPP, p. 6.2-5 (1.0)

1.10 c. Ref: NETPP, p. 6.4-5 (1.0)

1.11 b. Ref: CR3 HTFF p. 151 (1.0)

1.12 b. Ref: Steam tables or Mollier diagram (1.0)

1.13 c. Ref: 1. Westinghouse NTO, p. I-5.77 (1.0)
2. NETRO, 10.5-2
3. Duke Power Company, FNRE; p. 169

1.14 c. Ref: NETRO, p. 10.4-2 (1.0)

1.15 a. Ref: 1. STM-6-17, 18 (1.0)

1.16 a. More Inserted (50% equil Xe; $+\rho$) (2.0)
b. More Inserted (Xe free; $+\rho$)
c. More inserted (535 - 532°F)
d. More Inserted (difference ≈.35%, Curve 3.9)

Ref: OP-210 and OP-103

1.17 c. Ref: 1. GP, HTT and FFF, IIB2, p. 182 (1.0)
2. CR, HTT, Section 1 pp. 71, 157

1.18 b. Ref: TS p. B 3/4 1-1 (1.0)

1.19 d.+a Ref: TS p. 3/4 2-12 (1.0)
TS p. B 2-5

1.20 d. Ref: STS B 6-4 (1.0)

1.21 b Ref: NETPP pp. 6.5-1 to 6.5-3 (1.0)

1.22 c. Ref: CR3 HTFF, 4th from last page (1.0)

1.23 a. axial power imbalance (2.0)

b. reactor power, % thermal power

c. acceptable 3 (& 4) pump operation

d. acceptable 4 pump operation

Ref: TS Figure 3.2.2.

ANSWERS SECTION 2

2.1 b. Ref: ANO-91, p. 6, Rev. 0 (1.0)

2.2 d. Ref: ANO-102, pp. 1, 11, and 14 (1.0)

2.3 b. HP flash tank is correct, MSRLP flash tank is wrong (p. 15) (a); 1A/B, 2A/B heaters do not have non-return valves, pp. 19 & 20 (c); only on 1A/B, 2A/B heaters, pp. 18 & 19 (d). (1.0)

Ref: NAO-99, pp. 15-20

2.4 b. Ref: STM 25-3 (1.0)

2.5 b. Ref: STM2-77 (1.0)

2.6 ~~d.~~ c. Ref. STM2-11 (1.0)

2.7 a. Ref: STM4-2 (1.0)

2.8 d. Caution - N2 heater should not remain energized for extended period with no N2 flow (a); waste disposal system CFV-15F, 16F (b); aux bldg sump (c). (1.0)

Ref: OP-401 p. 7

2.9 c. Ref: STM-12-9 (1.0)

2.10 c. Ref: STM 28-4 (1.0)

2.11 c. Ref: STM 405 p. 2,6, 7 (1.0)

NOTE: (c) is a criterion test item; no, fully redundant (a); raises pH to alkaline (b); DHCCS p. 11 (d).

2.12 1. Upper (Thrust oil bearing) Cooler (2.0)
2. Lower (Guide oil bearing) Cooler
3. Motor air cooler
4. Seal Area Cooler

Ref: STM-23-7 and 8

2.13 a. Ref: STM 22-1 and 44 (1.0)

2.14 a. Ref: STM 17-10 and 12 (1.0)

2.15 d. Ref: STM 17-5 (1.0)

2.16 b. Ref: STM 10-4 and 5 (1.0)

2.17 b. Ref: STM 1-17 (1.0)

2.18 c. Ref: PASS lesson plan RO-105 p. 8 (1.0)

2.19 b. (1.0)

a. 3 hours @ nameplate rating

c. 1-AC, 1-DC

d. overflows to FOST

Ref: 1. STM 15-4 & 5

2. STM 10-8 & 12

2.20 a. A-1, B-2 (0.5)

b. A-2 (0.25)

c. B-1 & A-2 (0.5)

d. B-1 (0.25)

e. A-1 & B-2 (0.5)

Ref: CR Main Steam Handout

2.21 c. Ref: OP-605, p. 5 and 6, Rev. 28 (1.0)

+b

2.22 c. Ref: STM-38-7 (1.0)

2.23 a. 4

b. 3

c. 5

d. 1

Ref: STM 15-17

2.24 1. Open DHV-11 and 12 (LPI to HPI cross connects) (0.33 each)

2. Close MUV-58 & 73 (BWST Suction valves)

3. Open DHV-42 and 43 (RB Sump suction valves)

4. Close (BSV-36 & 37) (NAOH tank outlet valves) - (Not required)

Ref: STM 4-9 thru 12

(check) Open - 42 + 43
Close - 34 + 35

Step 34. Open DHV-34 + 35
check Open DHV-11 + 12
Close MUV-58+73

Step 35. Open 42+43
Close 34+35

3.1 c. Ref: OP 504, p. 3, Rev. 7 (1.0)

3.2 b. Ref: STM 13-2 (1.0)

3.3. a. Ref: STM 12-11 (1.0)
STM 12-13

3.4 a. Ref: STM 20-2, 3 (1.0)

3.5 ~~d.~~ b and d Ref: OP-504, p. 8, Rev. 7 (1.0)
STM 27-56

3.6 'A' 'B' (2.0)

a.	Main FW Block Valve	(FWV-30	FWV-29)	(0.25 ea.)
	Lo-Load " "	(FWV-31	FWV-32)	
	Startup " "	(FWV-36	FWV-33)	
	Emergency " "	(FWV-35	FWV-34)	
	Emergency Bypass Valve	(FWV-162	FWV-161)	
	MFWP Suction Valve	(FWV-14	FWV-15)	
	FW Crosstie "	(--------FWV-28--------)		
	MSIVs	(MSV-411, 412	MSV-413, 414)	

b. 1. Affected OTSGs pressure has recovered to >725 psig (1.0)
2. Rupture matrix is bypassed

Ref: CR SLRM handout

3.7 b.

Ref: Power System Operation (1.0)
R. H. Miller, p. 22-24

3.8 a. Ref: STM 6-4 (1.0)

3.9 b. Ref: RPS Handout, p. 21 (1.0)

NOTE: State lamp - auto reset deadband set for maximum

3.10 Particulate and iodine are looking at buildup on filters. (1.0)
May signify filters have to be changed.

Ref: STM 43-12 to 16

3.11 d. Ref: STM 6-24

3.12 b. Ref: STM 504-93

3.13 c. Ref: STM 43-9

3.14 ~~a.~~ c or d Ref: STM 15-10

3.15 a. Ref: STM 16-10

3.16 d. Ref: RPS Handout, pp. 29, 33, 34

3.17 b Ref: STM 28-18 & 19 (1.0)

~~3.18 d Ref: STM 10-47 & 49~~ (1.0)

3.19 a Ref: STM 2-121 (1.0)

3.20 b Ref: STM 12-14 (1.0)

3.21 d Ref: STM 17-19 (1.0)

3.22 a. 1. 270 ±10 (1.0)

2. 100 ±10 (0.2 each)

3. 170 ±10

4. 50 °

5. 10 °

b. 1. ~~Any Tave~~ Wide Range Tc (1.0)

2. DH-Hx ~~inlet~~ Outlet Temp. (0.5 each)

3. Narrow Range Tc ≥ 520° Incores

Ref: a. OP-209, p. 2, Rev. 48

b. OP-209, p. 11, Rev. 48

4.1 a. NONE (AP-241) (2.5)

b. 1, 2, 3, 7, 8 (AP-242) (0.5 each)

c. 3 (AP-243)

d. 2 (AP-244)

e. 4, 5, 6, 7, 9 (AP-245)

4.2 1. Notify AB operator to ensure SDV-90 closed (0.25)

2. Notify TB operator to stop SDP-7 (0.25)

Ref: AP-277, pg. 2, Rev. 00

4.3 a Ref: AP-320, p. 2, Rev. 00 (1.0)

4.4 d Ref: AP-360, p. 1, Rev. 00 (1.0)

4.5 1. Bypass ES Actuation (.33 each)

2. Return ES equipment to STBY status

3. Go to VP-580

Ref: AP-380, p. 3, Rev. 01

4.6 1. Ensure <u>both</u> MFPs tripped (2.0)

2. Ensure closed: MBVs

LLBVs

SUBVs

3. Ensure <u>both</u> EFWPs start

4. Ensure emergency feedwater block valves open

5. Close FWV-162 (A OTSG)

FWV-161 (B OTSG)

Ref: AP-450, Rev. 1

4.7 d Ref: OP-502, p. 4, Rev. 13 (1.0)

4.8 a +b Ref: OP-502, p. 8, Rev. 13 (1.0)

4.9 c Ref: AP-380, p. 9, Rev. 00 (1.0)

4.10 b Ref: AP-501, p. 3 (1.0)

4.11 b Ref: OP-501, p. 2, Rev. 7 (1.0)

4.12 d Ref: OP-403 (1.0)

4.13 c Ref: OP-204, p. 3 & 4, Rev. 36 (1.0)

4.14 a Ref: EP-120, p. 2, Rev. 00 (1.0)

4.15 a Ref: OP-504, p. 15, Rev. 7 (1.0)

4.16 b Ref: OP-605, p. 3 & 4, Rev. 28 (1.0)

4.17 1. Ensure all feeder BKRs to affected bus are open. (1.0)

2. Close feeder BKR from Units 1 and 2 by holding in "Close" position for 10 seconds:

- 'A' bus BKR 3211
- 'B' bus BKR 3212

Ref: AP-770, p. 2, Rev. 00

4.18 b Ref: RP-101, p. 5, Rev. 19 (1.0)

4.19 b Ref: RP-101, p. 23, Rev. 19 (1.0)

4.20 b Ref: 10CFR 20.101, p. 239, Rev. 1/1/85 (1.0)

4.21 a. False, AI-500, p. 9 (0.5)

b. False, AI-500, p. 9 (0.5)

c. False, OSIM, p. III-2 (0.5)

d. True, OSIM, p. III-3 (0.5)

4.22 e Ref: EP-290, p. 7, Rev. 02 (1.0)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

ENCLOSURE 3

(2 of 2)

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

Facility: Crystal River
Reactor Type: B&W 177
Date Administered: July 9, 1985
Examiner: S. Lawyer
Candidate: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for answers. Write answers on one side only. Staple question sheet on top of the answer sheets. 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 Category Value		Category
25	____	_____	_____	5.	Theory of Nuclear Power Plant Operation, Fluids and Thermodynamics
25	____	_____	_____	6.	Plant Systems: Design, Control & Instrumentation
25	____	_____	_____	7.	Procedures-Normal, Abnormal, Emergency Radiological Control
25	____	_____	_____	8.	Administrative Procedures, Conditions and Limitations
100		_____			TOTALS

Final Grade _____%

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

_____
Candidate's Signature

5.0 THEORY OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW (25.0)

5.1 During a reactor startup, power is being raised above the point of adding heat (POAH). Which of the following statements is CORRECT? (Assume a linear reactor power increase to about 3% power) (1.0)

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

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

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

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

5.2 A general rule is often stated "doubling the count rate halves the margin to criticality." This is mathematically stated by the equation. (1.0)

$$-\frac{CR1}{CR2} = \frac{1\text{-keff } 2}{1\text{-keff } 1}$$

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

a. Both keff1 and keff2 have to be less than 1.0.

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

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

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

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

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

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

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

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

5.4 The reactor trips from full power, equilibrium xenon conditions. Six hours later the reactor is brought critical at 10^{-8}amps on the intermediate range. If power level is maintained at 10^{-8}amps which of the following statements is CORRECT concerning control rod motion? (1.0)

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

b. Rods will have to be inserted due to xenon decay.

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

d. Rods will approximately remain as is as the xenon establishes its equilibrium value for this power level.

5.5 Figure 6.2-3 shows a graph of pump laws i.e., the relationship between pump speed and other pump parameters. Which one of the following parameters is represented by curve 2? (1.0)

a. Power

b. Flow Rate

c. Voltage

d. Discharge Pressure

5.6 Startup of a centrifugal pump with the discharge valve shut is best characterized by which one of the following? (1.0)

a. high motor current and high discharge pressure

b. low motor current and low discharge pressure

c. low motor current and high discharge pressure

d. high motor current and low discharge pressure

5.7 Figure 43, "Surface Utilization vs Flow," represents the heat transfer process in your OTSGs. Which of the following statements is CORRECT concerning Departure from Nucleate Boiling (DNB) Ratio as it relates to this Figure? (1.0)

a. DNBR of 1.0 occurs prior to nucleate boiling and cannot be shown on this figure.

b. DNBR of 1.0 occurs between the nucleate boiling and the film boiling areas.

c. DNBR of 1.0 occurs between the film boiling and the superheat areas.

d. DNBR of 1.0 must be avoided all at costs and does not occur in the OTSGs.

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

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

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

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

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

5.9 An estimated critical boron concentration of 500 ppm was calculated using the information on Worksheet II (attached). Assume the reactor achieved criticality at 80% withdrawn on Group 7. How would this critical rod position change (Group 7 more inserted, more withdrawn or no change) if <u>each</u> of the following conditions was different from that on Worksheet II? Assume no boron change and consider each condition separately.

a. Line 2.2.a. Last power level was 50% FP for 50 hours. (.5)

b. Line 2.2.b. Time shutdown was 72 hours. (.5)

c. Line 4.a. Average RC Temperature was 532F. (.5)

d. Line 5. Group 8 @ 0% WD. (.5)

5.10 One of the characteristics of water is that it will hold gases dissolved in solution. Which of the following will <u>INCREASE</u> the concentration of dissolved gases in a quantity of water? (1.0)

a. Increasing the pressure and/or lowering the temperature.

b. Decreasing the pressure and/or lowering the temperature.

c. Increasing the pressure and/or raising the temperature.

d. Decreasing the pressure and/or raising the temperature.

5.11 In the feedwater subsystem of the ICS, feedwater demand is modified as a function of feedwater temperature. Select the <u>CORRECT</u> statement concerning this feedwater temperature compensation. (1.0)

a. Since feedwater temperature remains constant as power increases, additional heat must be provided in the OTSG for the steam to reach the proper superheat criteria.

b. FW must be temperature compensated to account for the differing mass content of a gallon of water as temperature varies.

c. The effect of cooler FW entering the OTSG is that aspirating steam flow is reduced, header pressure decreases, and therefore, MW gen will decrease.

d. The FW temperature compensation will affect the BTU limit calculation but have no affect on the FW demand signal.

5.12 To maintain steam header pressure constant, it is necessary for OTSG steam pressure to _____ by approximately 25 psig from no load to full load. This is in response to the laws of fluid dynamics which state that as the flow of steam increases in a steam line, the pressure drop experienced per unit line length _____. (1.0)

a. increase; increases

b. increase; decreases

c. decrease; increases

d. decrease; decreases

5.13 Which one of the following is NOT part of the bases for the Tech Spec minimum temperature for criticality? (1.0)

a. Pressurizer is capable of being in an operable status with a steam bubble.

b. Reactor pressure vessel is above its minimum RT_{NDT} temperature.

c. Protective instrumentation is within its normal operating range.

d. Minimum DNBR is maintained during normal operation and short term transients.

5.14 You are plotting an inverse multiplication plot (1/m) during fuel loading. When fuel is loaded so that the distance between the detector and the fuel steadily decreases, the 1/m plot will look like ____ in Figure 5.21. (1.0)

a.

b.

c.

d.

5.15 A synchroscope moving slowly in the SLOW direction (counter-clockwise) indicates which of the following? (1.0)

a. Machine frequency higher than bus frequency, phases not matched.

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

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

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

5.16 The Main Steam Line Break Accident forms the basis for the Shutdown Margin requirement at End-of-Life (EOL) conditions because: (1.0)

a. Beta-effective is at its maximum value.

b. MTC is at its most negative value.

c. Control rod insertion limits are most restrictive.

d. Hot channel factors are at the most conservative values.

5.17 The process of hydrogen generation in the reactor building after a LOCA which is controlled by the addition of caustic (NaOH) is: (1.0)

a. Radiolysis

b. Zirc-water reaction

c. Hydrogen coming out of solution

d. Zinc-boric acid reaction

5.18 Which of the following is NOT one of the conditions necessary for brittle fracture? (1.0)

a. plastic deformation at or below the yield point.

b. temperature at or below the NDTT

c. nominal stress level

d. flaw such as a crack present

5.19 The startup, intermediate and power range channels all use boron in their respective detectors (BF_3 or boron lined). Which of the following is the CORRECT reason for use of boron? (1.0)

a. It reduces the critical volume (size) of the detector. Detectors which rely soley on gas ionization by neutrons are much larger.

b. Neutrons do not carry a net electric charge. Neutron detection must depend upon their interaction with target nuclei.

c. Ionization of the Boron by neutrons is much more responsive and accurate than other ionizations such as neutron-rhodium used in the in-core detectors.

d. The neutron-boron reaction produces beta particles which have a much higher specific ionization than neutrons alone.

5.20 Power peaking is not a directly observable quantity, therefore, limits have been established on the basis of Axial Power Imbalance produced by the power peaking. In addition to maintaining Axial Power Imbalance within prescribed limits, What three limitations on control rod movement ensure that hot channel factors are maintained? (1.5)

5.21 Answer the following TRUE or FALSE concerning the Small Break LOCA analyses and reactor coolant pump trip criteria:

a. The worst case SBLOCA was found to be a cold leg break in RCP discharge piping. (0.5)

b. The analyses assume that the RC pumps remain operative for some time after the break and then are lost by some means (loss-of-off-site power, equipment failure, etc.) (0.5)

c. If the RC pumps remain operating throughout the blowdown and reflood phase, the peak clad temperature critieria (PCT) would not be exceeded. (0.5)

d. With the RCPs lost and only one HPI pump operating, the PCT criteria would be exceeded; with both HPI pumps operating, it would not be exceeded. (0.5)

5.22 The RC pump power monitors have both high (262%) and low (20.9%) setpoints. The low setpoint is based on the maximum time within which a trip must occur to provide DNBR protection for the four pump coastdown. What is the high setpoint based on? (0.5)

5.23 Select the CORRECT statement concerning pump cavitation. (1.0)

a. Vapor bubbles are formed when the enthalpy difference between the pump discharge and pump suction exceeds the latent heat of vaporization.

b. When the vapor bubbles enter a higher pressure region, the bubbles collapse which produces high pressure pulses or shock waves.

c. Vapor cavities (bubbles) are produced when the localized pressure exceeds the vapor pressure at the existing temperature.

d. As the vapor bubbles are discharged from the pump they impinge on downstream piping and valves causing water hammer.

END OF SECTION 5

6.0 PLANT SYSTEMS: DESIGN, CONTROL, AND INSTRUMENTATION (25.0)

6.1 Which of the following statements concerning the reactor building isolation and cooling system (RBI & CS) interlocks is CORRECT? (1.0)

a. RBI and CS can be bypassed before it is actuated but only if RB pressure >2 psig.

b. Only two of the three channels of actuation are required to be bypassed by the system logic for the operator to regain control of all components actuated by the RBI & CS.

c. Once a component has been actuated to its ES position, it will remain in that position except the RB fans which can be shifted to FAST speed if required.

d. The RBI and CS actuation will override any other signal except the control signal.

6.2 Select the INCORRECT statement concerning the Chilled Water System. (1.0)

a. The system supplies low temperature water to the Control Complex Air Handlers, Post Accident Sampling Coolers, Penetration Air Handlers, and Switchgear Room.

b. The Chilled Water System pumps (CHP-1A & 1B) are powered from 480V ES MCCs.

c. The Water Chiller units can be cooled by either Nuclear Services Closed Cycle Cooling or Secondary Services Closed Cycle Cooling.

d. Under accident conditions, only the Control Complex Air Handler cooling function is required to be operable.

6.3 Select the CORRECT statement concerning the Heater Drain and Vent System. (1.0)

a. The only heater drain valves that have control switches on the Main Control Board are the high level dumps for the MSR HP flash tanks and the high level dumps for the MSR LP Flash Tanks.

b. A high level in the 1A, 1B, 2A, and/or 2B heaters will trip the main turbine.

c. All condensate and feedwater heaters have extraction steam non-return valves to prevent damage to the LP turbines.

d. When the main turbine trips, the high level dump valves on all condensate and feedwater heaters open and dump to the main condenser.

6.4 The synchronizing pin and bearing in the upper portion of the rotor tube in the Control Rod Drive Mechanism (CRDM) is used to ensure... (1.0)

a. uniform rod speed over full travel

b. proper direction of rotation

c. both segment arms move together

d. correct place relationship between individual rods within a group.

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

a. Unloader valves

b. Relief valves

c. High pressure accumulators

d. Pressure switches

6.6 The Nuclear Services Closed Cycle Cooling System supplies four separate coolers on each Reactor Coolant Pump and Motor. LIST these four coolers. (1.0)

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

a. Main lube oil pump

b. Main gear oil pump

c. Backup gear oil pump

d. Backup lube oil pump

6.8 Which one of the following statements is CORRECT regarding the design of the emergency diesel generator air start system? (1.0)

a. There are two valves, one manual and the other remotely operated, in the interconnecting line between the two diesel air start systems.

b. The manual air shutoff valve between the air reservoirs and its starting air manifold is provided with an alarm switch which actuates whenever the valve is not fully open.

c. An air pressure low alarm (APLA) pressure switch alarms at 150 psig decreasing and auto starts the DC compressor motor.

d. The pressure switch that auto starts and stops the AC motor (at 225 psig and 250 psig respectively) does not function when the DC motor is used; the DC motor must be started and stopped manually.

6.9 Four Post Accident Sampling System (PASS) containment isolation valves are circled on the attached Figure 3. Of these, all but one must be deenergized during normal operation. Which one? (1.0)

a. CAV-429

b. CAV-430

c. CAV-431

d. CAV-432

6.10 Select the CORRECT statement concerning the Diesel Generator fuel oil system. (1.0)

a. Sufficient fuel oil is stored in each unit's day tank for approximately 24 hours at name plate rating.

b. The two 30,000 gallon fuel oil storage tanks have a double valve connection between them to provide additional fuel capacity to either diesel generator unit.

c. Both fuel oil transfer pumps on each DG are DC powered to provide redundancy in case of a station blackout.

d. Care must be taken when filling the day tank from a storage tank since the day tank overflows to the waste system.

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

a. Overspeed

b. Low deaerator level

c. Suction valves not full open

d. Main steam line rupture matrix actuation

6.12 In the long term, following a SBLOCA, the BWST has reached its lo-lo level alarm setpoint, but RCS pressure has remained above the shutoff head of the LPI pumps. LIST the sequence of valve manipulations (by name or number) that are necessary to set up the LPI and HPI systems for continued injection into the RCS. (Six valves required.) (1.0)

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

a. The station will control in either auto or manual, whichever was last selected.

b. The station will not control in either auto or manual.

c. The station will control in auto since auto overrides when both are selected.

d. The station will control in manual since manual overrides when both are selected.

6.14 Which of the following statements is CORRECT concerning the source range channels? (1.0)

a. The source range signals originate in two high sensitivity BF_3 detectors that operate in the proportional range.

b. The detectors are surrounded by lead shielding, thus making gamma compensation unnecessary.

c. Due to the low level pulses from the detectors, preamplifiers located in the RPS cabinets are required to provide impedance matching.

d. Due to their sensitivity, long term outages will have no noticeable effect on the range of indication.

6.15 Assume the reactor tripped on high Th of 618°F. After Th stabilized at a lower value (550°F) what would you expect to see on the Output State Lamp and Output Memory Lamp for the Th bistables in each RPS cabinet? (1.0)

a. both lamps dim

b. both lamps bright

c. Output State Lamp - dim
Ouput Memory Lamp - bright

d. Output State Lamp - bright
Output Memory Lamp - dim

6.16 Which one of the following is CORRECT concerning the fuel handling controls? (1.0)

a. Simultaneous movement of the bridge, trolley and hoist is permitted only with the fuel grapple mechanism disengaged.

b. Movement of the bridge or trolley is not possible unless the grapple (engaged or disengaged) is raised entirely up into the mast.

c. The grapple mechanism cannot be disengaged by operator error or electric or hydraulic failure when the grapple is loaded.

d. A limit switch is provided to prevent raising the fuel assembly above minimum shielding depth.

6.17 Select the CORRECT statement concerning the FW Pump Discharge Crossover Valve, FWV-28. (1.0)

a. During normal full power operation, the valve is open with its control switch in AUTO position.

b. On reset of the steam line rupture matrix it will automatically open.

c. It will auto close on actuation of either steam line rupture matrix or ES channels A and B.

d. The auto open signal comes from a pressure switch on the main feedwater pump control oil pressure.

6.18 a. LIST by name or number the valves that will be isolated following actuation of the Steam Line Rupture Matrix. Consider either OTSG. (2.0)

b. What are the two conditions, either of which must be satisfied in order to reopen any of the isolated valves? (1.0)

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

a. both the outgoing and the incoming will close

b. both the outgoing and the incoming will trip

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

d. the outgoing will trip before the incoming will close

e. the outgoing will trip after the incoming closes

6.20 Which one of the following choices of depressing STOP push-buttons will, by itself, trip the diesel generator output breaker? ~~(1.0)~~

delete

a. stop pushbutton in the control room

b. one stop push button on the diesel gaugeboard

c. both stop push buttons on the diesel gaugeboard

d. stop pushbutton on the diesel generator local control panel by the D-G air start compressor

6.21 Which of the following statements about RB Purge control is CORRECT? (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. RB purge exhaust fans are operated from the "ES" panel and the isolation valves are operated from the H&V panel.

d. Purge valves are automatically closed and supply and exhaust fans trip on a HIGH radiation alarm from RM-A-1.

6.22 Which one of the following is an interlock provided on the waste gas disposal system at Crystal River? (1.0)

a. If a waste gas decay tank discharge exceeds 50 cfm a flow sensor will close that tanks discharge valve (WDV-436, WDV-437, or WDV-438).

b. High Radiation on RM-A-11 will close the waste gas decay tank outlet to the recycle valves (WDV-393, WDV-394, and WDV-395).

c. Each waste gas decay tank inlet valve is interlocked so it cannot be opened unless the outlet valves are open for that tank.

d. High Radiation on RM-A-2 will close the waste gas discharge auto control valve (WDV-439).

e. A pressure greater than 80 psig in all waste gas decay tanks will close ventilation dampers D-29 (supply) and D-36 (exhaust) isolating the waste gas surge tank and decay tank area.

6.23 Select the CORRECT statement concerning instruments and controls associated with the Fuel Handling Bridge. (1.0)

a. The selsen unit consists of a synchro transmitter which is used to indicate the relative position of the Trolley.

b. The Z-Z tape is a stainless steel measuring tape that provides the interlock that actuates the "Grapple Tube Up" Light.

c. The weight range over which the Dillon load cell is indicating is manually selected from the inside of the control panel.

d. The main bridge is located in the East-West direction by means of a sight window which the operator lines up against the fixed scale on the rails.

END OF SECTION 6

7.0 PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL (25.0)

7.1 The Immediate Actions, in response to High Alarms from Atmospheric Radiation Monitors RM-A1 through RM-A5, require you to "ensure stopped" various ventilation fans. Match the fans you are required to ensure stopped with the appropriate monitor and procedure. (2.5)

NOTE: Some fans may be required in more than one procedure.

a.	RM-A1 (AP-241)	1.	AHF-9A & 9B
b.	RM-A2 (AP-242)	2.	AHF-10
c.	RM-A3 (AP-243)	3.	AHF-11A and 11B
d.	RM-A4 (AP-244)	4.	AHF-17A and 17B
e.	RM-A5 (AP-243)	5.	AHF-19A and 19B
		6.	AHF-20A and 20B (or in slow speed)
		7.	AHF-30
		8.	AHF-34
		9.	AHF-44A and 44B

7.2 List your immediate actions in response to an alarm from RM-L7. (0.5)

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

a. Select "DISABLE" on "HIGH ALARM" toggle switch OR "LO ALARM" toggle switch.

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

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

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

7.4 The following is the first immediate action under AP-380, "Engineered Safeguards system actuation". IF SRMA present OR RC PRESS < 1500 psig, THEN depress "HPI Actuation" Pushbutton "A" and "B". What are the Remedial Actions associated with this step? (1.0)

7.5 LIST your Immediate Actions to AP-450, "Emergency Feedwater Actuation." (2.0)

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

a. Less than three stators are energized and the reactor is NOT critical.

b. RC system temperature is between 200°F and 300°F.

c. Air temperature around the drives in the service structure is less than 150°F.

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

7.7 If OTSG's are available, Step 14.a of AP-380 (see Figure 5 & 6 attached) requires the starting of a number of RCPs in a particular loop configuration. (NOTE: Some information has been deleted from Figure 5 & 6). If the RC pressure is 300 psi and RC temperature (Tc) is 300°F, you should: (1.0)

a. start one pump in either loop

b. start one pump in each loop

c. start two pumps in either loop

d. start two pumps in each loop

e. Refer to AP-530

7.8 Annunciator Window I-2-3 on the ICS Panel is labeled "Pressure Transient in Progress." Which one of the following is a CORRECT indicated condition for this annunciator? (1.0)

a. Pressurizer Safety Valve Open

b. High RC pressure at low temperature (NDTT)

c. High RCS pressure (above trip setpoint)

d. HPI Actuation on low RCS pressure

7.9 ICS procedure, OP-501 states in part, "If operating signal source malfunctions make signal source transfer necessary, transfer to another signal source should be done ... " Which one of the following CORRECTLY completes this statement? (1.0)

a. immediately after placing the affected ICS station in HAND.

b. immediately, regardless of ICS operating mode.

c. only after checking the computer for a valid alternate signal and placing the affected ICS station in HAND.

d. only after checking the computer for a valid alternate signal; affected ICS station may be in HAND or AUTO.

7.10 Which one of the following is an appropriate "immediate" action according to EP-120, "Inadequate Shutdown Value?" (1.0)

a. Stop cleanup.

b. Establish letdown flow to MUT $\geq$ 40 gpm.

c. Start boric acid pump CAP-3A or 3B.

d. Verify reactor trip, go to VP-580.

7.11 Which one of the following is CORRECT concerning the operation of the ICS main feedwater pump speed control station? (1.0)

a. Tripping of the associated feedwater pump will inhibit "auto" operation and light both "auto" and "hand" lamps.

b. Care should be taken when simultaneously transferring both Loops "A" and "B" main feedwater pump control stations to "auto".

c. "Meas-VAR" position indicates feedwater demand error when the main block valves are shut.

d. "MEAS-VAR" position indicates feedwater train ΔP when the main block valves are open.

7.12 Which one of the following is a CORRECTLY stated Limit and Precaution as contained in OP-605, "Feedwater System". (1.0)

a. If at any time emergency FW pump discharge drops to zero pressure, immediately secure the pump under all operating conditions.

b. If at any time emergency FW pump discharge drops to to zero pressure, immediately secure the pump, except under emergency operation.

c. The motor-driven emergency FW pump (EFP-1) will not auto-start if emergency diesel generator 3B (EDG-3B) is running and closed onto its respective bus.

d. The motor-driven emergency FW pump (EFP-1) will not auto-start if emergency diesel generator 3B (EDG-3B) is running with its output breaker open.

7.13 Which one of the following is CORRECT concerning the bridge and trolley limit switches and interlocks? (1.0)

a. All limit switches may be bypassed with the exception of the proximity switches.

b. A proximity switch on the right side of eacn bridge prevents the two bridges from running into each other.

c. The auxiliary bridge has a right limit switch to prevent running into the reactor vessel head locating studs.

d. To move the trolley the fuel grapple must be up and disengaged.

7.14 Who determines whether a person is a "qualified bridge operator?" (1.0)

a. CNO

b. Shift Supervisor on duty

c. Training Manager

d. Operations Superintendent

7.15 Under which of the following conditions are you required to manually trip the reactor during a startup? (1.0)

a. A main steam isolation valve goes closed.

b. The reactor goes critical with Group 5 below insertion limits.

c. A startup rate > 1 DPM is achieved.

d. Pressurizer level goes above 290 inches.

7.16 With the reactor < 40% FP, which of the following operations would NOT require bypassing the RCP Power Monitors? (1.0)

a. Paralleling an EDG to a 4160V bus.

b. Switchover between startup and unit auxiliary transformers.

c. Energizing an idle RCP.

d. De-energizing an operating RCP.

7.17 If loss of seal injection occurs on a secured RCP (with plant operating or in hot standby) which of the following actions is required? (1.0)

a. No action required if seal return temperature remains < 180°F.

b. Close the controlled bleed off valve if seal return temperature reaches 155°F.

c. Immediately shut seal injection valve, start standby makeup pump, then reopen injection valve.

d. Secure remaining pumps until cause of loss is determined.

7.18 An Immediate Action to AP-770, "Emergency Diesel Generator Actuation" is: (1.0)

IF under voltage exists on 4160V ES bus, then ensure affected bus is energized by EDG.

What are the Remedial Actions associated with this step?

7.19 Which one of the following "Radiation Area" definitions means the same as that given in RP-101, "Radiation Protection Manual"? (1.0)

a. any area where the dose rate exceeds five mrem/hr or where, in any five (5) consecutive day period, exceeds 100 mrem/hr at any time.

b. any accessible area where a major portion of the body could exceed a dose of five mrem in any one (1) hour, or in any five (5) consecutive days a dose in excess of 100 mrem.

c. any accessible area where any portion of the body could exceed a dose rate of five mrem/hr or where, in any five (5) consecutive day period, could exceed a dose rate of 100 mrem/hr at any time.

d. any area where the dose rate to any portion of the body could exceed a dose of five mrem in any one (1) hour, or in any five (5) consecutive days a dose in excess of 100 mrem.

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

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

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

c. The background reading should be less than 300 dpm/100 cm^2.

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

7.21 Which one of the following is CORRECTLY stated regarding a permissible dose to an operator in a restricted area as specified in 10CFR 20. (1.0)

a. Under non-accident conditions, the operator is permitted to receive no more than 7½ rems per calendar quarter to each hand and to each foot.

b. Under non-accident conditions, the operator is permitted to receive no more than 1¼ rad of beta per calendar quarter to the lens of the eye.

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

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

7.22 According to EP-290, "Inadequate Core Cooling", the hot leg vents should be used under two separate conditions. Which of the following choices states those conditions. (See page 7 of EP-290 attached for reference to "Regions"). (1.0)

a. Pzr press >1500 psig; press and temperature in Region 2

b. Pzr press >1500 psig; subcooling margin <50°F

c. Pzr press >1500 psig; press and temperature in Region 3

d. Pzr press >2300 psig; subcooling margin <50°F

e. Pzr press >2300 psig; press and temperature in Region 3

7.23 Select the CORRECT statement concerning the "Waste Gas Disposal System," OP-412. (1.0)

a. The "Warning" and "High" setpoints on the radiation monitors are adjusted by Chem Rad and verified by the Shift Supervisor.

b. If the meteorological instrumentation is inoperable, wind speed, direction and delta temperature may be estimated and the release may proceed.

c. Any waste gas tank to be released to the environment must be recirculated through at least two tank volumes prior to sampling.

d. It is not required to completely isolate the tank, nor initiate a Release Permit when discharging a waste gas decay tank to containment.

END OF SECTION 7

8.0 ADMINISTRATIVE PROCEDURES, CONDITIONS AND LIMITATIONS (25.0)

8.1 During a plant startup with the reactor at 2% power, one power range channel (NI-6) for example), is found to be inoperable. Which of the following statements is CORRECT? Refer to the attached Tech Specs. (1.0)

a. Operation above 5% Rated Thermal Power is not allowed until the inoperable channel is repaired and declared operable.

b. If NI-6 is placed in a tripped condition AND the other three channels are operable, you must reduce the Nuclear Overpower Trip Setpoint to $\leq$ 85% and Thermal Power is restricted to $\leq$ 75%.

c. If NI-6 is placed in a tripped condition AND the other three channels are operable, operation to 100% Rated Thermal Power is unrestricted.

d. The only restrictions on proceeding to 100% Rated Thermal Power are that NI-6 be placed in a tripped condition and Quadrant Power Tilt be monitored at least once per 12 hours.

8.2 Which of the following statements is CORRECT concerning the Quandrant Power Tilt (QPT)? (1.0)

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

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

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

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

8.3 Which one of the following is CORRECT regarding EM-201, "Duties of an Individual Who Discovers an Emergency"? (1.0)

a. Any individual discovering an emergency condition has the authority to implement this procedure to the fullest extent of his qualifications.

b. Primary examples of emergency conditions covered by this procedure are tornado, acid and caustic spills, security threats and any other emergencies not involving radioactive material.

c. An individual who discovers an emergency condition shall notify the control room and the nuclear plant manager or his designee.

d. The individual should take any immediate action that will minimize the emergency except extinguishing fires; fires shall only be fought by the fire brigade members.

8.4 According to administrative procedure AI-100, an individual should not be permitted to work more than 24 hours in any _____-hour period (excluding shift turnover time) unless authorized at the _____ level or above. (Choose the correct pair below.) (1.0)

a. 48, Nuclear Operations Superintendent

b. 48, Nuclear Plant Manager

c. 72, Nuclear Operations Superintendent

d. 72, Nuclear Plant Manager

8.5 Which one of the following type of procedures must be step-by-step (as opposed to guidance) according to AI-500, "Conduct of Operations?" (1.0)

a. Those which directly effect the mitigation of unusual events.

b. Those which directly effect containment integrity.

c. Those which provide for coping with plant emergency conditions.

d. Those which provide the details of on-shift practices.

8.6 An event in process which indicates a potential degradation of the level of safety of the plant is classified as: (1.0)

a. an unusual event

b. an alert

c. a site emergency

d. a general emergency

8.7 If you are escorting a visitor while you are off shift when a Site Emergency is declared, you must: (1.0)

a. Direct the visitor to the PEA by the most direct route.

b. Escort the visitor off site.

c. Direct the visitor to remain with you on site.

d. Escort the visitor to the control room.

8.8 Immediate notification of NRC and DHRS is required if the release of radioactive materials in concentrations which, if averaged over a perid of 24 hours, would exceed _____ times the limits specified for such materials in Appendix "B", Table II of 10CFR 20; _____ damage to property in excess of $_____. Fill in the blanks with the CORRECT information by choosing ONE of the below combinations. (1.0)

a. 500; or; 2,000

b. 500; and; 2,000

c. 5,000; or; 200,000

d. 5,000; and; 200,000

8.9 TRUE OR FALSE

a. In order to raise a new fuel assembly or dummy fuel assembly with the new fuel elevator, it requires the approval of either the Refueling Supervisor OR the Reactor Specialist. (0.5)

b. In order to raise an irradiated fuel assembly with the new fuel elevator, it requires the approval of both the Refueling Supervisor AND the Reactor Specialist. (0.5)

8.10 Complete the following statement by selecting the CORRECT fill in from below. (1.0)

"When two (2) irradiated fuel assemblies are being handled within the FTC, a minimum separation of _____ ft. shall be maintained between the assemblies at all times.

a. 3

b. 5

c. 10

d. 23

8.11 Answer the following TRUE or FALSE regarding various Tech Spec Surveillance Requirements.

a. While subcritical in Mode 2, verifying that the regulating rod groups are above the insertion limits is an acceptable method of determining that the shutdown margin Tech Spec is met. (0.5)

b. Since APSR's do not insert on a reactor trip, they have no surveillance requirements regarding operability (except for their position indication system). (0.5)

c. Even though the core flood tank isolation valves are open with their breakers in "Lock Reset" (Modes 1 & 2), a surveillance requirement exists for verifying each isolation valve is open. (0.5)

d. Surveillance requirements have to be performed on inoperable equipment if the equipment is inoperable due to an auxiliary system failure that does not prevent operation of the equipment (for example, air compressor failure on a DG renders the diesel INOP). (0.5)

8.12 What is the time interval at which a short-term instruction automatically expires? (1.0)

a. whenever reissued

b. 30 days after issue

c. 90 days after issue

d. at the beginning of the next refueling outage

8.13 Crystal River operating policy gives guidance on the primary to secondary steam generator tube leakage at which consideration should be given to shutting down the plant? What is that leak rate? (1.0)

a. anything greater than zero, since it is pressure boundary leakage

b. .3 gpm

c. 1 gpm

d. 10 gpm

8.14 The attached Figure 2 is the Crystal River Technical Specifications bases Figure 2.1. Which one of the following statements is CORRECT concerning these curves? (1.0)

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

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

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

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

8.15 Only one of the following components has a maximum boron concentration specified in Technical Specification for the operational MODE indicated. Which one? (1.0)

a. Pressurizer - MODE 2

b. Concentrated boric acid storage system - MODE 3

c. Core flood tank - MODE 4

d. BWST - MODE 5

8.16 DG A, which supplies ES 4 KV Bus A is INOPERABLE. LPI pump B supplied by ES 4 KV Bus B is INOPERABLE. The Tech Specs for ECCS subsystems and AC Sources are attached. Which statement is CORRECT concerning continued Operation in Mode 1? (1.0)

a. The Action Statements for both the LPI pump and the DG are applied independently, each must be restored to OPERABLE in 72 hours.

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

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

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

8.17 If the shutdown margin is less than 1% $\Delta k/k$ in Mode 5, the required action is _____ and continued boration at $\geq$ _____ gpm of 11,600 ppm boric acid solution or its equivalent until the required SHUTDOWN MARGIN is restored. (1.0)

a. immediately initiate, 1

b. within 15 minutes initiate, 10

c. immediately initiate, 10

d. within 15 minutes initiate, 1

8.18 During hydrostatic testing operations above system design pressure, what is the maximum temperature change permitted by Tech Specs in any one hour period? (1.0)

a. 5°F

b. 50°F

c. 100°F

d. no limit

8.19 The Tech Spec ECCS limits on BWST minimum volume and boron concentration ensure that: (Select one of the following). (1.0)

a. sufficient borated water is available within containment to absorb 99% of the iodine released in a LOCA.

b. the 2 hour thyroid dose at the site boundary will be consistent with the analysis presented in the FSAR for postulated steam generator tube rupture.

c. the reactor coolant system can be cooled down to less than 280°F from normal operating conditions in the event of a total loss of off-site power concurrent with a LOCA.

d. the reactor will remain subcritical in the cold condition following mixing of the BWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly.

8.20 a. What is the <u>only</u> condition under which the designated "Operator at the Controls" can leave the red-carpeted general area for non-emergency purposes? (1.0)

b. In the event of an emergency affecting the safety of operations, the "Operator at the Controls" may momentarily be absent from the general area in front of the control board provided .... (Complete this sentence). (1.0)

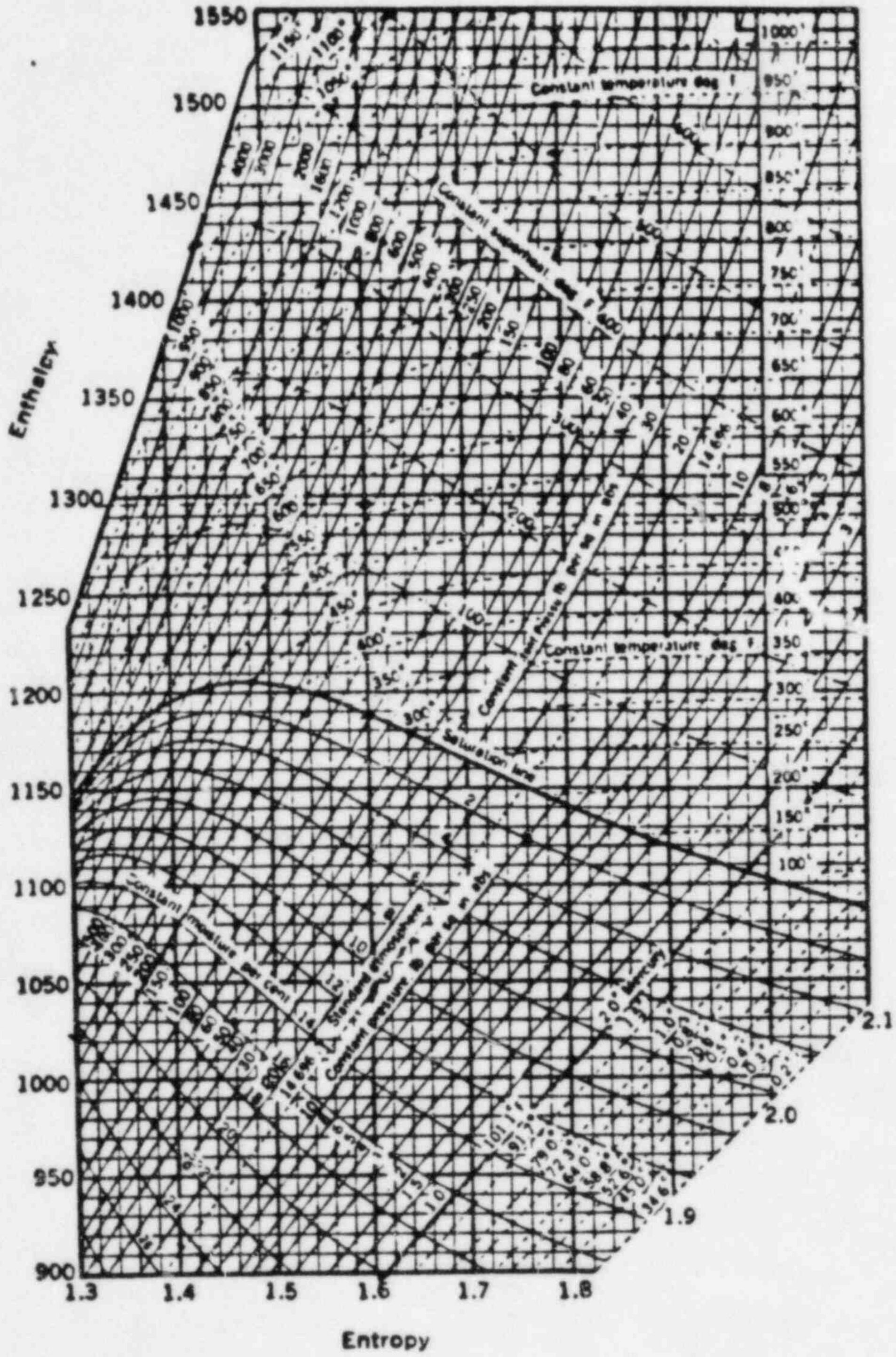
8.21 When a reactor trip or plant shutdown occurs, the Nuclear Shift Supervisor first ensures that the plant is placed in a safe condition by having the necessary operations performed in accordance with approved procedures.

a. He then makes 5 notifications: List them. (1.0)

b. Explain the NSS's responsibilities concerning Form 912212, Reactor Trip and Shutdown Report. (1.0)

8.22 When performing a valve lineup or power supply breaker position verification, what are the two conditions that should not be signed off? (1.0)

END OF SECTION 8



Mollier diagram for steam

TABLE D-1.*
Properties of Dry Saturated Steam *
Pressure

Abs press. psia	Temp. °F	Specific volume		Enthalpy			Entropy		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor	Sat liquid	Evap	Sat vapor
p	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
1.0	101.74	0.01614	333.6	69.70	1036.3	1106.0	0.1326	1.8456	1.9782
2.0	126.08	0.01623	173.73	93.99	1022.2	1116.2	0.1749	1.7451	1.9200
3.0	141.48	0.01630	118.71	109.37	1013.2	1122.6	0.2008	1.6855	1.8863
4.0	152.97	0.01636	90.63	120.86	1006.4	1127.3	0.2198	1.6427	1.8625
5.0	162.24	0.01640	73.52	130.13	1001.0	1131.1	0.2347	2.6094	1.8441
6.0	170.06	0.01645	61.98	137.96	996.2	1134.2	0.2472	1.5820	1.8292
7.0	176.85	0.01649	53.64	144.76	992.1	1136.9	0.2581	1.5586	1.8167
8.0	182.86	0.01653	47.34	150.79	988.5	1139.3	0.2674	1.5383	1.8057
9.0	188.28	0.01656	42.40	156.22	985.2	1141.4	0.2759	1.5203	1.7962
10	193.21	0.01659	38.42	161.17	982.1	1143.3	0.2835	1.5041	1.7876
14.696	212.00	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
15	213.03	0.01672	26.29	181.11	969.7	1150.8	0.3135	1.4415	1.7549
20	227.96	0.01683	20.089	196.16	960.1	1156.3	0.3356	1.3962	1.7319
25	240.07	0.01692	16.303	208.42	952.1	1160.6	0.3533	1.3606	1.7139
30	250.33	0.01701	13.746	218.82	945.3	1164.1	0.3680	1.3313	1.6993
35	259.28	0.01708	11.898	227.91	939.2	1167.1	0.3807	1.3063	1.6870
40	267.25	0.01715	10.498	236.03	933.7	1169.7	0.3919	1.2844	1.6763
45	274.44	0.01721	9.401	243.36	928.6	1172.0	0.4019	1.2650	1.6669
50	281.01	0.01727	8.515	250.09	924.0	1174.1	0.4110	1.2474	1.6585
55	287.07	0.01732	7.787	256.30	919.6	1175.9	0.4193	1.2316	1.6509
60	292.71	0.01738	7.175	262.09	915.5	1177.6	0.4270	1.2168	1.6438
65	297.97	0.01743	6.655	267.50	911.6	1179.1	0.4342	1.2032	1.6374
70	302.92	0.01748	6.206	272.61	907.9	1180.6	0.4409	1.1906	1.6315
75	307.60	0.01753	5.816	277.43	904.5	1181.9	0.4472	1.1787	1.6259
80	312.03	0.01757	5.472	282.02	901.1	1183.1	0.4531	1.1676	1.6207
85	316.25	0.01761	5.168	286.39	897.8	1184.2	0.4587	1.1571	1.6158
90	320.27	0.01766	4.896	290.56	894.7	1185.3	0.4641	1.1471	1.6112
95	324.12	0.01770	4.652	294.56	891.7	1186.2	0.4692	1.1376	1.6068
100	327.81	0.01774	4.432	298.40	888.8	1187.2	0.4740	1.1286	1.6026
110	334.77	0.01782	4.049	305.66	883.2	1188.9	0.4832	1.1117	1.5948

TABLE D-1a
Properties of Dry Saturated Steam *(continued)*
Pressure

Abs press psia	Temp °F	Specific volume		Enthalpy			Entropy		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor	Sat liquid	Evap	Sat vapor
P	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
120	341.25	0.01789	3.728	312.44	877.9	1190.4	0.4916	1.0962	1.5878
130	347.32	0.01796	3.455	318.81	872.9	1191.7	0.4995	1.0817	1.5812
140	353.02	0.01802	3.220	324.82	868.2	1193.0	0.5069	1.0682	1.5751
150	358.42	0.01809	3.015	330.51	863.6	1194.1	0.5138	1.0556	1.5694
160	363.53	0.01815	2.834	335.93	859.2	1195.1	0.5204	1.0436	1.5640
170	368.41	0.01822	2.675	341.09	854.9	1196.0	0.5266	1.0324	1.5590
180	373.06	0.01827	2.532	346.03	850.8	1196.9	0.5325	1.0217	1.5542
190	377.51	0.01833	2.404	350.79	846.8	1197.6	0.5381	1.0116	1.5497
200	381.79	0.01839	2.288	355.36	843.0	1198.4	0.5435	1.0018	1.5453
250	400.95	0.01865	1.8438	376.00	825.1	1201.1	0.5675	0.9588	1.5263
300	417.33	0.01890	1.5433	393.84	809.0	1202.8	0.5879	0.9225	1.5104
350	431.72	0.01913	1.3260	409.69	794.2	1203.9	0.6056	0.8910	1.4966
400	444.59	0.0193	1.1613	424.0	780.5	1204.5	0.6214	0.8630	1.4844
450	456.28	0.0195	1.0320	437.2	767.4	1204.6	0.6356	0.8378	1.4734
500	467.01	0.0197	0.9278	449.4	755.0	1204.4	0.6487	0.8147	1.4634
550	476.94	0.0199	0.8424	460.8	743.1	1203.9	0.6608	0.7934	1.4542
600	486.21	0.0201	0.7698	471.6	731.6	1203.2	0.6720	0.7734	1.4454
650	494.90	0.0203	0.7083	481.8	720.5	1202.3	0.6826	0.7548	1.4374
700	503.10	0.0205	0.6554	491.5	709.7	1201.2	0.6925	0.7371	1.4296
750	510.86	0.0207	0.6092	500.8	699.2	1200.0	0.7019	0.7204	1.4223
800	518.23	0.0209	0.5687	509.7	688.9	1198.6	0.7108	0.7045	1.4153
850	525.26	0.0210	0.5327	518.3	678.8	1197.1	0.7194	0.6891	1.4085
900	531.98	0.0212	0.5006	526.6	668.8	1195.4	0.7275	0.6744	1.4020
950	538.43	0.0214	0.4717	534.6	659.1	1193.7	0.7355	0.6602	1.3957
1000	544.61	0.0216	0.4456	542.4	649.4	1191.8	0.7430	0.6467	1.3897
1100	556.31	0.0220	0.4001	557.4	630.4	1187.7	0.7575	0.6205	1.3780
1200	567.22	0.0223	0.3619	571.7	611.7	1183.4	0.7711	0.5956	1.3667
1300	577.46	0.0227	0.3293	585.4	593.2	1178.6	0.7840	0.5719	1.3559
1400	587.10	0.0231	0.3012	598.7	574.7	1173.4	0.7963	0.5491	1.3454
1500	596.23	0.0235	0.2765	611.6	556.3	1167.9	0.8082	0.5269	1.3351
2000	635.82	0.0257	0.1878	671.7	463.4	1135.1	0.8619	0.4230	1.2849
2500	668.13	0.0287	0.1307	730.6	360.5	1091.1	0.9126	0.3197	1.2322
3000	695.36	0.0346	0.0858	802.5	217.8	1020.3	0.9731	0.1885	1.1615
3206.2	705.40	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

TABLE D-1b
Properties of Dry Saturated Steam *(continued)*
Temperature

Temp. °F	Abs. press. psia	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap	Sat. vapor	Sat. liquid	Evap	Sat. vapor
t	p	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
32	0.08854	0.01602	3306	0.00	1075.8	1075.8	0.0000	2.1877	2.1877
35	0.09995	0.01602	2947	3.02	1074.1	1077.1	0.0061	2.1709	2.1770
40	0.12170	0.01602	2444	8.05	1071.3	1079.3	0.0162	2.1435	2.1597
45	0.14752	0.01602	2036.4	13.06	1068.4	1081.5	0.0262	2.1167	2.1429
50	0.17811	0.01603	1703.2	18.07	1065.6	1083.7	0.0361	2.0903	2.1264
60	0.2563	0.01604	1206.7	28.06	1059.9	1088.0	0.0555	2.0393	2.0948
70	0.3631	0.01606	867.9	38.04	1054.3	1092.3	0.0745	1.9902	2.0647
80	0.5069	0.01608	633.1	48.02	1048.6	1096.6	0.0932	1.9428	2.0360
90	0.6982	0.01610	468.0	57.99	1042.9	1100.9	0.1115	1.8972	2.0087
100	0.9492	0.01613	350.4	67.97	1037.2	1105.2	0.1295	1.8531	1.9826
110	1.2748	0.01617	265.4	77.94	1031.6	1109.5	0.1417	1.8106	1.9577
120	1.6924	0.01620	203.27	87.92	1025.8	1113.7	0.1645	1.7694	1.9339
130	2.2225	0.01625	157.34	97.90	1020.0	1117.9	0.1816	1.7296	1.9112
140	2.8886	0.01629	123.01	107.89	1014.1	1122.0	0.1984	1.6910	1.8894
150	3.718	0.01634	97.07	117.89	1008.2	1126.1	0.2149	1.6537	1.8685
160	4.741	0.01639	77.29	127.89	1002.3	1130.2	0.2311	1.6174	1.8485
170	5.992	0.01645	62.06	137.90	996.3	1134.2	0.2472	1.5822	1.8293
180	7.510	0.01651	50.23	147.92	990.2	1138.1	0.2630	1.5480	1.8109
190	9.339	0.01657	40.96	157.95	984.1	1142.0	0.2785	1.5147	1.7932
200	11.526	0.01663	33.64	167.99	977.9	1145.9	0.2938	1.4824	1.7762
210	14.123	0.01670	27.82	178.05	971.6	1149.7	0.3090	1.4508	1.7598
212	14.696	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
220	17.186	0.01677	23.15	188.13	965.2	1153.4	0.3239	1.4201	1.7440
230	20.780	0.01684	19.382	198.23	958.8	1157.0	0.3387	1.3901	1.7288
240	24.969	0.01692	16.323	208.34	952.2	1160.5	0.3531	1.3609	1.7140
250	29.825	0.01700	13.821	216.48	945.5	1164.0	0.3675	1.3323	1.6998
260	35.429	0.01709	11.763	228.64	938.7	1167.3	0.3817	1.3043	1.6860
270	41.858	0.01717	10.061	238.84	931.8	1170.6	0.3958	1.2769	1.6727
280	49.203	0.01726	8.645	249.06	924.7	1173.8	0.4096	1.2501	1.6597
290	57.556	0.01735	7.461	259.31	917.5	1176.8	0.4234	1.2238	1.6472
300	67.013	0.01745	6.466	269.59	910.1	1179.7	0.4369	1.1980	1.6350
310	77.68	0.01755	5.626	279.92	902.6	1182.5	0.4504	1.1727	1.6231
320	89.66	0.01765	4.914	290.28	894.9	1185.2	0.4637	1.1478	1.6115
330	103.06	0.01776	4.307	300.68	887.0	1187.7	0.4769	1.1233	1.6002
340	118.01	0.01787	3.788	311.13	879.0	1190.1	0.4900	1.0992	1.5891

TABLE D-1b
Properties of Dry Saturated Steam *(continued)*
Temperature

Temp °F	Abs press, psia	Specific volume		Enthalpy			Entropy		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor	Sat liquid	Evap	Sat vapor
t	p	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
350	134.63	0.01799	3.342	321.63	870.7	1192.3	0.5029	1.0754	1.5783
360	153.04	0.01811	2.957	332.18	852.2	1194.4	0.5158	1.0519	1.5677
370	173.37	0.01823	2.625	342.79	853.5	1196.3	0.5286	1.0287	1.5573
380	195.77	0.01836	2.335	353.45	844.6	1198.1	0.5413	1.0059	1.5471
390	220.37	0.01850	2.0836	364.17	835.4	1199.6	0.5539	0.9832	1.5371
400	247.31	0.01864	1.8633	374.97	826.0	1201.0	0.5664	0.9608	1.5272
410	276.75	0.01878	1.6700	385.83	816.3	1202.1	0.5788	0.9386	1.5174
420	308.83	0.01894	1.5000	396.77	806.3	1203.1	0.5912	0.9166	1.5078
430	343.72	0.01910	1.3499	407.79	796.0	1203.8	0.6035	0.8947	1.4982
440	381.59	0.01926	1.2171	418.90	785.4	1204.3	0.6158	0.8730	1.4887
450	422.6	0.0194	1.0993	430.1	774.5	1204.6	0.6280	0.8513	1.4793
460	466.9	0.0196	0.9944	441.4	763.2	1204.6	0.6402	0.8298	1.4700
470	514.7	0.0198	0.9009	452.8	751.5	1204.3	0.6523	0.8083	1.4606
480	566.1	0.0200	0.8172	464.4	739.4	1203.7	0.6645	0.7868	1.4513
490	621.4	0.0202	0.7423	476.0	726.8	1202.8	0.6766	0.7653	1.4419
500	680.8	0.0204	0.6749	487.8	713.9	1201.7	0.6887	0.7438	1.4325
520	812.4	0.0209	0.5594	511.9	686.4	1198.2	0.7130	0.7006	1.4136
540	962.5	0.0215	0.4649	536.6	656.6	1193.2	0.7374	0.6568	1.3942
560	1133.1	0.0221	0.3868	562.2	624.2	1186.4	0.7621	0.6121	1.3742
580	1325.8	0.0228	0.3217	588.9	588.4	1177.3	0.7872	0.5659	1.3532
600	1542.9	0.0236	0.2668	610.0	548.5	1165.5	0.8131	0.5176	1.3307
620	1786.6	0.0247	0.2201	646.7	503.6	1150.3	0.8398	0.4664	1.3062
640	2059.7	0.0260	0.1798	678.6	452.0	1130.5	0.8679	0.4110	1.2789
660	2365.4	0.0278	0.1442	714.2	390.2	1104.4	0.8987	0.3485	1.2472
680	2708.1	0.0305	0.1115	757.3	309.9	1067.2	0.9351	0.2719	1.2071
700	3093.7	0.0369	0.0761	823.3	172.1	995.4	0.9905	0.1484	1.1389
705.4	3206.2	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

Properties of Superheated Steam

Abs press., psia (Sat temp., °F)		Temperature, °F											
		200	300	400	500	600	700	800	900	1000	1100	1200	1400
1 (101.74)	v	392.6	452.3	512.0	571.6	631.2	690.8	750.4	809.9	869.5	929.1	988.7	1107.8
	h	1150.4	1195.8	1241.7	1288.3	1335.7	1383.8	1432.8	1482.7	1533.5	1585.2	1637.7	1745.7
	s	2.0512	2.1153	2.1720	2.2233	2.2702	2.3137	2.3542	2.3923	2.4283	2.4625	2.4952	2.5566
5 (162.24)	v	78.16	90.25	102.26	114.22	126.16	138.10	150.03	161.95	173.87	185.79	197.71	221.6
	h	1148.8	1195.0	1241.2	1288.0	1335.4	1383.6	1432.7	1482.6	1533.4	1585.1	1637.7	1745.7
	s	1.8718	1.9370	1.9942	2.0456	2.0927	2.1361	2.1767	2.2148	2.2509	2.2851	2.3178	2.3792
10 (193.21)	v	38.85	45.00	51.04	57.05	63.03	69.01	74.98	80.95	86.92	92.88	98.84	110.77
	h	1146.6	1193.9	1240.6	1287.5	1335.1	1383.4	1432.5	1482.4	1533.2	1585.0	1637.6	1745.6
	s	1.7927	1.8595	1.9172	1.9689	2.0160	2.0596	2.1002	2.1383	2.1744	2.2068	2.2413	2.3028
14.696 (212.00)	v		30.53	34.68	38.78	42.86	46.94	51.00	55.07	59.13	63.19	67.25	75.37
	h		1192.8	1239.9	1287.1	1334.8	1383.2	1432.3	1482.3	1533.1	1584.8	1637.5	1745.5
	s		1.8160	1.8743	1.9261	1.9734	2.0170	2.0576	2.0958	2.1319	2.1662	2.1989	2.2603
20 (227.96)	v		22.36	25.43	28.46	31.47	34.47	37.46	40.45	43.44	46.42	49.41	55.37
	h		1191.6	1239.2	1286.6	1334.4	1382.9	1432.1	1482.1	1533.0	1584.7	1637.4	1745.4
	s		1.7808	1.8396	1.8918	1.9392	1.9829	2.0235	2.0618	2.0978	2.1321	2.1648	2.2263
40 (267.25)	v		11.040	12.628	14.168	15.688	17.198	18.702	20.20	21.70	23.20	24.69	27.68
	h		1186.8	1236.5	1284.8	1333.1	1381.9	1431.3	1481.4	1532.4	1584.3	1637.0	1745.1
	s		1.6994	1.7608	1.8140	1.8619	1.9058	1.9467	1.9850	2.0212	2.0555	2.0883	2.1498
60 (292.71)	v		7.259	8.357	9.403	10.427	11.441	12.449	13.452	14.454	15.453	16.451	18.446
	h		1181.6	1233.6	1283.0	1331.8	1380.9	1430.5	1480.8	1531.9	1583.8	1636.6	1744.8
	s		1.6492	1.7135	1.7678	1.8162	1.8605	1.9015	1.9400	1.9762	2.0106	2.0434	2.1049
80 (312.03)	v			6.220	7.020	7.797	8.562	9.322	10.077	10.830	11.582	12.332	13.830
	h			1230.7	1281.1	1330.5	1379.9	1429.7	1480.1	1531.3	1583.4	1636.2	1744.5
	s			1.6791	1.7346	1.7836	1.8281	1.8694	1.9079	1.9442	1.9787	2.0115	2.0731
100 (327.81)	v			4.937	5.589	6.218	6.835	7.446	8.052	8.656	9.259	9.860	11.060
	h			1227.6	1279.1	1329.1	1378.9	1428.9	1479.5	1530.8	1582.9	1635.7	1744.2
	s			1.6518	1.7085	1.7581	1.8029	1.8443	1.8829	1.9193	1.9538	1.9867	2.0484
120 (341.25)	v			4.081	4.636	5.165	5.683	5.195	6.702	7.207	7.710	8.212	9.214
	h			1224.4	1277.2	1327.7	1377.8	1428.1	1478.8	1530.2	1582.4	1635.3	1743.9
	s			1.6287	1.6869	1.7370	1.7822	1.8237	2.8625	1.8990	1.9335	1.9664	2.0281
140 (353.02)	v			3.468	3.954	4.413	4.861	5.301	5.738	6.172	6.604	7.035	7.895
	h			1221.1	1275.2	1326.4	1376.8	1427.3	1478.2	1529.7	1581.9	1634.9	1743.5
	s			1.6087	1.6683	1.7190	1.7645	1.8063	1.8451	1.8817	1.9163	1.9493	2.0110
160 (363.53)	v			3.008	3.443	3.849	4.244	4.631	5.015	5.396	5.775	6.152	6.906
	h			1217.6	1273.1	1325.0	1375.7	1426.4	1477.5	1529.1	1581.4	1634.5	1743.2
	s			1.5908	1.6519	1.7033	1.7491	1.7911	1.8301	1.8667	1.9014	1.9344	1.9962
180 (373.06)	v			2.649	3.044	3.411	3.764	4.110	4.452	4.792	5.129	5.466	6.136
	h			1214.0	1271.0	1323.5	1374.7	1425.6	1476.8	1528.6	1581.0	1634.1	1742.9
	s			1.5745	1.6373	1.6894	1.7355	1.7776	1.8167	1.8534	1.8882	1.9212	1.9831
200 (381.79)	v			2.361	2.726	3.060	3.380	3.693	4.002	4.309	4.613	4.917	5.521
	h			1210.3	1268.9	1322.1	1373.6	1424.8	1476.2	1528.0	1580.5	1633.7	1742.6
	s			1.5594	1.6240	1.6767	1.7232	1.7655	1.8048	1.8415	1.8763	1.9094	1.9713
220 (389.86)	v			2.125	2.465	2.772	3.066	3.352	3.634	3.913	4.191	4.467	5.017
	h			1206.5	1266.7	1320.7	1372.6	1424.0	1475.5	1527.5	1580.0	1633.3	1742.3
	s			1.5453	1.6117	1.6652	1.7120	1.7545	1.7939	1.8308	1.8656	1.8987	1.9607
240 (397.37)	v			1.9276	2.247	2.533	2.804	3.068	3.327	3.584	3.839	4.093	4.597
	h			1202.5	1264.5	1319.2	1371.5	1423.2	1474.8	1526.9	1579.6	1632.9	1742.0
	s			1.5319	1.6003	1.6546	1.7017	1.7444	1.7839	1.8209	1.8558	1.8889	1.9510
260 (404.42)	v				2.063	2.330	2.582	2.827	3.067	3.305	3.541	3.776	4.242
	h				1262.3	1317.7	1370.4	1422.3	1474.2	1526.3	1579.1	1632.5	1741.7
	s				1.5897	1.6447	1.6922	1.7352	1.7748	1.8118	1.8467	1.8799	1.9420
280 (411.05)	v				1.9047	2.156	2.392	2.621	2.845	3.066	3.286	3.504	3.938
	h				1260.0	1316.2	1369.4	1421.5	1473.5	1525.8	1578.6	1632.1	1741.4
	s				1.5796	1.6354	1.6834	1.7265	1.7662	1.8033	1.8383	1.8716	1.9337
300 (417.33)	v				1.7675	2.005	2.227	2.442	2.652	2.859	3.065	3.269	3.674
	h				1260.0	1316.2	1368.3	1420.6	1472.8	1525.2	1578.1	1631.7	1741.0
	s				1.5701	1.6268	1.6751	1.7184	1.7582	1.7954	1.8305	1.8638	1.9260
350 (431.72)	v				1.4923	1.7036	1.8980	2.084	2.266	2.445	2.622	2.798	3.147
	h				1251.5	1310.9	1365.5	1418.5	1471.1	1523.8	1577.0	1630.7	1740.3
	s				1.5481	1.6070	1.6563	1.7002	1.7403	1.7777	1.8130	1.8463	1.9086
400 (444.59)	v				1.2851	1.4770	1.6508	1.8161	1.9767	2.134	2.290	2.445	2.751
	h				1245.1	1306.9	1362.7	1416.4	1469.4	1522.4	1575.8	1629.6	1739.5
	s				1.5281	1.5894	1.6398	1.6842	1.7247	1.7623	1.7977	1.8311	1.8936

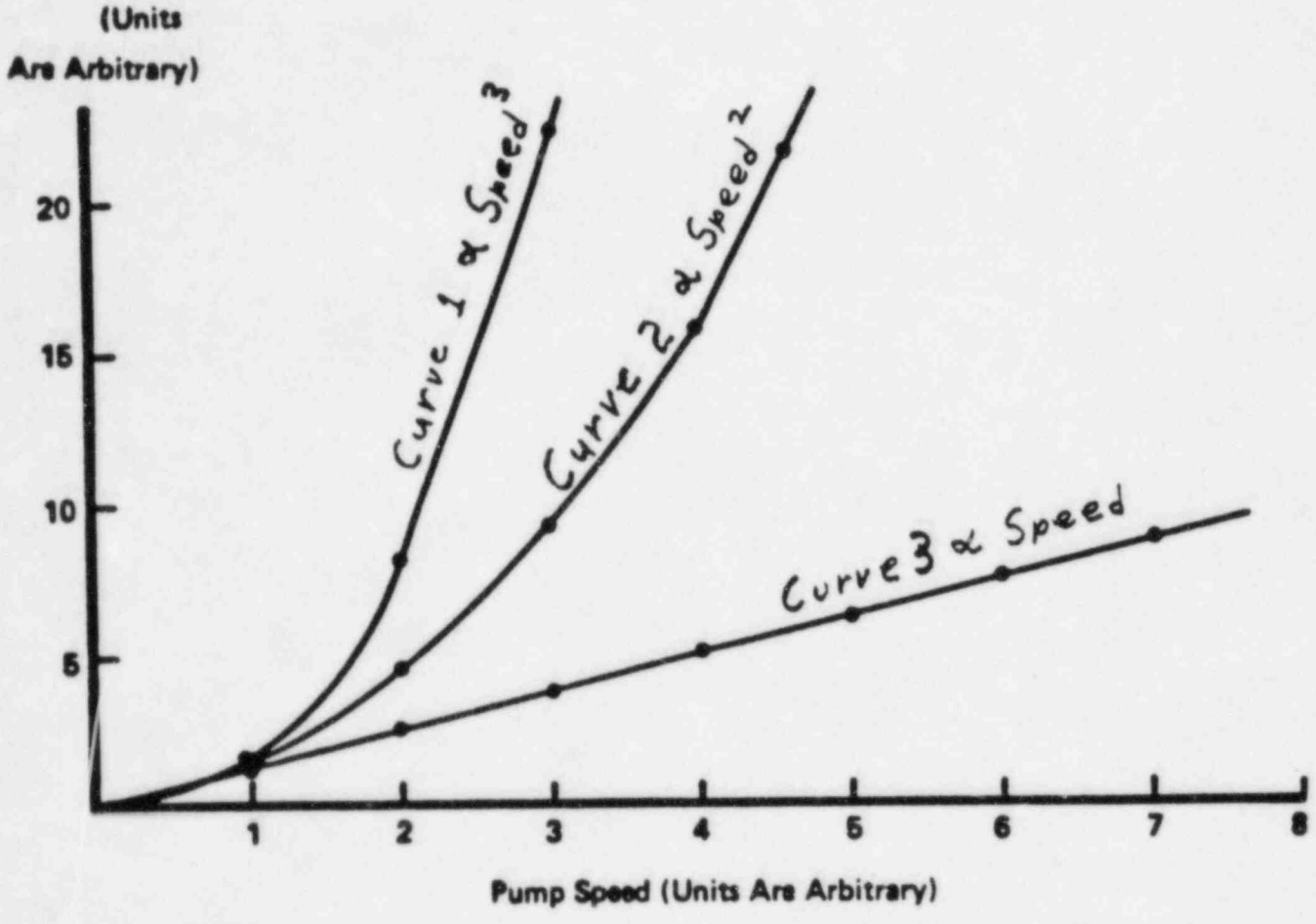


Figure 6.2-3. Pump Laws

SURFACE UTILIZATION Vs FLOW

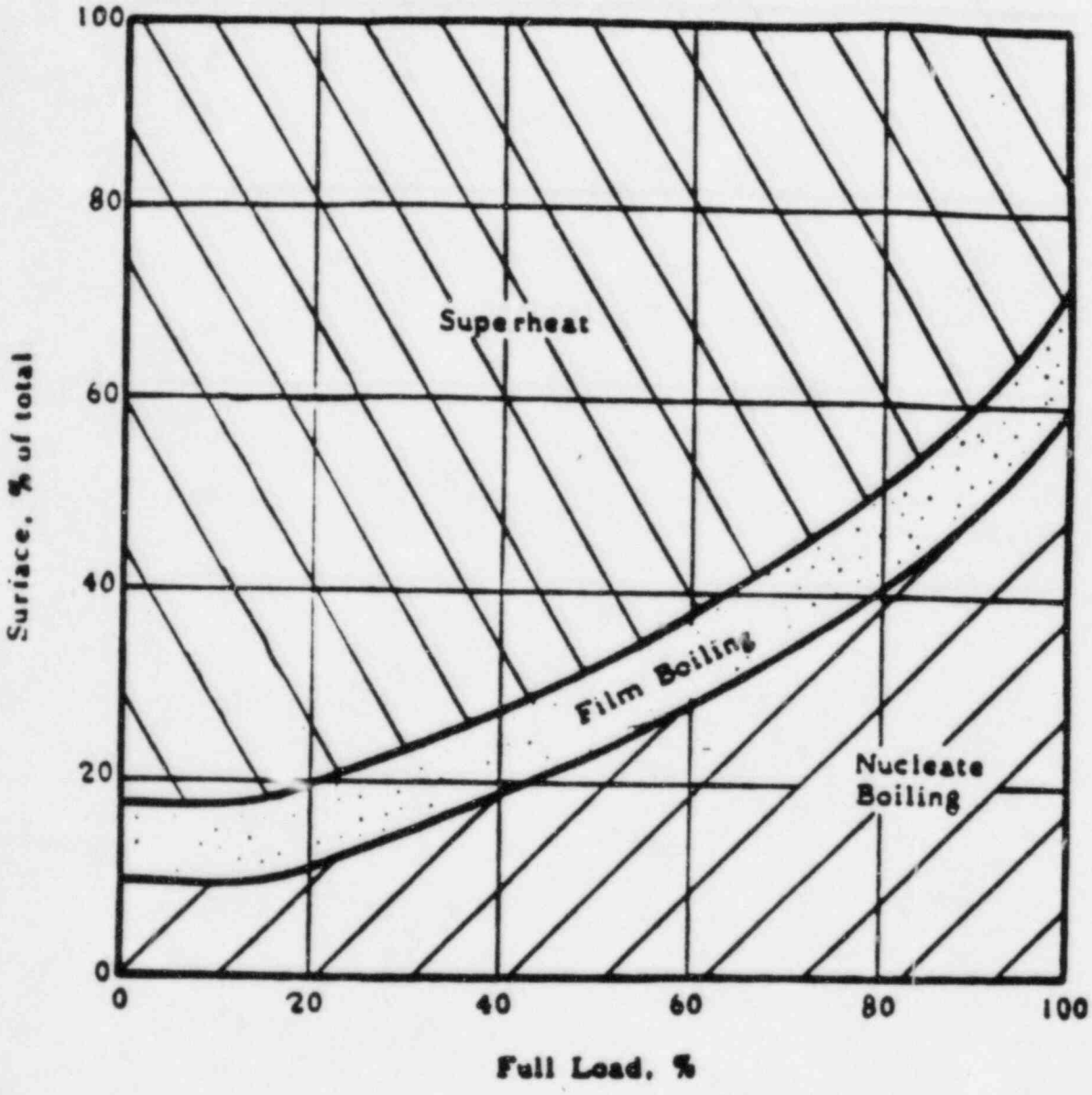


FIGURE 43

ESTIMATED CRITICAL BORON CONCENTRATION

REFERENCE CONDITIONS: 532°F, 0% FP, No Xenon, No Control Rods, Equilibrium Samarium

1. **Fuel Reactivity**

   a. Core Burnup 200 EFPD
   b. Read Curve 3.1 of OP-103, Plant Curve Book. ____ % Δk/k

2. **Xenon Reactivity** (Use Step 2.1 or 2.2)

2.1 Value calculated by SAXON I (submit printout).
(_____ % Δk/k) = _____ % Δk/k

OR

2.2 a. Last power level was 100 % FP for 504 hrs.
   b. Time Shutdown 24 hrs.
   c. If time at last power level was < 40 hrs. and SAXON is unavailable, consult with Reactor Specialist.
(_____ % Δk/k) = _____ % Δk/k

3. **Samarium Reactivity Buildup After Shutdown**

3.1 Value calculated by SAXON I (submit printout) _____ % Δk/k

4. **Reactivity Effect From Temperature**

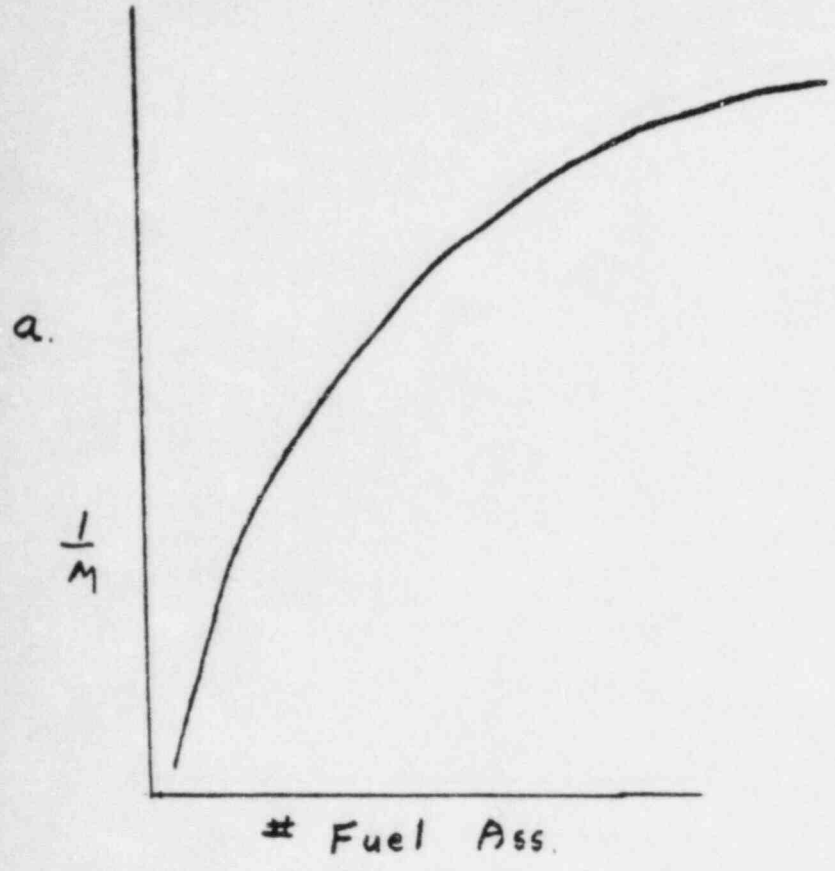
   a. Average RC Temperature 535 °F
   b. Reference temperature is 532°F.
   c. Temperature coefficient at _____ ppmB is obtained from Curve 3.6 of OP-103, Plant Curve Book, to be _____ x 10^{-2}% Δk/k/°F.
   d. Reactivity = [T(ave) - 532] [Temp. Coeff.]
   e. Reactivity = (_____ - _____) (_____ x 10^{-2}% Δk/k/°F) = _____ % Δk/k

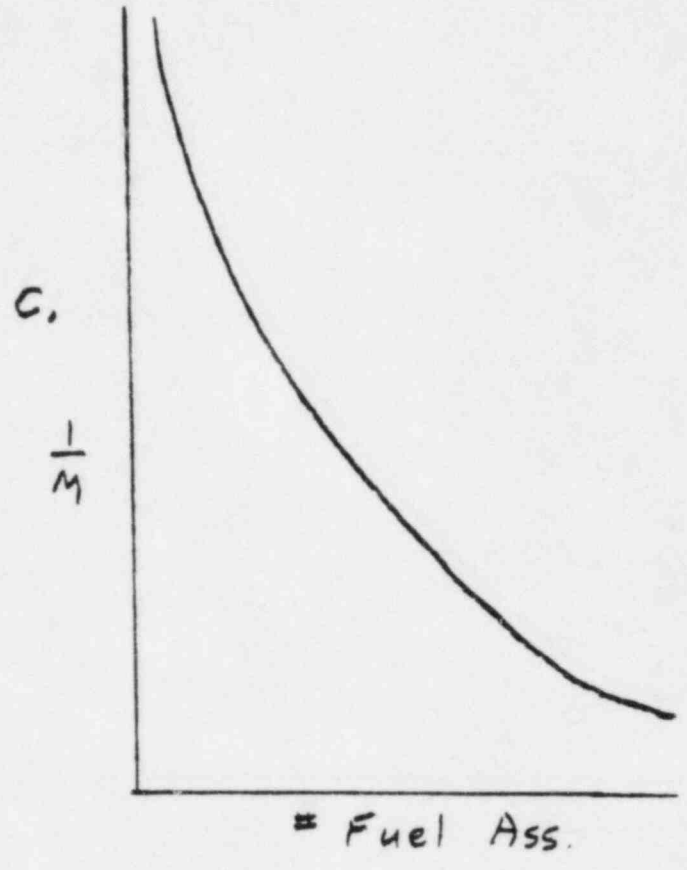
5. **Reactivity of Control Rods at Desired Insertion**

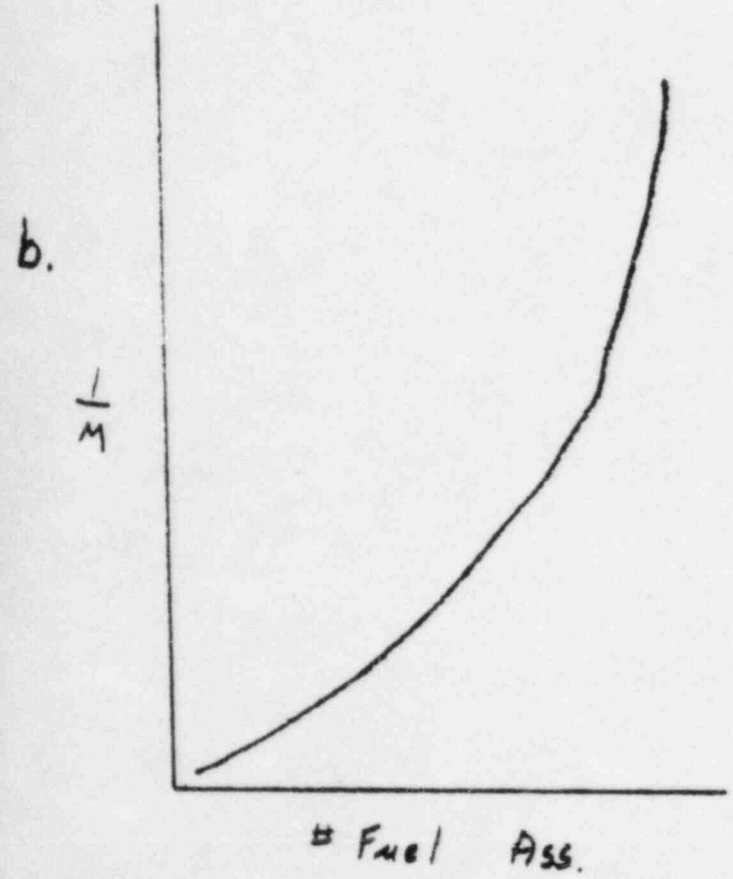
Groups 1-4 at	100 % WD		
Group 5 at	100 % WD		
Group 6 at	100 % WD		
Group 7 at	80 % WD	Regulating Group Worth	_____ % Δk/k
Group 8 at	40 % WD	Group 8 Worth	_____ % Δk/k

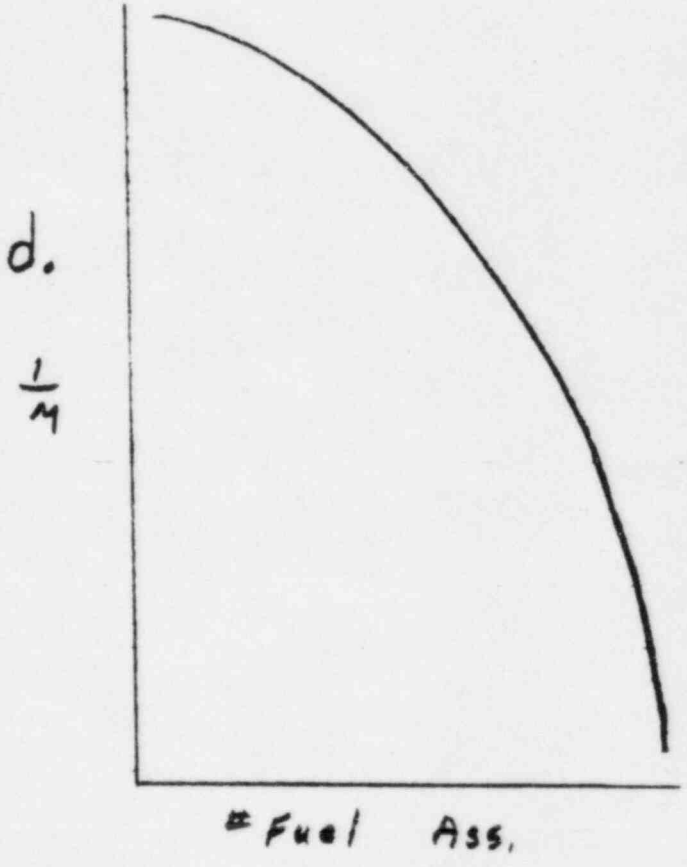
Calculated By _____ Date _____

Figure 5.21









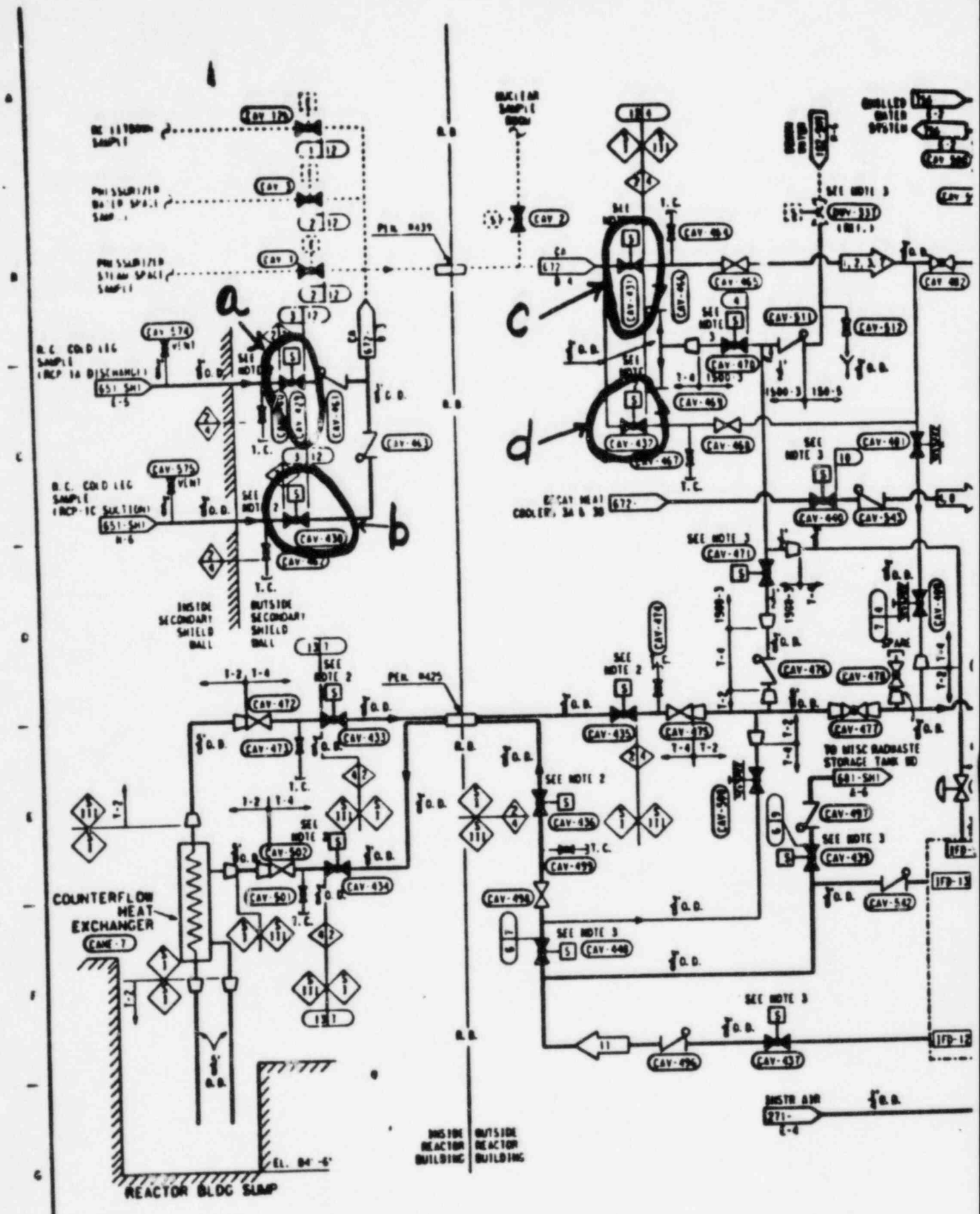

a
b
c
d
COUNTERFLOW HEAT EXCHANGER
REACTOR BLDG SUMP
INSIDE SECONDARY SHIELD WALL
OUTSIDE SECONDARY SHIELD WALL
INSIDE REACTOR BUILDING
OUTSIDE REACTOR BUILDING
SEE NOTE 2
SEE NOTE 3
TO MISC RADWASTE STORAGE TANK NO

Fig 3

FOLLOW-UP (Cont'd)

ACTIONS	DETAILS
14. IF RCPs are available, THEN ensure: • Seal injection • Seal return • SW cooling AND: a. IF OTSGs available, THEN start 1 RCP in each loop OR start 2 RCPs in one loop OR b. IF OTSGs NOT available, THEN start one RCP.	NOTE RCPs are available when the following criteria are met: • Pump start permissive • Power available • RC PRESS and TEMP above RCP curve, Enclosure 1. NOTE RCP-1B is preferred. IF RCPs NOT available, THEN refer to AP-530, Natural Circulation.

Fig. 5

ENCLOSURE 1

RCP CURVES

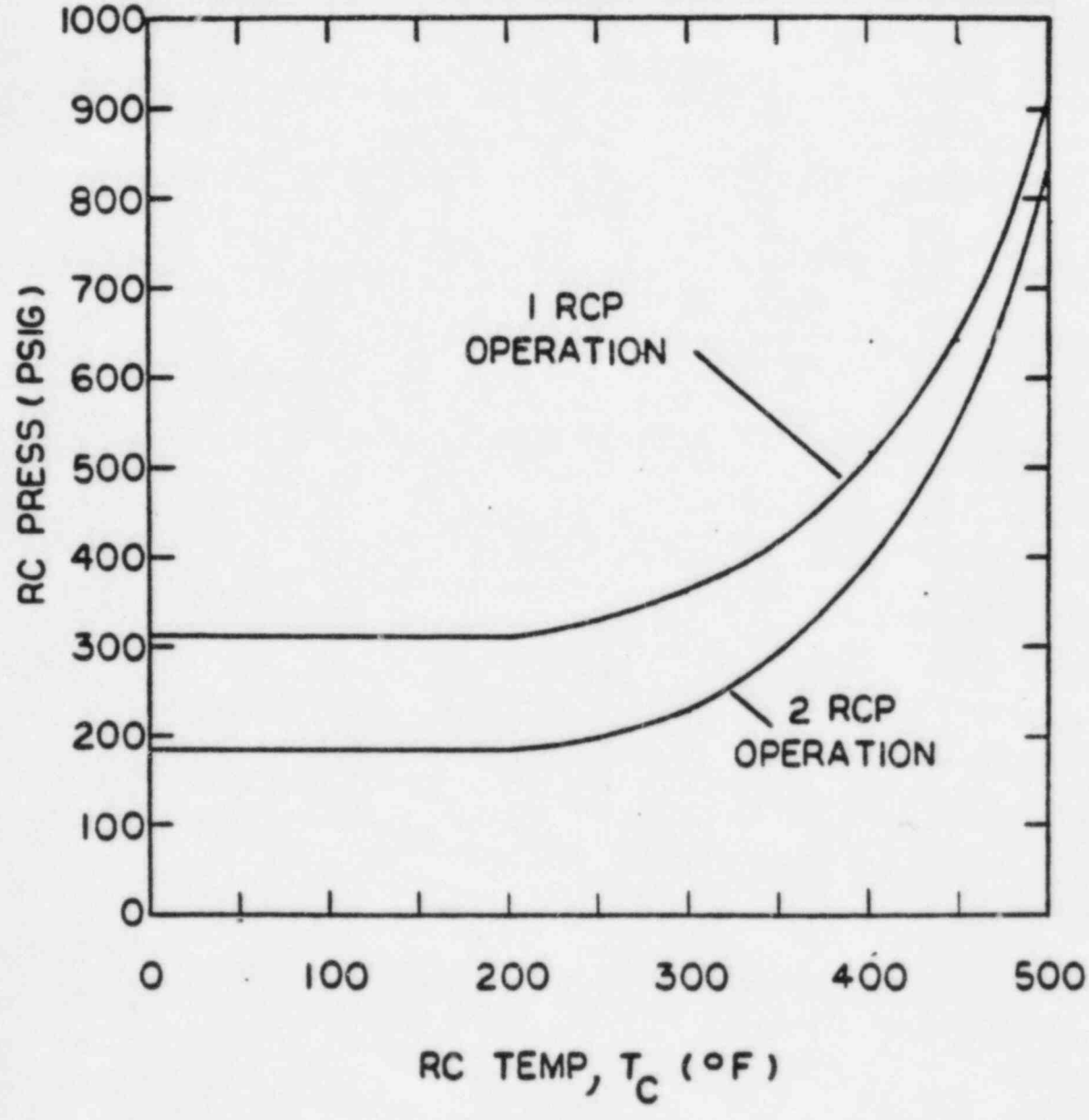


Fig 6

FOLLOW-UP (Cont'd)

ACTIONS	DETAILS
1.8 Refer to Figure 1. o IF in Region 2, THEN go to Step 1.9 o IF in Region 3, THEN go to Section 2.0 (T_{CLAD} > 1400°) o IF in Region 4, THEN go to Section 3.0 (T_{CLAD} > 1800°)	

Figure 1 CORE EXIT FLUID TEMPERATURE FOR INADEQUATE CORE COOLING

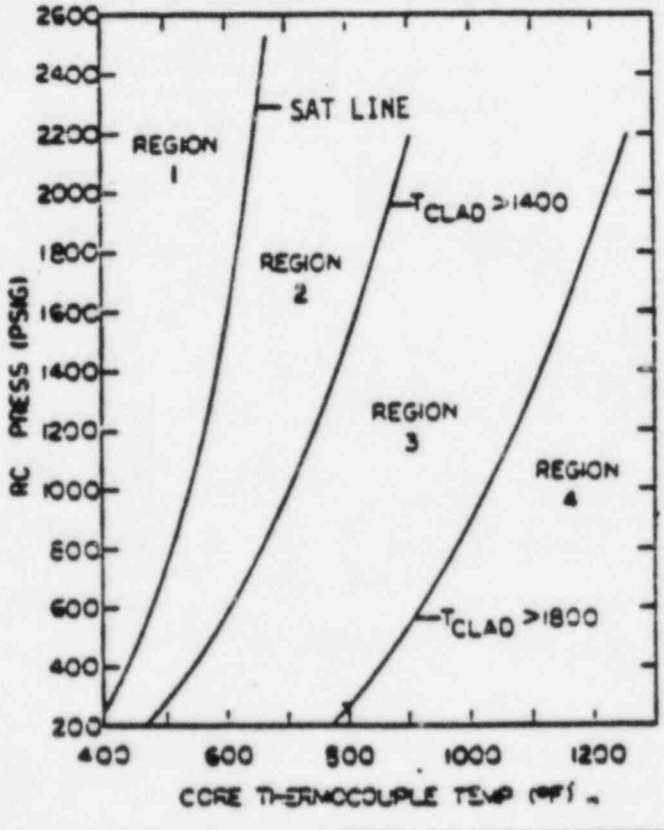


TABLE 3.3-1

REACTOR PROTECTION SYSTEM INSTRUMENTATION

	FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
1.	Manual Reactor Trip	1	1	1	1, 2 and *	8
2.	Nuclear Overpower	4	2	3	1, 2	2#
3.	RCS Outlet Temperature - High	4	2	3	1, 2	3#
4.	Nuclear Overpower Based on RCS Flow and AXIAL POWER IMBALANCE	4	2(a)	3	1, 2	2#
5.	RCS Pressure - Low	4	2(a)	3	1, 2	3#
6.	RCS Pressure - High	4	2	3	1, 2	3#
7.	Variable Low RCS Pressure	4	2(a)	3	1, 2	3#
8.	Reactor Containment Pressure - High	4	2	3	1, 2	3#
9.	Intermediate Range, Neutron Flux and Rate	2	1	2	1, 2 and *	4
10.	Source Range, Neutron Flux and Rate					
	A. Startup	2	0	2	2## and *	5
	B. Shutdown	2	0	1	3, 4 and 5	6
11.	Control Rod Drive Trip Breakers	2 per trip system	1 per trip system	2 per trip system	1, 2 and *	7#
12.	Reactor Trip Module	2 per trip system	1 per trip system	2 per trip system	1, 2 and *	7#
13.	Shutdown Bypass RCS Pressure - High	4	2	3	2**, 3**, 4**, 5**	6#
14.	Reactor Coolant Pump Power Monitors	2 per pump	1 from 2 or more pumps (a,b)	2 per pump	1, 2	25

TABLE 3.3-1 (Continued)

TABLE NOTATION

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

**When Shutdown Bypass is actuated.

#The provisions of Specification 3.0.4 are not applicable.

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

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

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

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

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

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

ACTION STATEMENTS

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

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

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

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

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

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

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

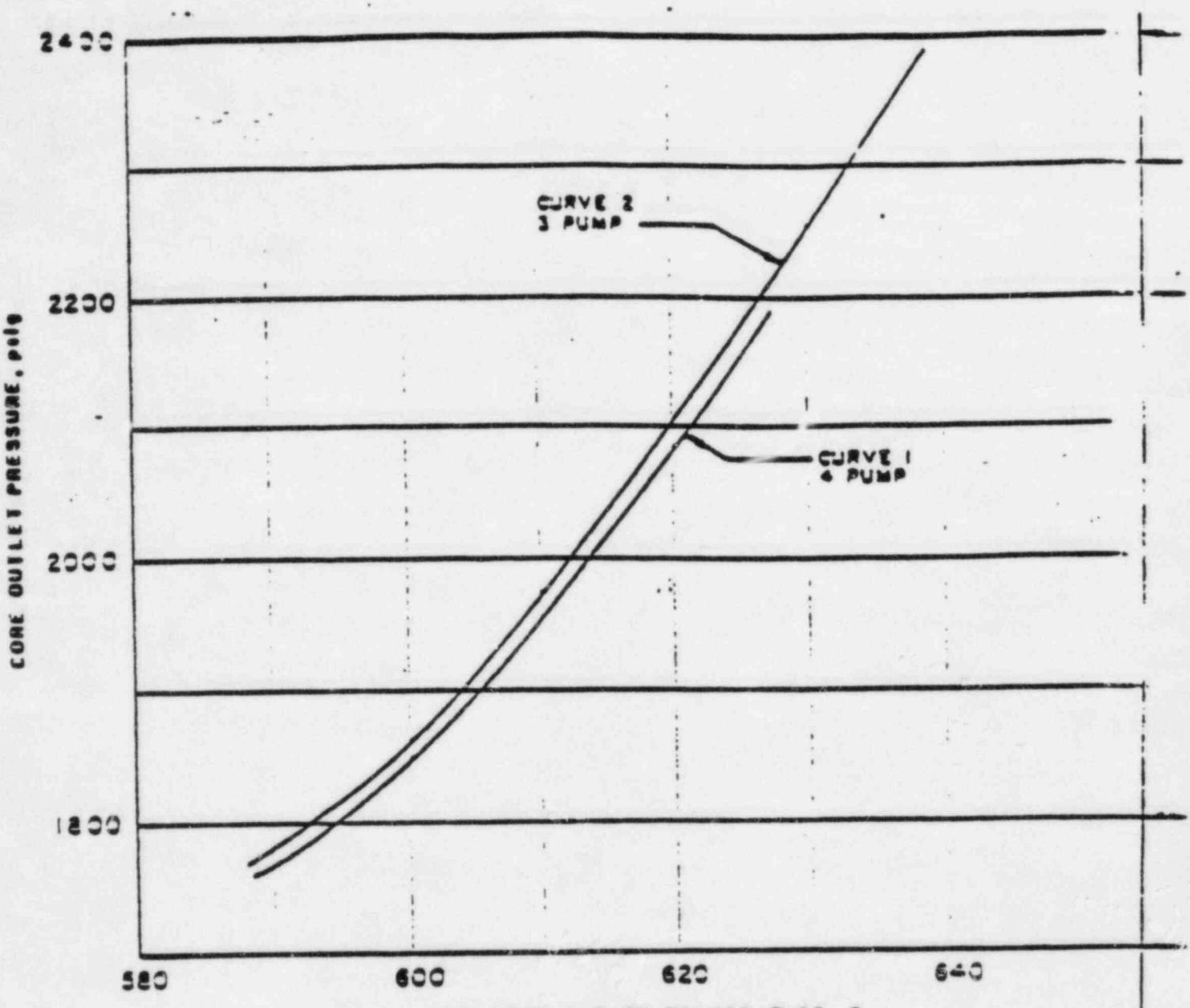
a. The inoperable channel is placed in the tripped condition within one hour.

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

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

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

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



REACTOR COOLANT FLOW

CURVE	FLOW (% DESIGN)	POWER (RTP)	PUMPS OPERATING (TYPE OF LIMIT)
1	139.7×10^6 (106.5%)	113.05 %	4 PUMPS (DNBR)
2	104.4×10^6 (79.6%)	90.84 %	3 PUMPS (DNBR)

PRESSURE/TEMPERATURE LIMITS AT MAXIMUM ALLOWABLE POWER FOR MINIMUM DNBR

BASES FIGURE 2.1

Fig 2

3/4 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

LIMITING CONDITION FOR OPERATION

3.0.1 Limiting Conditions for Operation and ACTION requirements shall be applicable during the OPERATIONAL MODES or other conditions specified for each specification.

3.0.2 Adherence to the requirements of the Limiting Condition for Operation and/or associated ACTION within the specified time interval shall constitute compliance with the specification. In the event the Limiting Condition for Operation is restored prior to expiration of the specified time interval, completion of the ACTION statement is not required.

3.0.3 When a Limiting Condition for Operation is not met, except as provided in the associated ACTION requirements, within 1 hour action shall be initiated to place the unit in a MODE in which the Specification does not apply to placing it, as applicable, in:

1. At least HOT STANDBY within the next 6 hours,
2. At least HOT SHUTDOWN within the following 6 hours, and
3. At least COLD SHUTDOWN within the subsequent 24 hours.

Where corrective measures are completed that permit operation under the ACTION requirements, the ACTION may be taken in accordance with the specified time limits as measured from the time of failure to meet the Limiting Condition for Operation. Exceptions to these requirements are stated in the individual Specifications.

3.0.4 Entry into an OPERATIONAL MODE or other specified applicability condition shall not be made unless the conditions of the Limiting Condition for Operation are met without reliance on provisions contained in the ACTION statements unless otherwise excepted. This provision shall not prevent passage through OPERATIONAL MODES as required to comply with ACTION statements.

3.0.5 When a system, subsystem, train, component or device is determined to be inoperable solely because its emergency power source is inoperable, or solely because its normal power source is inoperable, it may be considered OPERABLE for the purpose of satisfying the requirements of its applicable Limiting Condition for Operation, provided: (1) its corresponding normal or emergency power source is OPERABLE; and (2) all of its redundant system(s), sybsystem(s), train(s), component(s) and device(s) are OPERABLE, or likewise satisfy the requirements of this specification. Unless both conditions (1) and (2) are satisfied, within 2 hours action shall be initiated to place the unit in a MODE in which the applicable Limiting Condition for Operation does not apply by placing it as applicable in:

1. At least HOT STANDBY within the next 6 hours,
2. At least HOT SHUTDOWN within the following 6 hours, and
3. At least COLD SHUTDOWN within the subsequent 24 hours.

This Specification is not applicable in MODES 5 or 6.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T_{avg} > 280°F

LIMITING CONDITION FOR OPERATION

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

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

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

c. One OPERABLE decay heat cooler, and

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

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

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

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

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

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

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

b. Two separate and independent diesel generators each with:

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

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

3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

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

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

ACTION (Continued)

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

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

SURVEILLANCE REQUIREMENTS

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

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

1. Correct breaker alignments and indicated power availability, and

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

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

MASTER KEY

ANSWERS - SECTION 5

5.1 b. Ref: CR3 HTFF pp. 148-156 (1.0)

5.2 a. Ref: 1. Duke Power Company, FNRE; pp. 115-120 (1.0)
2. NETRO, 12.1-4

5.3 b. Ref: 1. OP-210, Rev. 16, p.8 (1.0)
2. NUS, NETRO, Unit 6
3. Westinghouse Reactor Physics, Sect. 3 & 5

5.4 a. Ref: NETRO, p. 10.3-2 (1.0)

5.5 d. Ref: NETPP, p. 6.2-5 (1.0)

5.6 c. Ref: NETPP, p. 6.4-5 (1.0)

5.7 b. Ref: CR3 HTFF p. 151 (1.0)

5.8 c. Ref: 1. Westinghouse NTO, p. I-5.77 (1.0)
2. NETRO, 10.5-2
3. Duke Power Company, FNRE; p. 169

5.9 a. More Inserted (50% equil Xe; ++) (2.0)
b. More Inserted (Xe free; + +)
c. More inserted (535 - 532F)
d. More Inserted (difference .35%, Curve 3.9)

Ref: OP-210 and OP-103

5.10 a. Ref: Water Box Primary System, ANAO-29, p.2 (1.0)

5.11 b. Ref: ICS: RO-103, p. 58 (1.0)

5.12 a. Ref: ICS, RO-103, p. 5 (1.0)

5.13 d. Ref: TS p. 3/4 1-2 (d is p. 3/4 2-1) (1.0)

5.14 c. Ref: Duke Power Company, FNRE, p. 124-128 (1.0)

5.15 b. (1.0)

Ref: Power System Operation (1.0)
R. H. Miller, p. 22-24

5.16 b. Ref: TS p. B 3/4 1-1 (1.0)

5.17 d. Ref: ~~STS B 6-4~~ Oconee LP OP-OC-SPS-SY-HDC pg 10 + 11 (1.0)

5.18 a. Ref: Duke Power Co., FWRE pp. 200 & 221 (1.0)

5.19 b. Ref: Duke FNRE, pp. 253-257 (1.0)

5.20 1. Control rods in a single group move together ($\leq \pm$ 6.5% deviation) (1.5)

2. Reg. groups are sequenced with overlap as required.

3. Reg rod and APSR insertion limits are maintained.

Ref: Power Dist. Design Criteria, 1984, J. P. Haerle

5.21 a. True, p. 10 (2.0)
b. True, p. 2
c. True, pp. 2-3
d. False, p. 7

Ref: Analysis Summary in Support of an Early RC Pump Trip B&W Submittal, August 24, 1979.

5.22 To assure that certain potential faults (such as a seismically induced fault high signal) will not prevent this instrumentation from providing the protection action. (0.5)

Ref: TS p. B 2-7

5.23 b. Ref: CR 3 Draft HTFF/Thermo, p. 82 (1.0)

ANSWERS - SECTION 6

6.1 b. Ref: ANO-91, p. 6, Rev. 0 (1.0)

6.2 d. Ref: ANO-10 , pp. 1, 11, and 14 (1.0)

6.3 b. HP flash tank is correct, MSRLP flash tank is wrong (p. 15) (a); 1A/B, 2A/B heaters do not have non-return valves, pp. 19 & 20 (c); only on 1A/B, 2A/B heaters, pp. 18 & 19 (d). (1.0)

Ref: NAO-99, pp. 15-20

6.4 c. Ref: STM-12-9 (1.0)

6.5 c. Ref: TM 28-4 (1.0)

6.6 1. Upper Thrust bearing Cooler (1.0)
2. Lower Guide bearing Cooler
3. Motor air cooler
4. Seal Area Cooler

Ref: STM-23-7 and 8

6.7 a. Ref: STM 17-10 and 12 (1.0)

6.8 b. Ref: STM 10-4 and 5 (1.0)

6.9 c. Ref: PASS lesson plan RO-105 p. 8 (1.0)

6.10 b. (1.0)

a. 3 hours @ nameplate rating
c. 1-AC, 1-DC
d. overflows to FOST

Ref: 1. STM 15-4 & 5
2. STM 10-8 & 12

6.11 c. Ref: OP-605, p. 5 and 6, Rev. 28 (1.0)

6.12 1. Open DHV-11 and 12 (LPI to HPI cross connects) (0.33 each) (1.0)
2. Close MUV-58 & 73 (BWST Suction valves)
3. Open DHV-42 and 43 (RB pump suction valves)
4. Close (BSV-36 & 37) (NAOH tank outlet valves) - (Not required)

Ref: STM 4-9 thru 12

6.13 b. Ref: STM 13-2 (1.0)

6.14 a. Ref: STM 6-4 (1.0)

6.15 b. Ref: RPS Handout, p. 21 (1.0)

NOTE: State lamp - auto reset deadband set for maximum

6.16 c. Ref: CR Requalification Fuel Handling Lesson Plan p. 13, Rev. 1 (1.0)

6.17 d. + b Ref: OP-504, p. 8, Rev. 7
STM 27-56 (1.0)

6.18 (2.0)

		'A'	'B'	
a.	Main FW Block Valve	(FWV-30	FWV-29)	(0.25 ea.)
	Lo-Load " "	(FWV-31	FWV-32)	
	Startup " "	(FWV-36	FWV-33)	
	Emergency " "	(FWV-35	FWV-34)	
	Emergency Bypass Valve	(FWV-162	FWV-161)	
	MFWP Suction Valve	(FWV-14	FWV-15)	
	FW Crosstie "	(--------FWV-28--------)		
	MSIVs	(MSV-411, 412	MSV-413, 414)	

b. 1. Affected OTSGs pressure has recovered to >725 psig (1.0)
2. Rupture matrix is bypassed

Ref: CR SLRM handout

6.19 c. or d Ref: STM 15-10 (1.0)

delete ~~6.20 d Ref: STM 10-47 & 49~~ (1.0)

6.21 b. Ref: STM-22, pp. 22-25 (1.0)

6.22 b. Ref: STM 41-4, 5 (1.0)

6.23 c. Ref: Fuel Handling, Requal Training, p. 18 (1.0)

ANSWERS - SECTION 7

7.1 a. NONE (AP-241) (2.5)
b. 1, 2, 3, 7, 8 (AP-242) (0.5 each)
c. 3 (AP-243)
d. 2 (AP-244)
e. 4, 5, 6, 7, 9 (AP-245)

7.2 1. Notify AB operator to ensure SOV-90 closed (0.25)
2. Notify TB operator to stop SOP-7 (0.25)

Ref: AP-277, pg. 2, Rev. 00

7.3 a Ref: AP-320, p. 2, Rev. 00 (1.0)

7.4 1. Bypass ES Actuation (.33 each)
2. Return ES equipment to STBY status
3. Go to VP-580

Ref: AP-380, p. 3, Rev. 01

7.5 1. Ensure both MFPs tripped (2.0)
2. Ensure closed: MBVs
LLBVs
SUBVs
3. Ensure both EFWPs start
4. Ensure emergency feedwater block valves open
5. Close FWV-162 (A OTSG)
FWV-161 (B OTSG)

Ref: AP-450, Rev. 1

7.6 d Ref: OP-502, p. 4, Rev. 13 (1.0)

7.7 c Ref: AP-380, p. 9, Rev. 00 (1.0)

7.8 b Ref: AP-501, p. 3 (1.0)

7.9 b Ref: OP-501, p. 2, Rev. 7 (1.0)

7.10 a Ref: EP-120, p. 2, Rev. 00 (1.0)

7.11 a Ref: OP-504, p. 15, Rev. 7 (1.0)

7.12 b. Ref: OP-605, p. 3 & 4, Rev. 28 (1.0)

7.13 a. Ref: Fuel Handling Lesson Plan, pp. 25 & 26, Rev. 1 (1.0)

7.14 d. Ref: Fuel Handling Lesson Plan, p. 31, Rev. 1 (1.0)

7.15 d. Ref: OP-210, Step 4.9 (1.0)

7.16 a. Ref: OP-210, Step 4.14 (1.0)

7.17 b. Ref: OP-402, Rev. 41, Step 4.11 (1.0)

7.18 1. Ensure all feeder BKRs to affected bus are open. (1.0)

2. Close feeder BKR from Units 1 and 2 by holding in "Close" position for 10 seconds:

- 'A' bus BKR 3211
- 'B' bus BKR 3212

Ref: AP-770, p. 2, Rev. 00

7.19 b Ref: RP-101, p. 5, Rev. 19 (1.0)

7.20 b Ref: RP-101, p. 23, Rev. 19 (1.0)

7.21 b Ref: 10CFR 20.101, p. 239, Rev. 1/1/85 (1.0)

7.22 e Ref: EP-290, p. 7, Rev. 02 (1.0)

7.23 b. Ref: OP-412, Rev. 29, pp. 2-9 (1.0)

ANSWERS - SECTION 8

8.1	d.	Ref: TS 3/4 3-3 and 3-4	(1.0)
8.2	b.	Ref: TS p. 3.2.4	(1.0)
8.3	a.	Ref: EM-201, Rev. 4, p. 1-4	(1.0)
8.4	b.	Ref: AI-100, Rev. 7, p. 7	(1.0)
8.5	b.	Ref: AI-500, Rev. 46, p. 10	(1.0)
8.6	a.	Ref: EM-202, Rev. 19, p. 3	(1.0)
8.7	b.	Ref: EM-205, Rev. 8, p. 6	(1.0)
8.8	c.	Ref: EM-207, Rev. 16, p. 5	(1.0)
8.9	a.	False	(0.5)
	b.	False	(0.5)
		Ref: FP-601, Rev. 17, p. 4	
8.10	c.	Ref: FP-601, Rev. 17, p. 6	(1.0)
8.11	a.	False, p. 3/4 1-1	(0.5)
	b.	False, p. 3/4 1-20	(0.5)
	c.	True, p. 3/4 5-1	(0.5)
	d.	False, p. 3/4 0-2	(0.5)
		Ref: TS, pp. noted above	
8.12	c.	Ref: OSIM III-10, Rev. 8	(1.0)
8.13	b.	Ref: OSIM VI-9, Rev. 22	(1.0)
8.14	a.	Ref: TS pp. 2-2 and 2-3	(1.0)
8.15	b.	Ref: TS pp. 4-5, 1-16, 5-1, 1-14	(1.0)
8.16	d.	Ref: 1. TS p. 3/4 0-1	(1.0)
8.17	c.	Ref: TS 3/4 1-1	(1.0)
8.18	a.	Ref: TS p. 3/4 4-24	(1.0)
8.19	d.	Ref: TS p. 3/4 5-2	(1.0)

8.20 a. Must obtain a qualified relief operator at the controls (1.0)

b. He remains within the confines of the control center (.5) and maintains an unobstructed view of the operational control panels. (.5) (1.0)

Ref: OSIM p. III-2

8.21 a. (1.0)

SOTA	(.2)
Nuclear Operations Superintendent	(.2)
Person-on-call	(.2)
NRC (red phone)	(.2)
NRC Resident Inspector	(.2)

b. Completes steps 1 - 9 (1.0)
Assigns next consecutive report number
Forwards it to Nuc. Ops. Sup. for disposition

8.22 1. A red tagged item in other than the specified condition (1.0)

2. A blue tagged item issued to any person other than the SSOD.

ENCLOSURE 4

REQUALIFICATION PROGRAM EVALUATION REPORT

Facility: Crystal River Unit 3

Examiner: Sandy Lawyer

Date(s) of Evaluation: May 14-16 and July 9-11, 1985

Areas Evaluated: X Written X Oral ___ Simulator

1. Evaluation of Examination

   Both of these written examinations were totally written and administered to all candidates by NRC. This portion of the evaluation is therefore N/A.

2. Evaluation of facility examination administration: N/A

3. If NRC examination was substituted for facility examination (or sections thereof), attach examination summary sheet to this form.
   Summary sheets attached X :

4. Evaluation of examination grading: N/A

Oral Examination - NRC administered orals

1. Overall evaluation Satisfactory

2. Number observed N/A Number conducted 21 Number passed 21

Simulator Examination

1. Overall evaluation N/A

2. Number observed _____ Number conducted _____

Overall Program Evaluation

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

Areas of deficiency identified by the NRC written examinations were Controls and Instrumentation (Section 3), Procedures (Sections 4 and 7), and Administrative Conditions and Limitations (Section 8).

In accordance with Examiner Standard ES-601, the March 1985 Requalification Program Audit resulted in an Unsatisfactory rating while the combined audits of May and July 1985 resulted in a pass rate of 71% which is considered Marginal. It was expected that the accelerated retraining program, conducted since March, would have resulted in a pass rate of greater than 80% and thus, a Satisfactory rating. The licensee is to identify corrective action and discuss their program re-evaluation in the near future.

Submitted: L. L. Lawyer

Forwarded: B. A. Wilson

Approved: C. A. Julian